BEFORE THE UNITED STATES DEPARTMENT OF AGRICULTURE,

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

PETITION FOR RULEMAKING

TO PROMULGATE A REGULATORY FRAMEWORK FOR THE WILDLIFE SERVICES PROGRAM TO IMPROVE TRANSPARENCY, ACCOUNTABILITY, THE HUMANE TREATMENT OF ANIMALS, THE PROTECTION OF SPECIES, AND PROTECT THE PUBLIC HEALTH AND SAFETY

November 21, 2023

SUBMITTED BY:

ANIMAL LEGAL DEFENSE FUND
CENTER FOR BIOLOGICAL DIVERSITY
PROJECT COYOTE
ANIMAL WELFARE INSTITUTE
WILDEARTH GUARDIANS

NOTICE OF PETITION FOR RULEMAKING

Via Electronic Mail and Certified Mail/Return Receipt Requested (with Literature Cited)

November 21, 2023

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Dear Secretary Vilsack, Administrator Shea, and Deputy Administrator Bucknall:

Pursuant to the Administrative Procedure Act, 5 U.S.C. § 553(e) ("APA"), and 7 C.F.R. § 1.28, the Animal Legal Defense Fund, Center for Biological Diversity, Project Coyote, Animal Welfare Institute, and WildEarth Guardians (hereinafter "Petitioners") hereby petition for the issuance of new rules and the amendment of certain existing rules governing the Wildlife Services ("WS") program that is administered by the Animal and Plant Health Inspection Service ("APHIS"), an agency within the U.S. Department of Agriculture ("USDA").[1]

Petitioners seek the issuance of new rules and the amendment of certain existing rules to provide a regulatory framework to govern the Wildlife Services program and to make it consistent with American values, science, and with all relevant legal authorities and policies.

[1] Section 553(e) provides that "[e]ach agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule." 5 U.S.C. § 553(e). USDA regulations state that "interested persons" may file petitions in accordance with Section 553(e) "for the issuance, amendment or repeal of a rule . . . with the official that issued or is authorized to issue the rule," and that "[a]ll such petitions shall be given prompt consideration and petitioners will be notified promptly of the disposition made of their petitions." 7 C.F.R. § 1.28.

Specifically, Petitioners seek the issuance of new rules and the amendment of certain existing rules to ensure that the Wildlife Services program:

- Prioritizes and requires documented exhaustion of reasonable non-lethal methods before Wildlife Services resorts to lethal action, except as necessary to address an immediate risk to human health or safety, or to address a situation for which a depredation permit has already been issued, if applicable;

- Emphasizes the use of selective, non-lethal, non-toxic, and non-capture methods in field operations;

- Prohibits the following cruel and indiscriminate methods from being used in field operations: (1) neck snares; (2) padded and unpadded steel-jaw leghold traps; (3) body-crushing traps such as Conibear, quick-kill, and snap traps; (4) M-44 sodium cyanide devices; (5) chemicals used in denning operations; (6) aerial gunning; and (7) Weevil-Cide® to target prairie dogs;

- Operates in a manner that is humane and in accordance with proscribed ethical standards, including requiring the use of trap monitors and shortening trap-check intervals to under 24 hours nationwide;

- Does not conduct lethal wildlife damage management operations in wilderness areas, wilderness study areas, and other special management areas;

- Requires the exclusive use of non-lethal methods for operations targeting ecologically important apex predators, including coyotes, cougars, bears, bobcats, and wolves, as well as operations targeting beavers and prairie dogs;

- Prohibits the use of lead ammunition in field operations;

- Operates in a manner that is fully transparent and accountable to the public;

- Maintains and makes routinely available to the public reliable data and information about its activities;

- Adheres strictly to all applicable procedural and substantive legal requirements; and

- Sets procedural and substantive criteria for Wildlife Services to identify and control invasive species.

A. Petitioners

The ANIMAL LEGAL DEFENSE FUND ("ALDF") is a national, non-profit organization dedicated to protecting the lives and advancing the interests of animals through the legal system. ALDF works to halt the ecologically harmful and inhumane killing of wild and domestic animals resulting from the outdated and unscientific predator policies practiced by Wildlife Services. To this end, ALDF is engaged with governmental entities at the federal, state, and county level to highlight the problems of indiscriminate lethal control methods, provide compiled statistical data, and inform them of their legal obligations to protect and preserve wild animals currently being destroyed through their association with Wildlife Services.[2]

The CENTER FOR BIOLOGICAL DIVERSITY ("Center") is a national, non-profit conservation organization with over 1.7 million supporters whose mission is to work through science, law and creative media to secure a future for all species, great or small, hovering on the brink of extinction. The Center accomplishes its mission through scientific and legal advocacy, public education, and grassroots organizing.

PROJECT COYOTE works to promote coexistence between people and wildlife through education, science and advocacy. Project Coyote aims to create a shift in attitudes toward native carnivoresby replacing ignorance and fear with understanding and appreciation. Project Coyote accomplishes its mission by championing progressive management policies that reduce human-coyote conflict, by supporting innovative scientific research, and by fostering respect for and understanding of America's apex predators.

ANIMAL WELFARE INSTITUTE ("AWI") has sought to alleviate the suffering inflicted on animals by people since 1951. It seeks better treatment of animals everywhere—in the wild, in agriculture, in commerce, in our communities, and in research. This is accomplished through strategically crafted policy and legal advocacy, educational programs, litigation, research, and engagement with industry, policymakers, scientists, and other NGOs. AWI works to reform Wildlife Services by advocating against the use of cruel lethal control techniques including, but not limited to, steel-jaw leghold traps, snares, poisoning, aerial gunning, and denning. Instead, AWI favors non-lethal strategies to humanely resolve human-wildlife conflicts and funds research to develop and test new strategies. AWI also works to minimize the impacts of human actions that are detrimental to endangered species.

WILDEARTH GUARDIANS ("Guardians") is a non-profit conservation organization dedicated to protecting and restoring the wildlife, wild places, wild rivers, and health of the American West. Guardians has more than 235,000 members and supporters and is committed to ensuring the survival and recovery of western wildlife, including our native carnivores. Guardians has long worked to hold Wildlife Services accountable to federal laws and the best available science regarding its "predator damage management" programs in western states and advocates for an end to the cruel and indiscriminate trapping practices employed by Wildlife Services.

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[2] 13,129 members of the Animal Legal Defense Fund have signed on to this petition. *See* Ex. 1, Signatures from ALDF Members.

B. Petitioners' Interests

Petitioners and their members are "interested persons" within the meaning of 7 C.F.R. § 1.28, with aesthetic, moral, scientific, recreational, and procedural interests in the nation's wildlife and ecosystems that are adversely affected and injured by the activities that are routinely conducted by Wildlife Services. Petitioners' members include individuals who have scientific or other interests in the species and ecosystems that are impacted by Wildlife Services' activities, as well as members whose companion animals have been injured or killed as a result of Wildlife Services' activities and/or who must curtail their activities out of concern for their own and their companion animals' well-being.

Thank you for your consideration. We look forward to your timely response.

Respectfully submitted,

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WILDEARTH GUARDIANS

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I. Executive Summary

Wildlife Services is a federal program that was established more than a century ago and today is administered by APHIS, an agency within USDA. The program kills millions of animals every year under the Animal Damage Control Act, 7 U.S.C. §§ 426-426d ("ADCA"), which provides statutory authority for—but does not require—establishment of a program within USDA for control of "injurious" wildlife.[3] In addition to the ADCA, Wildlife Services is bound by legal authorities that require transparency; the disclosure of reliable information; the humane treatment of animals; and the protection of species, habitat and public health.[4] The Wildlife Services program also operates pursuant to a series of "policy manuals" and "program directives" that ostensibly apply such requirements to the program.[5]

Despite the existing legal framework governing its operations, the Wildlife Services program has been marked by secrecy, controversy, public opposition, outdated and deficient environmental reviews, and indiscriminate killings of large numbers of animals, with over 23.3 million animals reportedly killed since 2013, including tens of thousands of animals killed unintentionally, including federally and state protected species as well as domestic companion animals.[6] The program has removed species from landscapes and continues to suppress restoration of their populations, creating cascading direct and indirect effects that ripple throughout and degrade ecosystems. It continues to carryout its activities despite decades of criticism, conflicting and evolving societal values, and substantial gains made in humankind's understanding of animals, species, and the natural world that challenge the program's foundational underpinnings. Vast and growing evidence demonstrates that Wildlife Services' practices are not only dangerous and inhumane, but also ineffective at achieving wildlife management objectives.

A program such as Wildlife Services "necessarily requires the formulation of policy and the making of rules to fill any gap left, implicitly or explicitly, by Congress"—through the promulgation of rules and regulations—something that is typically conducted as a matter of course under the APA.[7] Nonetheless, USDA and APHIS have never afforded interested persons or the public the opportunity to provide comment and guide the program through a rulemaking under the APA. Consequently, the program lacks substantive rules and regulations to ensure that

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[3] 7 U.S.C. §§ 426-426d. Specifically, § 426 provides that:

> The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect onthe day before October 28, 2000.

7 U.S.C. § 426.

[4] *E.g.*, 5 U.S.C. § 552; 7 U.S.C. §§ 135-136y; 16 U.S.C. §§1531-1544; *id.* §§ 668-668d; 42 U.S.C. § 4321-4370h.

[5] *See Wildlife Services Directives*, USDA APHIS, https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_ws_program_directives [https://perma.cc/5YRV-8D7J].

[6] USDA, APHIS, Wildlife Services' 2013-2022 Program Data Reports: Table G Animals Taken by Wildlife Services.

[7] *Morton v. Ruiz*, 415 U.S. 199, 231 (1974).

its activities are transparent, based on the best available science, safe, ethical, humane, and consistent with all applicable laws, policies, and American values. That Wildlife Services consistently fails to follow its own policy directives underscores the need for such binding regulations.

Petitioners are five conservation and animal protection organizations that previously submitted a petition for rulemaking on December 2, 2013, titled "For Promulgation Of A Regulatory Framework To Govern The Wildlife Services Program, For Transparency, Accountability, Reliability, The Humane Treatment Of Animals, And The Protection Of Animals And Species, And Public Health And Safety ("2013 Petition").[8] Petitioners incorporate the 2013 Petition for Rulemaking by reference.

Wildlife Services denied the 2013 Petition[9] on November 14, 2014, without addressing any of the numerous scientific studies cited by Petitioners. Petitioners now submit this new petition for rulemaking, updated with key scientific and legal developments since the submission of the previous petition. Petitioners once again seek to correct severe, long-standing defects, and to that end, petition the USDA and APHIS pursuant to Section 553(e) of the APA for promulgation of a comprehensive regulatory framework to govern Wildlife Services, which fills the gaps[10] in the relevant statutory scheme and prescribe a regulatory framework for program activities that achieves necessary reform, thereby ensuring consistency with all relevant laws and policies and the shared values of the American people.

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[8] Ex. 2, Petition from Ctr. for Biological Diversity et al., to Tom Vilsack, Sec'y, U.S. Dep't of Agric. et al. (Dec. 2, 2013), available at https://www.biologicaldiversity.org/programs/biodiversity/pdfs/Wildlife_Services_Rulemaking_Petition_Dec_2_2013.pdf [hereinafter "2013 Petition"].

[9] Ex. 3, USDA, Wildlife Services, Response to December 2, 2013 Petition for Rulemaking (Nov. 14, 2014) [hereinafter "Denial"].

[10] The Supreme Court and lower federal courts have repeatedly held that Congress's creation and funding of a program implicitly carries with it a general grant of rulemaking authority to "fill the gap" between the statutory grant and what rules are needed to carry out the mandated program. *See Morton*, 415 U.S. at 231; *In re Permanent Surface Mining Regul. Litig.*, 653 F.2d 514, 523-24 (D.C. Cir. 1981); *Citizens to Save Spencer Cnty. v. U.S. Envt. Prot. Agency*, 600 F.2d 844, 873 (D.C. Cir. 1979).

II. Introduction

Wildlife Services is a century-old, highly controversial and secretive animal "damage control" program that is administered by APHIS, an agency within USDA.[11] Wildlife Services traps, snares, poisons, and shoots millions of animals every year in the United States, primarily on behalf of the livestock and agricultural industries and other agribusiness as well as hunting interests.[12] "[T]he result . . . is a program that is wasteful, destructive to the balance of ecosystems, and ultimately ineffective."[13]

According to the program's reported data, Wildlife Services killed over 37.4 million animals between 2010 and 2022, including coyotes, foxes, mountain lions, beavers, and many species of birds, as well as federally- or state-protected animals like eagles, falcons, condors, kit foxes, wolves, grizzly bears, and many more.[14] Killing wildlife at this scale has contributed to the local extinction (the "extirpation") of many North American species, and has fundamentally altered ecosystems at a local, regional, and continental scale.[15]

Coyotes are one of the program's most frequently targeted mammals, with 665,015 coyotes reportedly killed between 2013 and 2022.[16] Such extensive killing of coyotes is typically unwarranted and ineffective at reducing conflict with humans and livestock and in suppressing their populations.[17] As high as these numbers are, however, the actual figures are likely much greater; the program's reported data are not reliable because much of the take is never reported.[18]

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[11] For an overview of the program, *see* USDA, APHIS, ANIMAL DAMAGE CONTROL PROGRAM: FINAL ENVIRONMENTAL IMPACT STATEMENT (1997) [hereinafter "1997 Programmatic FEIS"]. As set forth in the 1997 Programmatic FEIS, the agency broadly defines "control" as "integrated pest management" actions to prevent or minimize wildlife conflict, including technical assistance, direct control, or both. *Id*. at 1-5. "Direct control" means actions that kill or relocate wildlife. *Id.*

[12] Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

[13] Editorial, *Agriculture's Misnamed Agency*, N.Y. TIMES (July 19, 2013), https://www.nytimes.com/2013/07/18/opinion/agricultures-misnamed-agency.html.

[14] USDA, APHIS, Wildlife Services' 2010-2022 Program Data Reports: Table G Animals Taken by Wildlife Services.

[15] Ex. 4, N. J. Colman et al., *Lethal Control of an Apex Predator has Unintended Cascading Effects on Forest Mammal Assemblages*, 281 PROC. ROYAL SOC'Y B 1 (2014).

[16] Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

[17] Ex. 5, Bradley J. Bergstrom, *Carnivore Conservation: Shifting the Paradigm from Control to Coexistence*, 98 J. MAMMALOGY 1, 1-6 (2017); Ex. 6, Eric M. Gese, *Demographics and Spatial Responses of Coyotes to Changes in Food and Exploitation*, *in* PROCS. OF THE 11TH WILDLIFE DAMAGE MGMT. CONF. 271 (2005); *see also* Ex. 7, Bradley J. Bergstrom et al., *License to Kill: Reforming Federal Wildlife Control to Restore Biodiversity and Ecosystem Function*, 7 CONSERV. LETTERS 131 (2013); R.L. Crabtree & J.W. Sheldon, *Coyotes and Canid Coexistance in Yellowstone*, *in* CARNIVORES IN ECOSYSTEMS: THE YELLOWSTONE EXPERIENCE 127 (T. Clark ed., 1999); F.F. Knowlton et al., *Coyote Depredation Control: An Interface Between Biology and Management*, 52 J. RANGE MGMT. 398 (1999).

[18] *See* Tom Knudson, *Long Struggles in Leghold Device Make for Gruesome Deaths*, SACRAMENTO BEE (Apr. 29, 2012) (reporting that "many non-target mortalities are not reported to avoid drawing attention to the agency"); Tom Knudson, *Neck Snare Is a 'Non-Forgiving and Nonselective' Killer, Former Trapper Says*, SACRAMENTO

Moreover, a significant percentage of the animals killed or injured by Wildlife Services are unintentionally targeted. Based on program data, in fiscal year 2020 alone, Wildlife Services killed more than 2,688 "non-target" animals using indiscriminate killing methods like snares, leg-hold traps, and poisons.[19] The actual numbers are likely much higher, as mentioned above. These methods have also killed and injured domestic animals, and in some cases have harmed people.[20] As Congressman Peter DeFazio (D-OR) has warned, "[s]ooner or later [the program is] going to kill a kid."[21] Despite this, the Wildlife Services program has not materially altered its methods or its approach.

Not only does Wildlife Services use destructive and dangerous methods to decimate native wildlife populations and ecosystems and put the public at risk, but its killing of native wildlife has also been frequently ineffective at accomplishing its stated purpose: reducing livestock depredations and otherwise reducing or eliminating species that agricultural or other interests deem to be "pests."[22] The near extermination of wolves from the United States, for example, led to substantial increases in coyote populations through a process called "mesopredators release."[23] In response, Wildlife Services has killed millions of coyotes.[24] But, according to Wildlife Services' own scientists, this has only resulted in increased coyote populations due to compensatory reproduction.[25] Wildlife Services' own research branch, the National Wildlife Research Center, has identified and tested non-lethal measures to reduce livestock depredations that are more effective, humane, and in line with American values, but Wildlife Services has failed to emphasize these methods and adopt them widely in the field.[26]

BEE (Apr. 30, 2012) ("[t]he field guys do not report even a fraction of the non-target animals they catch," according to a former Wildlife Services trapper).

[19] USDA, APHIS, Wildlife Services' 2020 Program Data Report: Table G Animals Taken by Wildlife Services.

[20] *See* Oliver Milman, *'A Barbaric Federal Program': US Killed 1.75m Animals Last Years – or 200 per hour*, GUARDIAN (Mar. 25, 2022), https://www.theguardian.com/world/2022/mar/25/us-government-wildlife-services-animals-deaths [https://perma.cc/M9PM-K3BT].

[21] *See* CONG. REC. H4286 (June 16, 2011) (statement of Rep. DeFazio).

[22] Ex. 8, Adrian Treves et al., *Predator Control Should Not Be a Shot in the Dark*, 14 FRONTIERS ECOLOGY & ENV'T 380, 388 (2016), https://doi.org/10.1002/fee.1312.8; *see* Ex. 9, Lily M. van Eeden et al., *Carnivore conservation needs evidence-based livestock protection*, 16(9) PLOS BIOLOGY e20005577 (2018).

[23] *See* Kim Murray Berger & Mary M. Conner, *Recolonizing Wolves and Mesopredator Suppression of Coyotes: Impacts on Pronghorn Population Dynamics*, 18 ECOLOGICAL APPLICATIONS 599 (2008), https://doi.org/10.1890/07-0308.1; Kevin R. Crooks & Michael E. Soulé, *Mesopredator Release and Avifaunal Extinctions in a Fragmented System*, 400 NATURE 563 (1999); Taal Levi & Christopher C. Wilmers, *Wolves-Coyotes-Foxes: A Cascade Among Carnivores*, 93(4) ECOLOGY 921 (2012); L. R. Prugh et al., *The Rise of the Mesopredator*, 59 BIOSCIENCE 779–91 (2009); William J. Ripple et al., *Widespread Mesopredator Effects After Wolf Extirpation*, 160 BIOLOGICAL CONSERVATION 70 (2012).

[24] Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

[25] *See supra* note 17.

[26] Ex. 7, Bergstrom et al., *License to Kill* ("WS's NationalWildlife Research Center (NWRC) conducts important research in non-lethal control, but those methods NWRC concludes are effective rarely are adopted by WS field operation.").

These deficiencies and various additional problems associated with Wildlife Services' operations have been extensively documented for *decades*, with little discernible change in agency practice—instead, Wildlife Services has frequently worked to shield its worst actions from public scrutiny.[27]

Additionally, Wildlife Services lacks any formal regulations to specify its mission and to set regulatory standards for compliance with major federal statutes, including the Freedom of Information Act;[28] National Environmental Policy Act;[29] Data Quality Act;[30] Endangered Species Act;[31] Bald and Golden Eagle Protection Act;[32] Migratory Bird Treaty Act;[33] Federal Insecticide, Fungicide, and Rodenticide Act;[34] and other authorities, as well as with its own policies and prevailing American values. Moreover, the fact that Wildlife Services consistently fails to follow its own policy directives (as discussed throughout this petition) underscores the need for such binding regulations.

Based on the foregoing concerns, and in light of scientific developments as well as additional information made available since 2013 about the disastrous effects of Wildlife Services' operations, Petitioners once again seek a formal rulemaking under the APA, including notice and an opportunity for public comment and final promulgation of substantive regulations, that will fill gaps in the existing statutory scheme, establish a regulatory framework for program activities, and ensure the program's consistency with all applicable laws, policies, the best information, and American values.[35]

III. Areas in Need of Reform

A. Wildlife Services Continues to Contribute to Species Decline and Impairment of Recovery by Decimating Wildlife Populations and Unraveling Ecosystems

Since the 2013 Petition for Rulemaking, Wildlife Services has increased its lethal control of wildlife to an even greater extent: for the fiscal years 2013 through 2022, Wildlife Services

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[27] *See infra* at III.E (discussing program's lack of transparency).

[28] 5 U.S.C. § 552 *et seq*.

[29] 42 U.S.C. § 4321-4370h.

[30] Public Law 106–554; H.R. 5658.

[31] 16 U.S.C. §§ 1531-1544.

[32] *Id.* §§ 668-668d.

[33] *Id.* §§ 703-711.

[34] 7 U.S.C. §§ 135-136y.

[35] Legislative, or substantive, regulations are "issued by an agency pursuant to statutory authority and which implement the statute" and "have the force and effect of law." *Batterton v. Francis*, 432 U.S. 416, 437 (1977) (quoting U.S. Dep't of Justice, Attorney General's Manual on the Administrative Procedure Act (1947) and citing *United States v. Mersky,* 361 U.S. 431, 437-438 (1960); *Atchison, T. & S.F.R. Co. v. Scarlett***,** 300 U.S. 471, 474 (1937)); *see also Chrysler Corp. v. Brown*, 441 U.S. 281, 303 (1979) ("For agency discretion is limited not only by substantive, statutory grants of authority, but also by the procedural requirements which 'assure fairness and mature consideration of rules of general application.'") (quoting *NLRB v. Wyman-Gordon Co*., 394 U.S. 759, 764 (1969)).

killed approximately 25.3 million animals, for an average of 2.5 million animals per year.[36] That is nearly double the 1.4 million animals killed on average by Wildlife Services between 2003 and 2012.[37] The removal of so many animals from the environment — especially carnivores — certainly alters native ecosystems directly, indirectly, and cumulatively.[38] Indeed, literature indicates that killing wildlife at this scale has contributed to the localized extinction (extirpation) of many North American species, and has fundamentally altered ecosystems at a local, regional, and continental scale.[39] There is a consensus emerging among ecologists that extirpated, depleted, and destabilized populations of large predators are negatively affecting the biodiversity and resilience of ecosystems.[40]

At the time of the 2013 Petition for Rulemaking, there already existed a "consensus among ecologists that significant reductions in local populations of native primary consumers and apex predators has had far-reaching consequences on primary production, nutrient flows, disease incidence, and biodiversity at all levels and at all spatial scales."[41] To date, not a single "gold-standard" experiment—one in which an "intervention [is] used to protect a livestock herd (treatment) and its effectiveness is compared against a livestock herd that is not exposed to the intervention (placebo control)"—on lethal control of carnivores to prevent predation on domestic animals has proven reliable.[42]

Many of the species targeted by Wildlife Services play critical roles in ecosystems, and their removal results in a cascade of unintended consequences. In particular, it is well documented that the loss of top carnivores causes a wide range of "unanticipated impacts" that are often profound, altering "processes as diverse as the dynamics of disease, wildfire, carbon sequestration, invasive species, and biogeochemical cycles."[43]

The "restoration of apex predator populations and the ecosystem services they provide…[i]s a critical imperative for the conservation of biodiversity."[44] Recent studies have confirmed, for example, that mountain lions are vital to ecosystem health, creating large carcasses that feed more mammals and birds than any other predator.[45] Additionally, mountain lions act as "ecosystem engineers" by creating essential habitat for over two hundred species of

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[36] Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

[37] *See id.*; Ctr. for Biological Diversity, *Data Compilation of Annual Animal Killings by Wildlife Services* (2013).

[38] John Winnie Jr. & Scott Creel, *The many effects of carnivores on their prey and their implications for trophic cascades, and ecosystem structure and function*, 12 FOOD WEBS 88 (2017).

[39] William J. Ripple et al., *Large predators, deer, and trophic cascades in boreal and temperate ecosystems*, *in* TROPHIC CASCADES: PREDATORS, PREY, AND THE CHANGING DYNAMICS OF NATURE 141 (2010).

[40] Ex. 7, Bergstrom et al., *License to Kill*.

[41] *Id.*

[42] Ex. 8, Treves et al., at 462; *see also* Ex. 9, van Eeden et al.

[43] *Id.*

[44] Ex. 4, Colman et al.

[45] L. Mark Elbroch et al., *Vertebrate Diversity Benefiting from Carrion Provided by Pumas and Other Subordinate, Apex Felids*, 215 BIOLOGICAL CONSERVATION 123, 131 (2017).

carrion-dependent beetles.[46] Apex predators like cougars can also influence riparian vegetation. An examination of Fremont cottonwood recruitment in Zion National Park, Utah, linked a decline in mountain lions to a trophic cascade in Zion Canyon.[47] As cougar numbers declined, deer numbers increased, which let to reduced cottonwood recruitment, increased bank erosion, and decreased riparian diversity. In contrast, riparian communities where cougar populations remained undisturbed have remained intact.

The reintroduction of wolves in various riparian areas has also had major benefits for diverse species, including aspen, songbirds, beavers, bison, fish, pronghorn, foxes, and grizzly bears. [48] Through density-mediated (i.e., consumptive) and/or behaviorally-mediated (i.e., non-consumptive) influences on culling deer and elk,[49] wolves help reduce overgrazing in riparian areas, leading to less turbid waters,[50] increasing the height of berry-producing shrubs[51] and the number of berries available to birds, bears, and rodents.[52] Wolves also benefit scavengers by leaving carrion derived from predation; hence, wolf removal leads to reduced abundance of carrion for scavengers in specific areas.[53]

The removal of apex predators may have other unexpected outcomes; for example, it can cause the "release" of mid-sized or "mesopredators" like foxes, raccoons, and skunks that are not at the top of the food chain in the presence of coyotes.[54] Increased abundance of mesopredators in turn can negatively affect populations and diversity of other species, including ground-nesting birds, rodents, lagomorphs, and others.[55] In some cases, declines in these species result in

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[46] Joshua M. Barry et al., *Pumas as Ecosystem Engineers: Ungulate Carcasses Support Beetle Assemblages in the Greater Yellowstone Ecosystem*, 189(3) OECOLOGIA 577 (2019).

[47] William J. Ripple & Robert L. Beschta, *Linking a cougar decline, trophic cascade, and catastrophic regime shift in Zion National Park*, 133(4) BIOLOGICAL CONSERVATION 397 (2006).

[48] Ex. 7, Bergstrom et al., *License to Kill*, at 131–42; J.A. Estes et al., *Trophic Downgrading of Planet Earth*, 333 SCIENCE 301–06 (2011); Ex. 10, William J. Ripple & Robert L. Beschta, *Trophic Cascades in Yellowstone: The First 15 Years After Wolf Reintroduction*, 145 BIOL. CONSERV. 205 (2012).

[49] Peter Haswell et al., *Large Carnivore Impacts are Context-Dependent*, 12 FOOD WEBS 3 (2016).

[50] *See* Peter Kareiva et al., *A New Era of Wolf Management Demands Better Data and a More Inclusive Process*, CONSERVATION SCI. & PRACTICE 5 (2022), https://doi.org/10.1111/csp2.12821.

[51] Robert L. Beschta & William J. Ripple, *Riparian Vegetation Recovery in Yellowstone: The First Two Decades After Wolf Reintroduction*, 198 BIOLOGICAL CONSERVATION 93 (2016).

[52] Robert L. Beschta & William J. Ripple, *Berry-Producing Shrub Characteristics Following Wolf Reintroduction in Yellowstone National Park*, 276 FOREST ECOLOGY & MGMT. 132 (2012).

[53] Ex. 10, Ripple & Beschta, *Trophic Cascades in Yellowstone*; C.C. Wilmers et al., *Trophic Facilitation by Introduced Top Predators: Grey Wolf Subsidies to Scavengers in Yellowstone National Park*, 72 J. ANIM. ECOL. 909 (2003); C.C. Wilmers, D.R. Stahler, R.L. Crabtree, D.W. Smith, and W.M. Getz, *Resource Dispersion and Consumer Dominance: Scavenging at Wolf- and Hunter-Killed Carcasses in Greater Yellowstone, USA*, 6 ECOLOGY LETTERS 996–1003 (2003).

[54] Crooks & Soulé, *supra* note 23, at 563–66 (noting that although coyotes are mesopredators when wolves are present, they can act as apex carnivores where wolves have been extirpated); L.R. Prugh et al., *supra* note 23.

[55] William J. Ripple et al., *Widespread mesopredator effects after wolf extirpation*. 160 BIOLOGICAL CONSERVATION 70-79 (2013).

reduced prey for other carnivores and contribute to their decline and extirpation.

Black bears, too, have been found to be co-regulators (with wolves and cougars) of elk populations, which in turn helps regulate the ungulate impacts on plant biomass, maintaining the health of rangelands as well as habitat for other species of animals.[56] According to Marian Litvaitis, a professor of natural resources and the environment at the University of New Hampshire, "bobcats' success may be an important indicator of overall ecosystem health" as well.[57] Coyotes limit mesocarnivore populations and increase bird diversity and abundance;[58] coyotes also help to control rodents, thus reducing the spread of rodent-born zoonotic diseases such as plague, hantavirus, and tick borne diseases such as Lyme.[59] Coyotes also consume carrion, remove sick animals from the gene pool, disperse seeds, and increase the biological diversity of plant and wildlife communities.[60]

Despite these benefits, Wildlife Services continues to pursue lethal predator control to the detriment of ecosystem health and biodiversity. Between 2013 and 2022, Wildlife Services killed 665,015 coyotes, 7,975 bobcats, 3,382 gray wolves, 4,486 black bears, and 2,943 mountain lions.[61] In 2022 alone, Wildlife Services killed 56,010 coyotes.[62]

Moreover, Wildlife Services has not limited its lethal control activities to predators. Many other species that serve important roles in their ecosystems have been targeted by the program as well, such as prairie dogs and beavers.[63] Prairie dogs are keystone species,[64] providing a prey base for numerous species and providing numerous ecological services. Prairie dog destruction causes a reduction in prey base, which negatively affects the broad range of avian and mammalian predators that prey on prairie dogs or are dependent upon prairie dog

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56 Nicole M. Tatman et al., *Effects of Calf Predation and Nutrition on Elk Vital Rates*, 82 J. WILDIFE MGMT. 1417 (2018).

57 *New UNH Bobcat Research Aims to Understand Why Wildcats Are Rebounding*, U.N.H. (Oct. 17, 2016), https://www.unh.edu/unhtoday/news/release/2016/10/17/new-unh-bobcat-research-aims-understand-why-wildcats-are-rebounding [https://perma.cc/Q9XS-NRC9].

58 Crooks & Soulé, *supra* note 23.

59 Alexander G. Watts et al., *Urbanization, Grassland, and Diet Influence Coyote (Canis latrans) Parasitism Structure,* 12(4) ECOHEALTH 645 (2015); *see* Taal Levi, *Deer, Predators, and the Emergence of Lyme Disease*, 109(27) PROC. NAT'L ACAD. SCI. 10942 (2012), https://doi.org/10.1073/pnas.1204536109.

60 S.E. Henke & F.C. Bryant, *Effects of Coyote Removal on the Faunal Community in Western Texas*, 63 J. WILDLIFE MGMT. 1066 (1999); E.T. Mezquida, et al., *Sage-Grouse and Indirect Interactions: Potential Implications of Coyote Control on Sage-Grouse Populations*, 108(4) CONDOR 747 (2006); N. M. Waser et al., *Coyotes, Deer, and Wildflowers: Diverse Evidence Points to a Trophic Cascade*, 101 NATURWISSENSCHAFTEN 427 (2014).

61 Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

62 USDA, APHIS, Wildlife Services' 2022 Program Data Report: Table G Animals Taken by Wildlife Services, USDA Animal and Plant Health Inspection Service [hereinafter "2022 Program Data Report"].

63 Between 2018-2022, Wildlife Services killed 123,811 beavers and 66,021 prairie dogs. USDA, APHIS, Wildlife Services' 2018-2022 Program Data Reports: Table G Animals Taken by Wildlife Services.

64 Natasha B. Kotliar et al., *The Prairie Dog as a Keystone Species*, *in* CONSERVATION OF THE BLACK-TAILED PRAIRIE DOG: SAVING NORTH AMERICA'S WESTERN GRASSLANDS 53 (J. Hoogland ed., 2006); Miguel Delibes-Mateos et al., *The Paradox of Keystone Species Persecuted as Pests: A Call for the Conservation of Abundant Small Mammals in their Native Range*, 144 BIOLOGICAL CONSERVATION 1335 (2011).

colonies for habitat, such as badgers, black-footed ferrets, coyotes, ferruginous hawks, golden eagles, prairie falcons, burrowing owls, prairie rattlesnakes, mountain plovers, and horned larks.[65] In addition to serving as a prey base for dependent and associated species,[66] prairie dogs provide vital ecosystem services that are compromised when they are killed en masse. These ecosystem services include: increased groundwater recharge and water penetration,[67] soil aeration,[68] carbon sequestration,[69] nutrient cycling,[70] increased nitrogen content of soil and plants,[71] creation of a diverse mosaic of grassland habitats,[72] prevention of desertification,[73] and fire breaks.[74]

Similarly, Wildlife Services has killed approximately 25,000 beavers per year since 2013,[75] notwithstanding the fact that beavers are keystone species and ecosystem engineers that construct niches beneficial to diverse plant and animal assemblages. Beaver dams and ponds adjust stream morphology and in-stream habitat in a variety of ways that are beneficial for many freshwater species, including waterfowl and federally protected mussels.[76] Beaver dams retain and conserve water that otherwise would flow more quickly through a watershed, and thus help regulate the flow of streams and rivers and dampen the amplitude of fluctuations in flow levels below their dams. Beaver dams create areas of deeper water than would typically be found in small streams, and impounded waters upstream of beaver dams cover much greater surface area than the preexisting stream channels.[77] As a result, beavers enhance streams' carrying capacity

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65 *Id.*

66 *Id.*

67 A. OUTWATER, WATER: A NATURAL HISTORY (1996); L. Martínez-Estévez, et al., *Prairie dog decline reduces the supply of ecosystem services and leads to desertification of semiarid grasslands*, 8 PLOS ONE 1–9 (2013); J.K. Detling, *Mammalian herbivores: ecosystem-level effects in two grassland national parks*, 26 WILDLIFE SOC'Y BULL. 438–448 (1998).

68 Kotliar et al., *supra* note 64, at 53.

69 *Supra* note 67.

70 Kotliar et al., *supra* note 64.

71 Detling, *supra* note 67; E.A. Holland & J.K. Detling, *Plant response to herbivory and below ground nitrogen cycling*, 71 ECOLOGY 1,040 (1990).

72 C.N. SLOBODCHIKOFF, ET AL., PRAIRIE DOGS: COMMUNICATION AND COMMUNITY IN AN ANIMAL SOCIETY (2009).

73 Eduardo Ponce-Guevara, et al., *Interactive effects of black-tailed prairie dogs and cattle on shrub encroachment in a desert grassland ecosystem*, 11 PLOS ONE e0154748 (2016).

74 Kotliar et al., *supra* note 64.

75 Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

76 JANINE CASTRO ET AL., THE BEAVER RESTORATION GUIDEBOOK: WORKING WITH BEAVER TO RESTORE STREAMS, WETLANDS, AND FLOODPLAINS 4-17 (2015).

77 Robert J. Naiman et al., *Ecosystem Alteration of Boreal Forest Streams by Beaver* (*Castor canadensis*), 67(5) ECOLOGY 1254, 1258, 1266 (1986); *see* OR. DEP'T OF FISH & WILDLIFE, THE IMPORTANCE OF BEAVER (*CASTOR CANADENSIS*) TO COHO HABITAT AND TREND IN BEAVER ABUNDANCE IN THE OREGON COAST COHO ESU 2–3 (2005).

for fish.[78] Additionally, beaver ponds and dams dissipate stream energy during floods or high flow events and create areas of slow moving or still water in an otherwise moving-water environment.[79] By slowing water velocities and increasing water depth and storage capacity, beaver dams can contribute to groundwater recharge and thereby help increase summer low flows in streams.[80] By slowing river flow and retaining water in ponds, beaver dams can retain sediment, pollutants and nutrients so that the water quality downstream is improved and stream sediment load is reduced.[81] As such, beaver dams can benefit downstream mussel populations.[82]

Beaver ponds and dams also create complex shorelines and in-stream habitats.[83] That complexity results in greater aquatic productivity — and thus more food for piscivorous wildlife — than stream reaches that do not have beaver dams.[84] In incised and degraded streams, beaver-mediated restoration can efficiently restore ecosystem function and thereby increase imperiled fish populations such as steelhead.[85] Beaver not only create habitat but also facilitate movement of aquatic species through canals that enhance connectivity among isolated aquatic features and between aquatic and terrestrial environments.[86] Beaver dams also provide natural cover that is

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[78] W. HOFFMAN & F. RECHT, BEAVERS AND CONSERVATION IN OREGON COASTAL WATERSHEDS (2013), available at: http://www.martinezbeavers.org/wordpress/wp-content/uploads/2013/05/final-Beavers-and-Conservation-in-Oregon-Coastal-Watersheds.pdf [https://perma.cc/26BB-C99U].

[79] THE IMPORTANCE OF BEAVER (*CASTOR CANADENSIS*) TO COHO HABITAT, *supra* note 77; Ming-ko Woo & James M. Waddington, *Effects of Beaver Dams on Subarctic Wetland Hydrology*, 43(3) ARCTIC 223 (1990).

[80] Karen Leidholdt-Bruner et al., *Beaver Dam Locations and Their Effects on Distribution and Abundance of Coho Salmon Fry in Two Coastal Oregon Streams*, 66(4) NW. SCI. 218 (1992); *see* Michael M. Pollock et al., *Hydrologic and Geomorphic Effects of Beaver Dams and Their Influence on Influence on Fishes*, *in* THE ECOLOGY AND MANAGEMENT OF WOOD IN WORLD RIVERS (S.V. Gregory et al. eds., 2003).

[81] Angela M. Gurnell, *The hydrogeomorphological effects of beaver dam-building activity*, 22(2) PROGRESS IN PHYSICAL GEOGRAPHY 167 (1998); Frank Rosell et al., *Ecological impact of beavers* Castor fiber *and* Castor canadensis *and their ability to modify ecosystems*, 35(3-4) MAMMAL REV. 248 (2005).

[82] Ruairidh D. Campbell, *What has the beaver got to do with the freshwater mussel decline? A response to Rudzīte (2005)*, 710 BIOLOGY 159 (2006).

[83] Robert J. Naiman et al., *Alteration of North American Streams by Beaver*, 38(11) BIOSCIENCE 753 (1988).

[84] P. Colen & R.J. Gibson, *The general ecology of beavers (Castor spp.), as related to their influence on stream ecosystems and riparian habitats, and the subsequent effects on fish – a review*, 10(4) REVS. IN FISH BIOLOGY & FISHERIES 439 (2000); Leidholdt-Bruner et al., *supra* note 80; Joel W. Snodgrass & Gary K. Meffe, *Influence of Beavers on Stream Fish Assemblages: Effects of Pond Age and Watershed Position*, 79(3) ECOLOGY 928 (1998); Michael M. Pollock et al., *The Importance of Beaver Ponds to Coho Salmon Production in the Stillaguamish River Basin, Washington, USA*, 24 N. AM. J. OF FISHERIES MGMT. 749 (2004); Joseph M. Smith & Martha E. Mather, *Beaver dams maintain fish biodiversity by increasing habitat heterogeneity throughout a low-gradient stream network*, 58(7) FRESHWATER BIOLOGY 1523 (2013).

[85] Nicolaas Bouwes et al., *Ecosystem experiment reveals benefits of natural and simulated beaver dams to a threatened population of steelhead* (Oncorhynchus mykiss), 6 SCI. REPS. 28581 (2016).

[86] N.L. Anderson et al., *Linking aquatic and terrestrial environments: can beaver canals serve as movement corridors for pond-breeding amphibians?*, 18(3) ANIMAL CONSERVATION 287 (2015); Bartosz Grudzinski, *Beaver canals and their environmental effects*, 44(2) PROGRESS IN PHYSICAL GEOGRAPHY 189 (2019); Glynnis A. Hood, *Ecological engineering and aquatic connectivity: A new perspective from beaver-modified wetlands*, 60(1) FRESHWATER BIOLOGY 198 (2014).

especially important for fish rearing sites.[87] Beaver dam presence attenuates flow reducing downstream flood risk and mitigating uncharacteristic wildfire. Beaver dam presence might also help slow wildfires. Fires spread faster across uniformly dry landscapes covered with fuel such as trees and grass, quickly eating up whatever is in their path. Patchy landscapes like valleys dotted with beaver dams can slow a fire by forcing it to hop over hard-to-burn areas.[88] Finally, beaver-dammed wetlands may create critical refugia for plants and animals to withstand disturbance, increase riparian resilience to fire and drought, and contribute to climate-resiliency in various landscapes.[89] Due to these ecosystem impacts, the killing of beavers may result in the take of aquatic and riparian threatened and endangered species, thatuse habitats created by

[87] GORDON H. REEVES ET AL., U.S. DEP'T OF AGRIC., IDENTIFICATION OF PHYSICAL HABITATS LIMITING THE PRODUCTION OF COHO SALMON IN WESTERN OREGON AND WASHINGTON (1989), available at https://www.fs.usda.gov/pnw/pubs/pnw_gtr245.pdf [https://perma.cc/KWT2-NHXX].

[88] Olivia Box, *Let beavers do the work: Fighting wildfire one dam at a time*, NAT'L ASS'N SCI. WRITERS (Feb. 4, 2021), https://www.nasw.org/article/let-beavers-do-work-fighting-wildfire-one-dam-time [https://perma.cc/WE83-NNFC].

[89] Emily Fairfax & Andrew Whittle, *Smokey the Beaver: Can Beaver Dams Help Protect Riparian Vegetation During Wildfire?*, CONF. PROC.: AM. GEOPHYSICAL UNION FALL MEETING (2019); Glynnis A. Hood & Suzanne E. Bayley, *Beaver* (Castor canadensis) *mitigate the effects of climate on the area of open water in boreal wetlands in western Canada*, 141(2) BIOLOGICAL CONSERVATION 556 (2008).

beavers, including Chinook salmon, steelhead,[90] coho salmon,[91] southwestern willow flycatcher,[92] tidewater goby,[93] and Oregon spotted frog.[94]

The removal of beavers may also harm migratory bird species. Several studies show that beaver ponds attract and support waterfowl. It is well established that wood ducks are often

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[90] The final recovery plan for the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and the distinct population segment of California Central Valley steelhead explains that they need freshwater rearing sites like beaver dams that provide natural cover. *See* NOAA FISHERIES, RECOVERY PLAN FOR THE EVOLUTIONARILY SIGNIFICANT UNITS OF SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON AND CENTRAL VALLEY SPRING-RUN CHINOOK SALMON AND THE DPS OF CALIFORNIA CENTRAL VALLEY STEELHEAD (July 1, 2014), https://media.fisheries.noaa.gov/dam-migration/central_valley_salmonids_recovery_plan-accessible.pdf [https://perma.cc/Q446-BE6W].

[91] In the Final Rule designating critical habitat for Central California Coast and Southern Oregon/Northern California Coasts coho salmon, NMFS explained, "NMFS agrees with the statements by one commenter that beaver dams and their associated habitat changes (e.g., channel flooding, and flow and siltation changes) often create ideal conditions for coho salmon. Some of the beneficial habitat effects from beaver activity include improved rearing and overwintering habitat, increased water volumes during low flows, and backwater habitat refuge areas during floods . . . NMFS will identify beaver removal as an activity potentially requiring special management consideration, and encourages landowners and agencies to promote beaver habitation as one means by which to support coho salmon recovery." Designated Critical Habitat; Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon, 64 Fed. Reg. 24049, 24053 (May 5, 1999), https://www.federalregister.gov/documents/1999/05/05/99-11187/designated-critical-habitat-central-california-coast-and-southern-oregonnorthern-california-coasts. In the Final Rule listing the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of coho salmon, NMFS explained that "eradication of beaver have adversely modified fish habitat" and that "beaver trapping" is one of the "major activities responsible for the decline of coho salmon in Oregon and California." Endangered and Threatened Species; Threatened Status for Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon, 62 Fed. Reg. 24588 (May 6, 1997), https://www.federalregister.gov/documents/1997/05/06/97-11571/endangered-and-threatened-species-threatened-status-for-southern-oregonnorthern-california-coast. The "Final Recovery Plan for the Southern Oregon/ Northern California Coast Evolutionarily Significant Unit of Coho Salmon" provides a detailed discussion of the importance of beavers to coho salmon, explaining, for example, "[b]eaver ponds provide high quality winter and summer rearing habitat for coho salmon." NOAA FISHERIES, FINAL RECOVERY PLAN FOR THE SOUTHERN OREGON/NORTHERN CALIFORNIA COAST EVOLUTIONARILY SIGNIFICANT UNIT OF COHO SALMON *(ONCORHYNCHUS KISUTCH)* (Jan. 1, 2014), https://www.fisheries.noaa.gov/resource/document/final-recovery-plan-southern-oregon-northern-california-coast-evolutionarily [https://perma.cc/LE9A-M77D].

[92] In the Final Rule listing the southwestern willow flycatcher, FWS explained, "[b]eavers cut and use willow and cottonwood, but may also be important in creating quietwater riparian habitats by damming smaller and steeper creeks." Endangered and Threatened Wildlife and Plants; Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher, 60 Fed. Reg. 10694 (Feb. 27, 1995). In the Final Rule designating its critical habitat, FWS further explained, "[l]ands with moist conditions that support riparian plant communities are areas that provide flycatcher habitat. Conditions like these typically develop in lower elevation floodplains as well as where streams enter impoundments, either natural (such as beaver ponds) or human-made (reservoirs)." Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Southwestern Willow Flycatcher 78 Fed. Reg. 343 (Jan. 3, 2013).

[93] The Final Rule designating critical habitat for the tidewater goby explained that the fish are "sometimes in beaver impounded sections of streams." Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Tidewater Goby, 65 Fed. Reg. 69693 (Nov. 20, 2000).

[94] The Final Rule designating critical habitat for the Oregon spotted frog explained that removal of beavers and features created by beavers threatens "physical or biological features that are essential to the conservation of this species." Designation of Critical Habitat for the Oregon Spotted Frog, 81 Fed. Reg. 29335 (May 11, 2016).

associated with beaver ponds.[95] Other waterfowl also benefit from beavers and are harmed by their removal. In the Appalachian Plateau region of New York, hooded mergansers were found more often at active beaver ponds than at inactive beaver ponds or at the wetlands with no recent record of beaver occupation.[96] When beaver occupied wetlands in Finland and their dam-building created flooding, green-winged teal became more numerous.[97] Broods of the green-winged teal, mallard and goldeneye all foraged in beaver ponds as did juvenile green-winged teal and goldeneye.[98]

Wildlife Services itself acknowledges that "[w]hen trapping for beaver, special attention should be given to look for signs of river otter," seeing as "river otters occupy the same habitat and are frequently caught in beaver traps."[99] And yet Wildlife Services kills hundreds of river otters each year.[100]

In short, Wildlife Services' widespread killing of predators, prairie dogs, and beavers in particular has caused, and continues to create, significant adverse impacts on wildlife populations and ecosystems.

B. <u>Scientific Evidence Continues to Demonstrate that Non-lethal Methods Are More Effective in Preventing Livestock Depredations and Wildlife Conflicts</u>

Not only are Wildlife Services' wildlife damage management programs destructive, but they are also frequently ineffective at their stated purpose of protecting livestock and crops from native wildlife or boosting game species. Indeed, studies have shown that lethal predator control not only fails to reduce livestock predation over the long term, but in many cases lethal control actually increases livestock predation.[101] Similarly, as discussed in the 2013 Petition for

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[95] W.H. Carr, *Beaver and Birds*, 42(2) BIRD LORE 141 (1940); Anita M. Grover & G. Baldassarre, *Bird species richness within beaver ponds in south-central New York*, 15 WETLANDS 108 (1995); M. Todd Merendino et al., *Wetland Availability and Use by Breeding Waterfowl in Southern Ontario*, 59(3) J. WILDLIFE MGMT. 527 (1995); H.P. Nevers, *Waterfowl utilization of beaver impoundments in southeastern New Hampshire*, 25 TRANSACTIONS OF THE NE. FISH & WILDLIFE CONF. 105 (1968).

[96] Grover & Baldassarre, *supra* note 95.

[97] Petri Nummi & Hannu Pöysä, *Population and community level responses in Anas-species to patch disturbance caused by an ecosystem engineer, the beaver*, 20(6) ECOGRAPHY 580 (1997).

[98] Petri Nummi & Hannu Pöysä, *Habitat use by different-aged duck broods and juvenile ducks*, 1(3) WILDLIFE BIOLOGY 181 (1995).

[99] JIMMY D. TAYLOR ET AL., USDA-APHIS, WILDLIFE DAMAGE MANAGEMENT TECHNICAL SERIES: BEAVERS (2017), https://www.aphis.usda.gov/wildlife_damage/reports/Wildlife%20Damage%20Management%20Technical%20Series/Beaver-WDM-Technical-Series.pdf.

[100] Wildlife Services' 2013-2022 Program Data Reports, *supra* note 3.

[101] *See* Silke Bauer et al., *Shooting may aggravate rather than alleviate conflicts between migratory geese and agriculture*, 55(6) J. APPLIED ECOLOGY 2653 (2018); Richard Beggs et al., *Patch-scale culls of an overabundant bird defeated by immediate recolonization*, 29(3) ECOLOGICAL APPLICATIONS e01846 (2019); Ex. 5, Bergstrom, *Carnivore Conservation*; Elizabeth H. Bradley et al., *Effects of wolf removal on livestock depredation recurrence and wolf recovery in Montana, Idaho, and Wyoming*, 79(8) J. WILDLIFE MGMT. 1337 (2015); Heather M. Bryan et al., *Heavily hunted wolves have higher stress and reproductive steroids than wolves with lower hunting pressure*,

rulemaking, a study by Hurley et al. found that predator control programs have proven to be ineffective at increasing game populations because other factors, such as climate, habitat and forage are often more important than predation in determining population trajectory.[102] Yet Wildlife Services did not even address the Hurley study in its denial of the 2013 Petition, much as it failed to discuss the study in its Environmental Assessment for its program of lethal predator control in Idaho. According to the federal district court of Idaho:

> The IDFG [Idaho Department of Fish and Game] had commented on the Draft EA that it failed to provide an objective study of PDM's effectiveness, in part because it did not discuss an "extensive study [of Wildlife Services] involvement in southern Idaho, Hurley *et al*. 2011." [citation omitted] The Hurley study concluded that coyote removal by Wildlife Services in southeastern Idaho did not benefit mule deer populations. In the Final EA, Wildlife Services does not discuss the Hurley study in any detail, but merely states that "based on information from [Hurley] and published studies ... coyote removals for deer population enhancement are not anticipated." [citation omitted] Wildlife Services missed the point of the IDFG's comment—the Hurley study was an excellent source of analysis not just for that particular program but for the broader question of the effectiveness of predator removal.[103]

Since the 2013 Petition, new studies continue to undercut the scientific reasoning for Wildlife Services' use of lethal predator control. Bradley Bergstrom, Ph.D., a professor of wildlife biology at Valdosta State University and chairman of the American Society of Mammalogists' conservation committee, points to three reasons predator removal is likely to have no long-term effect—or even adverse effects—on depredation of livestock: (1) vacant territories are quickly recolonized, (2) immigration rate of breeding pairs into the area

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29(3) FUNCTIONAL ECOLOGY 347 (2015); H.S. Cooley et al., *Does hunting regulate cougar populations? A test of the compensatory mortality hypothesis*, 90(10) ECOLOGY 2913 (2009); H.S. Cooley et al., *Source populations in carnivore management: Cougar demography and emigration in a lightly hunted population*, 12(4) ANIMAL CONSERVATION 321 (2009); Alberto Fernández-Gil et al., *Conflict Misleads Large Carnivore Management and Conservation: Brown Bears and Wolves in Spain*, 11(3) PLOS ONE e0151541 (2016); Camille Imbert et al., *Why do wolves eat livestock? Factors influencing wolf diet in northern Italy*, 195 BIOLOGICAL CONSERVATION 156 (2016); Lyudmyla Kompaniyets & Marc A. Evans, *Modeling the relationship between wolf control and cattle depredation*, 12(10) PLOS ONE e0187264 (2017); Catherine M.S. Lambert et al., *Cougar Population Dynamics and Viability in the Pacific Northwest*, 70(1) J. WILDLIFE MGMT. 246 (2006); Kaylie A. Peebles et al., *Effects of Remedial Sport Hunting on Cougar Complaints and Livestock Depredations*, 8(11) PLOS ONE e79713 (2013); Niraj Poudyal et al., *Wolf Lethal Control and Livestock Depredations: Counter-Evidence from Respecified Models*, 11(2) PLOS ONE e0148743 (2016); William J. Ripple et al., Status and Ecological Effects of the World's Largest Carnivores, 343 SCI. 1241484 (2014); Benjamin N. Sacks et al., *Relative Vulnerability of Coyotes to Removal Methods on a Northern California Ranch*, 63(3) J. WILDLIFE MGMT. 939 (1999); Francisco J. Santiago-Avila et al., *Killing wolves to prevent predation on livestock may protect one farm but harm neighbors*, 13(12) PLOS ONE e0209716 (2018); Robert B. Wielgus & Kayle A. Peebles, *Effects of Wolf Mortality on Livestock Depredations*, 9(12) PLOS ONE e113505 (2014).

[102] Mark A. Hurley et al., *Demographic Response of Mule Deer to Experimental Reduction of Coyotes and Mountain Lions in Southeastern Idaho*, 178 WILDLIFE MONOGRAPHS 1 (2011).

[103] *W. Watersheds Project v. USDA APHIS Wildlife Services*, 320 F. Supp. 3d 1137, 1144 (D. Idaho 2018).

experiencing lethal control can increase, and (3) immigrants are more likely to be subadults, which have a greater propensity for livestock depredation than older adults.[104] In a global survey of interventions used to protect livestock from big cats, Igor Khorozyan and Matthias Waltert of the Department of Conservation Biology at Georg-August-Universität Göttingen, similarly found that lethal control—including even selective removal—has an effectiveness rate "much lower than that of non-lethal interventions."[105] Khorozyan and Waltert further note that "[t]he effects of lethal control are short-term and further decreasing as vacant places have been occupied by new immigrants which also can kill livestock."[106]

Furthermore, Wildlife Services' justification for killing predators to reduce livestock losses almost certainly overstates loss numbers. As Peter Kareiva et al. explain, USDA combines confirmed kills by wolves with self-reported "probable" cases into one "loss" figure.[107] This loss figure is biased upwards as it assumes every "probable" case is attributable to predators like wolves and is based upon unverified mail surveys.[108] When analyzing USDA's posted figures, Kareiva et al. found a "greater than [] tenfold difference between livestock kills confirmed by state biologists and those extrapolated by the USDA from mailed surveys."[109] As one USDA whistleblower explained: "[m]y guys in the field were going and rubber-stamping anything these people asked them to."[110] Another Wildlife Services District Supervisor stated that "we were the hired gun of the livestock industry."[111] For example, in 2015, USDA reported 2,834 cattle losses from wolves across Idaho, Montana, and Wyoming. But when researchers looked at data reported from the respective state agencies, they found only 148 confirmed cattle deaths attributable to wolves.[112] Researchers found that USDA was reporting wolf kills based on very tenuous connections that defy the facts on the ground—such as one instance in Idaho where the death of cattle with "no bite marks" or other noticeable injuries was still attributed to wolves.[113] In the case of wolves, as a further example, Kareiva et al. found several studies documenting "instances in which lethal methods are ineffective or counterproductive because they worsen conflict."[114] Echoing Dr. Bergstrom's findings, Kareiva et al. note that killing of wolves "disrupts pack stability" and leads to "pack dissolution, increased dispersal, and could lead to more attacks on livestock by single pack-less wolves."[115] Furthermore, a study by Robert Wielgus and Kaylie Peebles found that lethal wolf removal was associated with an *increase* in

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[104] Ex. 5, Bergstrom, *Carnivore Conservation*.

[105] Igor Khorozyan & Matthias Waltert, *A Global View on Evidence-Based Effectiveness of Interventions Used to Protect Livestock from Wild Cats*, 3 CONSERVATION SCI. & PRACTICE 317 (2020), https://doi.org/10.1111/csp2.317.

[106] *Id.*

[107] Ex. 11, Kareiva et al., at 2-3.

[108] *See id.* at 3.

[109] *Id.*

[110] *Id.*

[111] *Id.*

[112] *Id.*

[113] *See id.*

[114] *Id.*

[115] *Id.*

livestock loss the following year,[116] further demonstrating the ineffectiveness of lethal removal over non-lethal management practices. Other studies have reached similar conclusions.[117]

In order to inform future policy and research on predators, a team of scientists systematically evaluated past studies of efforts to combat livestock predation. Of the twelve North American and European tests that met "gold" or "silver" [118] standards for reliable inference, Treves et al. found a greater proportion of non-lethal methods were effective in preventing carnivore predation on livestock than lethal methods (eighty percent versus twenty-nine percent).[119]

Only tests of non-lethal methods have met the gold standard. A gold-standard study by Gehring et al. found that livestock guarding dogs were effective for reducing the risk of livestock depredations by wolves and coyotes on pastures associated with small- and medium-sized cattle farms.[120] A second gold-standard study by Davidson et al. found the technique known as fladry (in which flagging is mounted on fences or ropes as a visual deterrent to predators) demonstrated preventive effects.[121] A third gold-standard study by Ohrens et al. found, after conducting a randomized crossover experimental test, that flashing light deterrents discouraged pumas from preying on alpacas and llamas.[122] In addition to guard dogs and visual deterrents, researchers have cited the success of aversive stimuli generally, including conditioned taste aversion and induced odor aversion.[123]

Rather than continuing to pour tax dollars into the killing of coyotes by the hundreds of thousands, Wildlife Services would be well-advised to recognize the value of intact coyote pack structure in preventing livestock conflict.[124] When non-offending, subordinate, territorial coyotes are killed, social structure and territorial behavior are disrupted, allowing nearby depredating

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[116] Wielgus & Peebles, *supra* note 101.

[117] *See supra* note 101.

[118] Ex. 8, Treves et al. (Gold standard tests use "random assignment to control and treatment groups with experimental designs that avoid biases in sampling, treatment, measurement, or reporting." Silver standard tests are "quasiexperimental tests with haphazard assignment of treatments (case- control or Before–After Control–Impact [BACI] designs)").

[119] *See id.*

[120] Ex. 12, Thomas M. Gehrin et al., *Utility of Livestock-protection Dogs for Deterring Wildlife from Cattle Farms*, 37 WILDLIFE RES. 715 (2010).

[121] Sarah J. Davidson-Nelson & Thomas M. Gehring, *Testing Fladry as a Nonlethal Management Tool for Wolves and Coyotes in Michigan*, 4 HUMAN-WILDLIFE INTERACTIONS 87 (2010).

[122] Ex. 13, Omar Ohrens et al., *Non-Lethal Defense of Livestock Against Predators: Flashing Lights Deter Puma Attacks in Chile*, 17 FRONTIERS ECOLOGY & ENV'T 32 (2019).

[123] *See, e.g.*, Jorge Tobajas et al., *The Effectiveness of Conditioned Aversion in Wolves: Insights from Experimental Tests*, 181 BEHAV. PROCESSES 104259 (2020) (finding that four out of five wolves treated with averse scents demonstrated aversion to the treated meat); *see also* V. Selonen et al., *Protecting Prey by Deceiving Predators: A Field Experiment Testing Chemical Camouflage and Conditioned Food Aversion*, 275 BIOLOGICAL CONSERVATION 109749 (2022) (finding that conditioned food aversion can reduce nest predation).

[124] Randy Comeleo, *Using Coyotes to Protect Livestock. Wait. What?*, OR. STATE U. (Spring 2018), https://smallfarms.oregonstate.edu/using-coyotes-protect-livestock-wait-what [https://perma.cc/JQ7E-ZUGJ].

coyotes (that were formerly excluded) access to livestock.[125] Thus, "well-behaved" coyotes can actually prevent livestock losses by defending a territory which may overlap with sheep pastures—effectively excluding interlopers from neighboring packs who may have learned to kill sheep.[126]

Similarly, efforts to conserve threatened wildlife species have proven unsuccessful when focused on lethal control of predators. A study by Wildlife Services' own National Wildlife Research Center found that lethal control of coyotes did not improve sage grouse female survival or nest success.[127] Rather, the study concluded, "Solutions to address declining sage-grouse numbers must consider the multitude of influential factors affecting sage-grouse ecology (livestock grazing, fire regime, disease, predation and oil and gas development)."[128]

Of the few studies that have found lethal control to be effective, those studies have failed to adhere to the "gold standard" for scientific inference. The Wagner & Conover study,[129] for example (cited by Wildlife Services in its denial of the 2013 Petition in order to justify prophylactic lethal control[130]), was widely criticized as containing numerous design flaws that caused biased results:

> The study had five design flaws, some of which were noted by Mitchell et al. (2004): (1) control pastures started with 40% higher sheep densities, which has been shown to increase vulnerability to predation by North American canids (Robel et al. 1981; Mech et al. 2000; Wydeven et al. 2004) and implies a treatment bias; (2) pre-treatment sheep losses were 186% higher in untreated than treated pastures, suggesting selection bias; (3) untreated pastures were subject to twice the lethal effort (excluding aerial-gunning), again suggesting treatment bias; (4) livestock-guarding dogs (LGDs) were apparently matched between treated and untreated pastures but those data were not presented, implying reporting bias; and (5) the authors made an unsupported assumption in their analyses that the ratio of known to unknown losses was constant across treatments and years (measurement bias).[131]

Moreover, per the federal district court of Idaho, Wildlife Services' rebuttal to the Treves et al. study and defense of the Wagner & Conover study in the Draft EA "feels like equal parts

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[125] *Id.*

[126] *Id.*

[127] Elizabeth K. Orning & Julie K. Young, *Coyote Removal: Can the Short-term Application of a Controversial Management Tool Improve Female Greater Sage-grouse Survival or Nest Success?*, WILDLIFE BIOLOGY 1 (2017).

[128] *Id.*

[129] Kimberly Wagner & Michael Conover, *Effective of Preventive Coyote Hunting on Sheep Losses to Coyote Predation*, 63(2) J. WILDLIFE MGMT. 606 (1999).

[130] Ex. 3, Denial, at 5.

[131] Ex. 8, Treves et al.

personal attack and scientific rebuttal—it does not so much convince the reader of the agency's position as cry out for a more objective review."[132]

Nor are criticisms of Wildlife Services' overall approach and philosophy regarding predator control limited to outside experts, with other federal agencies levying strong criticisms as well. For example, the Bureau of Land Management ("BLM") has stated that "there is no guarantee that predator control will have the intended impact on prey populations." BLM went on to explain that scientific studies have shown how "mammalian predators respond to losses of individual members of populations by adjusting space use or increasing litter sizes."[133]

Indeed, many state agencies have recognized that wildlife management programs based on predator control are ineffective.[134] The Pennsylvania Game Commission issued the following statement in 2016:

> During the late 1800s and early 1900s, the Game Commission focused much of its energy and resources into predator control efforts. During this period, we did not understand the relationship between predators and prey. After decades of using predator control . . . with no effect, and the emergence of wildlife management as a science, the agency finally accepted the reality that predator control does not work.[135]

Much like its lethal predator control, Wildlife Services' lethal control of beavers lacks an adequate scientific basis. While Wildlife Services claims that "a variety of trapping methods and types of traps are effective for beavers,"[136] a U.S. Fish and Wildlife Service ("FWS") report concluded that "[n]on-lethal management [of beavers] is more effective and less costly than lethal removal."[137] This included resolving problems with beavers cutting down trees, with the

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[132] *W. Watersheds Project*, 320 F. Supp. 3d at 1149.

[133] *Id.*

[134] *E.g.*, N.C. WILDLIFE RES. COMM'N, COYOTE MGMT. PLAN (2018), available at https://www.ncwildlife.org/Portals/0/Learning/documents/Species/Coyote%20Management%20Plan_FINAL_030118.pdf [https://perma.cc/2C74-VKP4] (concluding, after reviewing a large body of scientific and peer-reviewed literature, that indiscriminate, lethal methods of controlling coyotes, such as bounties and harvest incentive programs, are ineffective and counterproductive, that coyotes provide benefits to humans and ecosystems, and that non-lethal measures are the best way to address conflicts with coyotes); N.Y. DEP'T OF ENVT. CONSERVATION, DIV. OF FISH & WILDLIFE, THE STATUS AND IMPACT OF EASTERN COYOTES IN NORTHERN NEW YORK (1991), available at https://voicesofwildlifeinnh.org/wp-content/uploads/The-Status-and-Impact-of-Eastern-Coyotes-in-Northern-New-York.pdf [https://perma.cc/4P7H-YLG2] (stating that "random removal of coyotes resulting from a year-round hunting season will not . . . control or reduce coyote populations").

[135] Bob Frye, *Habitat, not predators, seen as key to wildlife populations*, TRIB LIVE (July 25, 2016), http://triblive.com/sports/outdoors/10756490-74/game-predator-predators [https://perma.cc/M7EF-LF2V].

[136] JIMMY D. TAYLOR ET AL., USDA-APHIS, WILDLIFE DAMAGE MANAGEMENT TECHNICAL SERIES: BEAVERS (2017), https://www.aphis.usda.gov/wildlife_damage/reports/Wildlife%20Damage%20Management%20Technical%20Series/Beaver-WDM-Technical-Series.pdf [https://perma.cc/C9PM-3JWA].

[137] Michael M. Pollock & Greg Lewallen, *Chapter 9—Non-lethal Options for Mitigating the Unwanted Effects of Beaver*, *in* THE BEAVER RESTORATION GUIDEBOOK 103 (2015).

FWS report concluding that "surrounding trees with a cylindrical wire mesh cage is the simplest, most effective means of preventing a beaver from cutting down a tree."[138] As for unwanted flooding, the FWS report found that use of "flexible pond-levelers" have proven highly effective in permanently lowering water levels behind a beaver dam, resolving human-beaver conflicts eighty-three percent of the time.[139] Similarly, the FWS report on beaver control cites several studies all finding that non-lethal management methods, such as the installation of culvert-protective fencing, "is more effective and less costly than lethal removal" of beavers.[140]

When neither the science nor the cost nor state support can justify lethal control, Wildlife Services falls back on "landowner preference" as their basis for killing wildlife. While acknowledging the efficacy of non-lethal control for beaver-related flooding, for example, Wildlife Services emphasizes that "trapping must remain a viable option for managers to use appropriately when beaver damage exceeds stakeholder acceptance."[141] That "the public is becoming increasingly dissatisfied with lethal removal, in part because of concerns that trapping and drowning or bludgeoning beaver is not humane," (according to FWS[142]) is apparently immaterial, so long as a landowner stubbornly refuses to consider non-lethal alternatives[143] In the words of a former longtime Wildlife Services District Supervisor, Wildlife Services effectively acts as "the hired gun of the livestock industry."[144]

C. <u>Wildlife Services Fails To Account For The Economic And Health Benefits Of Predators And Other Targeted Animals</u>

Fifty years ago, the Cain Report called for "a detailed socio-economic study of cost-benefit ratios," to "evaluat[e] the need for and efficacy of the program and its separate parts."[145] Yet Wildlife Services operations have never been the subject of an independent cost-benefit analysis, and their internal economic analyses do not adhere to guidelines used by most federal agencies, nor do they consider lost ecological or economic values of the predators themselves.[146]

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[138] *Id.* at 104.

[139] *Id.* at 106.

[140] *Id.* at 103.

[141] Jimmy D. Taylor & Russell D. Singleton, *The Evolution of Flow Devices Used to Reduce Flooding by Beavers: A Review*, 38 WILDLIFE SOC'Y BULLETIN 127 (2013).

[142] Pollock & Lewallen, *supra* note 137, at 103.

[143] It's unsurprising then, that the *Chicago Tribune* editorial board lamented that Wildlife Services "slaughter[s] animals that other agencies are trying to help," with "a lot of the killing [being] a favor to ranchers. Editorial, *Why do the feds slaughter wildlife; Wildlife Services' targets predators for dubious reasons*, CHICAGO TRIB. (Jan. 16, 2017), https://www.chicagotribune.com/opinion/editorials/ct-wildlife-killing-federal-government-wolves-edit-1223-md-20170117-story.html.

[144] Ex. 11, Kareiva et al., at 3.

[145] Advisory Committee on Predator Control, Report to the Council on Environmental Quality and The Department of the Interior (Jan. 1972) [hereinafter "Cain Report (1971)"].

[146] *See* JOHN LOOMIS, NAT. RES. DEF. COUNSEL, FUZZY MATH: WILDLIFE SERVICES SHOULD IMPROVE ITS ECONOMIC ANALYSIS OF PREDATOR CONTROL (2012), https://www.nrdc.org/sites/default/files/fuzzy-math-IP.pdf [https://perma.cc/VCT7-BMNB].

Among the benefits that Wildlife Services fails to consider in the operation of its wildlife damage management program is protection against zoonotic diseases.[147] Indeed, some case studies have shown that predators can control diseases by reducing host and vector densities,[148] through local competitive exclusion, or directly through feeding on infected hosts.[149] Generalist predators such as foxes and coyotes may reduce Lyme disease risk in humans by controlling mice populations, the main reservoir for infected nymphal tick vectors.[150] Researchers have referred to wolves as the "first responders" to diseases in their prey, including selectively removing deer and elk with late stage chronic wasting disease most responsible for transmission and other pathogens which if left unchecked may threaten Yellowstone's deer and elk populations.[151]

Predators can also reduce the abundance of species that are responsible for costly wildlife–vehicle collisions.[152] Where large carnivores have declined or been extirpated, herbivore populations have often increased.[153] This trophic response not only impacts ecological structure but can directly influence human well-being. One study found that the potential recolonization of cougars over a 30-year period in the eastern USA would reduce deer populations and thereby curtail deer–vehicle collisions, resulting in 680 fewer injuries, 5 fewer deaths, and $50 million in cost savings annually.[154]

In addition to health and safety benefits, predators have economic benefits as well.[155] A single bobcat in Yellowstone has an estimated wildlife-watching value of $308,000 over a single winter season, compared to an exploitive value of $315 for a bobcat hunted or trapped in Wyoming over the same season.[156] This economic valuation did not include consideration of the

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[147] Christopher J. O'Bryan et al., *The Contribution of Predators and Scavengers to Human Well-Being*, 2(2) NATURE ECOLOGY & EVOLUTION 229 (2018).

[148] Sean M. Moore et al., *Predators Indirectly Control Vector-Borne Disease: Linking Predator-prey and Host-pathogen Models*, 7(42) J. ROYAL SOC'Y INTERFACE 161 (2009).

[149] Hussein Khalil et al., *Selective Predation on Hantavirus-infected Voles by Owls and Confounding Effects from Landscape Properties*, 181(2) OCEOLOGIA 597 (2016).

[150] Levi, *Deer, Predators, and the Emergence of Lyme Disease*, *supra* note 59; Richard S. Ostfeld & Robert D. Holt, *Are Predators Good for Your Health? Evaluating Evidence for Top-Down Regulation of Zoonotic Disease Reservoirs*, 2 FRONTIERS ECOLOGY & ENV'T 13 (2004).

[151] Ex. 11, Kareiva et al. This could have knock-on benefits for human health too, as some researchers suggest that wolves cull sick deer before mutating diseases like SARS-COV-2 have the opportunity to jump to humans. *See id.*; *see also* Ellen E. Brandell et al., *Examination of the interaction between age-specific predation and chronic disease in the Greater Yellowstone Ecosystem*, 91(7) ANIMAL ECOLOGY 1373 (2022).

[152] *See* Jennifer L. Raynor et al., *Wolves Make Roadways Safer, Generating Large Economic Returns to Predator Conservation*, 118(22) ECON. SCI. e2023251118 (2021).

[153] O'Bryan et al., *supra* note 147.

[154] Sophie L. Gilbert et al., *Socioeconomic Benefits of Large Carnivore Recolonization Through Reduced Wildlife-Vehicle Collisions*, 10(4) CONSERVATION LETTERS 431 (2016).

[155] *Id.*; Bridget L. Borg et al., *Implications of Harvest on the Boundaries of Protected Areas for Large Carnivore Viewing Opportunities*, 11(4) PLOS ONE e0153808 (2016); Jennifer L. Raynor et al., *Wolves make roadways safer, generating large economic returns to predator conservation*, 118(22) PNAS e2023251118 (2021).

[156] L. Mark Elbroch et al., *Adaptive Social Strategies in a Solitary Carnivore*, 3 SCI. ADVANCES 1 (2017).

ecological value of bobcats. Thompson et al. (2020) determined that beavers are worth millions to hundreds of millions of U.S. dollars annually, providing benefits of $133 million for positive impacts on habitat and biodiversity, $75 million in greenhouse gas sequestration, $1.6 million in consumptive value, and $167/hectare in non-consumptive recreation value.[157] While such comprehensive economic value assessment have not been done for most species, Gregr et al.[158] provide evidence of the type of ecological and existence values that can be assigned to all wild animals including any of the mammal, bird, and reptile species killed, removed, or destroyed by Wildlife Services.

Studies measuring willingness-to-pay have further found that "non-use" or "existence value" of biodiversity and threatened species meets or exceeds the use value of wildlife.[159] Furthermore, every wild species has both an intrinsic and an ecological value tied to their role in the ecosystem. Whether they are predators or prey, detritivores, scavengers, seed dispersers, whether they cache food, provide pollination services, control invasive species, transfer nutrients, consume insects or small mammals that may damage agricultural products or transmit disease (including to humans), all wild animals, in life and in death, provide critical ecological services or benefits to the ecosystems that they inhabit. Those services have an economic value. While humans may not have quantified such value for all species nationally or in specific states, this does not discount the fact that such value exists and should be considered by Wildlife Services.

D. Wildlife Services Continues to Use Dangerous and Inhumane Methods to Kill Wildlife

Since submission of the 2013 Petition, Wildlife Services has continued to kill animals in dangerous and inhumane ways.[160] Petitioners are particularly concerned with use of the following methods, due to their inherent cruelty[161] and the danger they pose to people,

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[157] Stella Thompson et al., *Ecosystem services provided by beavers* Castor *spp*., MAMMAL REV. (2020).

[158] Edward J. Gregr et al., *Cascading social-ecological costs and benefits triggered by a recovering keystone predator*, 368 SCI. 1243 (2020). Gregr et al. determined that sea otters in the eastern North Pacific Ocean had a net economic value of approximately 40.6 million USD, far in excess to their cost to the marine invertebrate fishing industry (5.5 million). *Id.*

[159] *E.g.*, Premachandra Wattage & Simon Mardle, *Total Economic Value of Wetland Conservation in Sri Lanka Identifying Use and Non-use Values*, 16 WETLANDS ECOLOGY & MGMT. 359 (2008); Ranjith Bandara & Clem Tisdell, *Use and Non-use Values of Wild Asian Elephants: A Total Economic Valuation Approach* (The University of Queensland Economics, Ecology and the Environment Working Paper No. 80); *see also* Pablo Campos et al., *Measurement of the Threatened Biodiversity Existence Value Output: Application of the Refined System of Environmental-Economic Accounting in the* Pinus pinea *Forests of Andalusia, Spain*, 11 LAND 1119 (2022).

[160] In Idaho alone, "at least 35 wolf pups, some . . . likely only four to six weeks old," were killed by Wildlife Services in 2019. Some wolves "died of hypothermia in traps set by [WS], and more were gunned down in aerial control actions." Jessica Corbett, *'Reckless, Violent, Massacre' of 570 Wolves and Wolf Pups in Idaho Bolsters Alarm Over Trump Attack on Species Protections*, COMMON DREAMS (Sept. 11, 2020), https://www.commondreams.org/news/2020/09/11/reckless-violent-massacre-570-wolves-and-wolf-pups-idaho-bolsters-alarm-over-trump [https://perma.cc/2JW2-HBF5].

[161] *See generally* MAMMAL TRAPPING: WILDLIFE MANAGEMENT, ANIMAL WELFARE & INTERNATIONAL STANDARDS (Gilbert Proulx ed., 2022). Recent research has further pointed out the insufficiency of international animal welfare

companion animals, and non-target species, including threatened and endangered species: (1) neck snares; (2) padded and unpadded steel-jawed leghold traps; (3) body-crushing traps such as Conibear, quick-kill, and snap traps; (4) M-44 sodium cyanide devices; (5) chemicals used in denning operations; (6) aerial gunning; and (7) Weevil-Cide® to target prairie dogs. Below is a discussion of our concerns about these methods.

1. Neck Snares

Neck snares are routinely used by Wildlife Services, yet this method is particularly inhumane. Regardless of the intention of the snare set (i.e., killing or restraining) or the type of snare in use, the cruelty associated with neck snares is extreme. In kill sets, the snare continues to tighten as the animal struggles until strangulation occurs. In sets intended to restrain the snared animal, the captured animal is held by his or her neck until the technician arrives to kill the animal, unless the animal has died due to the extent of his or her injuries and/or struggles, from predation, extreme weather, or from dehydration/starvation if the technician does not return in a timely fashion.

Wildlife Services uses neck snares to target coyotes and other canids,[162] despite it being a brutally inhumane method for canids. In their analysis of manual and powered neck snares for use in trapping canid species in Canada, Proulx et al. (2015) documented significant welfare concerns associated with the use of neck snares.[163] They found that manual and powered killing neck snares did not consistently and quickly render canids unconscious, were non-selective, and did not routinely capture animals by the neck. Proulx et al. also found the following:

1. Laboratory researchers failed to achieve exact and ideal positioning of neck snares behind the jaw of the target animal suggesting that, in the field, such exact placement would be far more difficult; for manual killing neck snares, one study of sixty-five snared coyotes found that fifty-nine percent were captured by the neck, twenty percent by the flank, and ten percent by the foot, and nearly half of the animals were still alive the morning after being snared;[164]

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indicators for traps, as such standards frequently ignore state-of-the-art trapping technology, rely on subjective judgments rather than objective quantitative measures, and do not include protocols for handling and dispatching of captured animals, among other failures. *E.g.*, Gilbert Proulx et al., *Updating the AIHTS Trapping Standards to Improve Animal Welfare and Capture Efficiency and Selectivity*, 10 ANIMALS 1262 (2020).

[162] *See* MAMMAL TRAPPING, *supra* note 161; Ex. 14, Gilbert Proulx et al., *Humaneness and Selectivity of Killing Neck Snares Used to Capture Canids in Canada: A Review*, 4(1) CANADIAN WILDLIFE BIOLOGY & MGMT. 55 (2015).

[163] Ex. 14, Proulx et al., *Humaneness and Selectivity of Killing Neck Snares*.

[164] Fred S. Guthery & Samuel L. Beasom, *Effectiveness and Selectivity of Neck Snares in Predator Control*, 42(2) J. WILDLIFE MGMT. 457 (1978).

2. In another study of various manual killing neck snares, between five and thirty-two percent of the snared animals were still alive when found twelve or more hours after capture;[165]

3. The amount of disturbance at a capture site is not indicative of time to death of the captured animal as "captured animals may remain conscious but physically inactive due to distress, shock, injury or pain;"

4. In a thorough evaluation of power killing neck snares, three models rendered four of five anaesthetized red foxes irreversibly unconscious within ten minutes but when used on non-anaesthetized animals in a semi-natural environment it was difficult to capture foxes behind the jaw with the snares and to cause irreversible loss of consciousness within three hundred seconds.[166]

Proulx et al. noted it is not the placement or operation of the neck snares that can result in suffering, but rather that the anatomy and physiology of canids can exacerbate the suffering associated with the use of neck snares. As reported by Proulx et al., laboratory tests with dogs show that canids have the ability to continue to circulate blood to the brain after bilateral ligation of the common carotid arteries because of the ability of other arteries (e.g., vertebral arteries) situated more deeply within the neck to compensate (Moss 1974; Clendenin and Conrad 1979a, b). Collateral circulation also occurs within the venous blood flow from the brain such that drainage can continue if the internal jugular veins are occluded (Andeweg 1996; Daoust and Nicholson 2004). Because of collateral blood circulation, it is difficult, if not impossible, to stop blood flow to and from the brain by tightening a snare on the neck.

More recently, in his book *Intolerable Cruelty: The Truth Behind Killing Neck Snares and Strychnine*,[167] Dr. Proulx reports that when a canid is snared, the thick musculature around the animal's neck allows the carotid artery to continue to supply blood to the brain, but the jugular vein is constricted, cutting off blood back down to the heart. A telltale sign is the grotesquely swollen heads of the snares' victims (which trappers refer to as "jellyheads"). Canids caught in neck snares take hours, if not days, to die.

Furthermore, the non-selectivity of neck snares resulting in non-target mammal and bird species was clearly reflected in data presented in Table 1 in Proulx et al. (2015), re-created in relevant part below:

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[165] Robert L. Phillips, *Evaluation of 3 Types of Snares for Capturing Coyotes*, 24(1) WILDLIFE SOC'Y BULL. 107 (1996).

[166] Gilbert Proulx & Morley W. Barrett, *Ethical Considerations in the Selection of Traps to Harvest Martens and Fishers*, *in* MARTENS, SABLES, AND FISHERS: BIOLOGY AND CONSERVATION 192 (Steven W. Buskirk et al. eds., 1994).

[167] GILBERT PROULX, INTOLERABLE CRUELTY: THE TRUTH BEHIND KILLING NECK SNARES AND STRYCHNINE (2018).

Species Common Name	Number of Cases		
	Injured by Snare	**Killed by Snare**	**Total Snared**
American black bear	1	0	1
Bobcat	0	1	1
Canada lynx	0	8	8
Fisher	0	2	2
Mountain lion	0	4	4
Snowshoe hare	0	1	1
White-tailed deer	0	4	4
Wolverine	0	1	1
Bald eagle	4	75	79
Barred owl	0	2	2
Common raven	0	2	2
Golden eagle	2	25	27
Goshawk	0	3	3
Great horned owl	2	2	4
Red-tailed hawk	1	10	11
Rough-legged hawk	0	7	7
Total Specimens	**17**	**147**	**164**

In light of the numerous concerns surrounding the inhumaneness of neck snares generally, the inhumaneness of the devices when used to capture canids specifically, and the high potential for non-target animals to be captured and killed by neck snares, Wildlife Services should cease using this method in its field operations entirely. In the event that Wildlife Services continues to employ neck snares, we have grave concerns about the trap check time that Wildlife Services technicians use across many states.[168] Wildlife Services should commit to a 24-hour

[168] *See* Donald M. Broom, *Some Thoughts on the Impact of Trapping on Mammal Welfare With Emphasis on Snares*, *in* MAMMAL TRAPPING: WILDLIFE MANAGEMENT, ANIMAL WELFARE & INTERNATIONAL STANDARDS 121 (Gilbert Proulx ed., 2022) ("Animals left in snares are susceptible to thirst, hunger, further injury and attack by predators, especially if in the trap for many hours or days."); Irene Rochlitz, *The Impact of Snares on Animal Welfare*, *in* ONEKIND REPORT ON SNARING (2010) ("Snares can cause severe injuries, pain, suffering, and death in trapped animals" and leaving animals in snares for hours or days "expos[es] them to the elements, to thirst, hunger, further injury and attack by predators."); Ex. 15, Gilbert Proulx & Dwight Rodtka, *Killing Traps and Snares in North America: The Need for Stricter Checking Time Periods*, 9(8) ANIMALS 570 (2019).

trap check frequency[169] in all its operations nationwide to reduce the suffering of animals that are caught. Longer trap check frequencies are unacceptable from a humaneness standpoint.

2. Steel-Jaw Leghold Traps

Steel-jaw leghold traps—whether unpadded, (so-called) padded, off-set, long-spring, coil-spring, dog-proof, or any other variety—are inhumane in terms of pain, distress, and physical injuries as a result of being caught in these devices, as well as potential mortality. Fundamentally, despite the wide range of device modifications that may be employed, no steel-jaw trap has been created that is able to reduced animal suffering to an acceptable level. The jaws of a leghold trap must slam together with sufficient force to catch the animal's limb, and they must clamp together with enough force to prevent an animal from pulling free. It is this basic operating principal that makes such traps brutal regardless of the modifications.

Some animals may suffer for an extended time in these traps until they are killed by the trapper (or are drowned). Animals may not be trapped as intended, enduring additional trauma. Many trapped animals will violently fight the trap after being caught, often biting at the device, which results in broken teeth and gum damage in addition to the damage to the captured limb, including lacerations, strained and torn tendons and ligaments, extreme swelling, and broken bones.[170] Some trapped animals are known to chew off their own trapped limb to escape on three legs. Constriction of a limb in a trap can greatly reduce or completely cut off blood supply to the affected appendage, which can cause the appendage to slough off due to gangrene and oftentimes require amputation of the limb in non-target animals. In winter conditions, the portion of the animals' toes or foot that are below the jaws can freeze. For these reasons, steel-jaw leghold traps have been condemned as inhumane by the World Veterinary Association, the American Veterinary Medical Association, the National Animal Control Association of the United States, and the American Animal Hospital Association.[171]

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[169] *See, e.g.*, International Organization for Standardization 10990-4:1999, Animal (mammal) traps – Part 4: Methods for testing killing-trap systems used on land or underwater § 7.5 (instructing that traps be checked "once within each 24 h period; at the same time of the day of at all possible"). A 24-hour trap check frequency is a minimum floor. Preferably, Wildlife Services should require that traps are checked every 12 hours. As the American Society of Mammalogists recommends, "restraining traps for nocturnal species should be set before dusk and checked as soon as possible after dawn, while restraining traps for diurnal species should be set at dawn or early morning and checked every few hours." Proulx et al., *Updating the AIHTS Trapping Standards*, *supra* note 161. In addition to daily trap checks, Wildlife Services should use relaxing locks and minimum loop stops to make neck snares less lethal. Many states already require these for cable restraints. *See, e.g.*, MICH. WILDLIFE CONSERVATION ORDER 3.609(2)(e) (requiring all snares to have a relaxing lock); OHIO ADMIN. CODE 1501:31-15-03(E)(1)(d) (making it illegal to use snares that do not have relaxing locks). Coupled with daily trap checks, less lethal traps make it more likely that a non-target animal will be able to survive if captured in a trap.

[170] *See* Graziella Iossa et al., *Mammal trapping: a review of animal welfare standards of killing and restraining traps*, 16(3) ANIMAL WELFARE 335 (2007).

[171] *E.g.*, *Leghold Traps*, AM. ANIMAL HOSPITAL ASS'N (Nov. 2014), https://www.aaha.org/about-aaha/aaha-position-statements/leghold-traps/ [https://perma.cc/L8SU-HV9T] ("The American Animal Hospital Association opposes the use of steel-jaw leghold traps on the grounds that their use is cruel and inhumane."); *AVMA positions address animal welfare concerns*, AM. VETERINARY MED. ASS'N (July 1, 2001), https://www.avma.org/javma-news/2001-07-15/avma-positions-address-animal-welfare-concerns [https://perma.cc/NRE8-B77C] ("The AVMA considers the steel-jaw leghold trap to be inhumane").

Iossa et al. (2007) provided an extensive review of the injury rates associated with multiple trap types, including padded, off-set, enclosed, and unpadded steel-jaw leghold traps.[172] Leghold traps resulted in minor injuries more than 50% of the time in the majority of studies reviewed, ranging from 8% minor injuries for Canada lynx captured in a padded leghold trap to 100% for a bobcat captured in a leg hold snare. For major injuries, the percentage of injuries ranged from 4% for red foxes captured in a padded leghold trap to 74% for raccoons captured in an unpadded leghold trap.[173]

The types of injuries assessed in evaluating the "humaneness" of traps include: (1) mild trauma, such as claw loss, edematous swelling or hemorrhage, minor cutaneous laceration, minor subcutaneous soft tissue maceration or erosion, major cutaneous laceration, except on footpads or tongue, and minor periosteal abrasion; (2) moderate trauma, such as severance of minor tendon or ligament, amputation of one digit, permanent tooth fracture exposing pulp cavity, major subcutaneous soft tissue laceration or erosion, major laceration on footpads or tongues, severe joint hemorrhage, joint luxation at or below the carpus or tarsus, major periosteal abrasion, simple rib fracture, eye lacerations, and minor skeletal degeneration; (3) moderately severe trauma, including simple fracture at or below the carpus or tarsus, compression fracture, comminuted rib fracture, amputation of two digits, major skeletal degeneration, and limb ischemia; and (4) severe trauma, including amputation of three or more digits, any fracture or joint luxation on limb above the carpus or tarsus, any amputation above the digits, spinal cord injury, severe internal organ damage (internal bleeding), compound or comminuted fracture at or below the carpus or tarsus; severance of a major tendon or ligament, compound or rib fractures, ocular injury resulting in blindness of an eye, myocardial degeneration, and death.[174]

Such injuries, particularly those included in the moderate trauma, moderately severe trauma, and the severe trauma categories, should not be considered acceptable or humane. In addition to identifiable injuries caused by the trap, when evaluating the impact of predator damage management on target and non-target species it is critical to consider the potential for indirect mortality as a result of capture in a leghold trap, or any restraining device. Intentional live capture and release of targeted species as well as unintentional capture and release of non-target species, can be harmful to the animal. Even if the animal is released with no apparent injuries or injuries deemed to be minor, the animal may still be suffering adverse side effects from restraint (including from restriction of blood flow or extended exposure to the elements), causing pain, suffering, and even death, hours, days, or weeks after capture.

This was demonstrated by Andreasen et al. (2018) in a study that examined cause-specific mortality in mountain lions unintentionally caught in leghold traps set for bobcats from 2009 through 2015 in their study site in Nevada.[175] The authors found that if female mountain lions were captured in leghold traps, it directly reduced their survival by causing injuries that made the animals more susceptible to other forms of mortality. Of the forty-eight lions originally

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[172] Iossa et al., *supra* note 170.

[173] *Id.*

[174] *Id.*

[175] Alyson M. Andreasen et al., *Survival of Cougars Caught in Non-Target Foothold Traps and Snares*, 82(5) J. WILDLIFE MGMT. 906 (2018).

included in the study, thirty-three died during its seven-year duration. Of the thirty-three lions, seven died as a consequence of non-target trapping (five were caught in leghold traps and two in snares). Of the seven that died due to non-target trapping, five (four adult females and one juvenile) had been captured in leghold traps one or more times, and the other two had been captured in snares. Most of the injuries recorded ranged from no visible damage or slight edema, to more severe lacerations or broken toes. Of the four adult females, two died as a result of trap related injuries several weeks after capture, another died from starvation and was missing two digits on her front right paw, and the fourth died three weeks after she escaped from a trap. The fourth mortality was discovered as a result of a lion paw being found in a trap, suggesting the animal may have self-amputated the paw to escape from the trap.

Additionally, Wildlife Services employs enclosed leghold traps (dog proof traps), which are generally used for trapping raccoons and opossums and are included as BMP traps for both species. Notably, such traps are particularly inhumane for raccoons, who experience excruciating pain when one of their front feet is caught due to the hyper-sensitivity of those limbs. While such traps, given their design, are intended to reduce bycatch of non-target species, feral cats and any species with a small paw able to reach into the trap and pull up could be captured in such traps. Even a human, including a young child, could be caught in such traps. Despite reducing the potential for non-target captures, enclosed leghold traps can result in injuries, amputations, and mortality.

Hubert et al. (1996) evaluated the injury rates associated with the EGG trap (one type of enclosed leghold trap) for capturing raccoons.[176] They used a scoring system that assigned points to different types of documented injuries with the higher scores reserved for the more severe injuries.[177] A score greater than 50 is considered serious damage while scores greater than 125 are reflective of severe damage. Of the 62 raccoons studied by Hubert et al., 23 experienced injury scores associated with the EGG trap of 50 or higher with 9 experiencing injury scores of 125 or greater. Of 62 raccoons captured in the EGG trap, there were 125 instances (affecting 82.3% of captured raccoons) of edematous swelling and/or hemorrhage, 47 (37.%) cutaneous lacerations greater than or equal to 2 centimeters, and 19 (22.6%) instances of damage to the periosteum. Wildlife Services should end the use of these traps as well.

In light of the numerous concerns surrounding the inhumaneness of steel-jaw leghold traps, Wildlife Services should cease using this method in its field operations entirely. In the event that Wildlife Services continues to employ steel-jaw leghold traps, we have the same concerns about trap check frequency as we expressed above in the subsection on snares.[178] We incorporate those concerns here regarding steel-jaw leghold traps. If Wildlife Services continues to use these devices, Wildlife Services technicians should employ trap monitors. Wildlife Services' National Wildlife Research Center ("NWRC") has found that trap monitors save driving or hiking time, decrease fuel usage and reduce driving time over rough terrain, save

[176] Ex. 16, George F. Hubert et al., *Evaluation of Two Restraining Traps to Capture Raccoons*, 24(4) WILDLIFE SOC'Y BULL. 699 (1996).

[177] *Id.* at 702.

[178] *See supra* note 168.

Wildlife Services and its customers money, and prioritize checks of particular traps.[179] Considering the benefits of such devices, particularly in terms of reducing suffering by animals left in traps for long periods of time, these devices can and should be used in circumstances where they are reliable and Wildlife Services, in collaboration with NWRC and trap monitor device manufacturers, should be pioneering efforts to improve the design, functionality, and efficiency of these devices by testing them under field conditions.

From a humane perspective, the use of monitoring devices is very important because it can greatly decrease the amount of time a captured animal is restrained, minimizing pain, stress, and injury and allowing non-target animals to be released in a timely manner to increase the likelihood of post-release survival. This was demonstrated by Will et al. (2010) in their study of the use of a telemetry-based trap monitoring system on San Nicolas Island off the coast of California during a project to eradicate the island's feral cat population.[180] Given the size of the island and the presence of fewer than 600 island foxes, the trap monitoring system was essential to "remotely check trap status, decrease staff time spent checking traps, and decrease response time to captured animals to limit fox injuries and mortalities due to exposure."[181] The system allowed a field team of six people to conduct daily checks of nearly 250 traps with a response time of less than sixty minutes during daylight hours. Specifically, Will et al. reported:

> The average daytime response time for capture events was 43 minutes ± 31 minutes (n = 162), while the average overall response time was 5 hours ± 4 hours (n = 853). Foxes that were caught after working hours spent an average of 6 hours ± 3 hours (n = 691) in traps. While 4 foxes were in a trap for an unknown amount of time because of monitor failures, no animal was in a trap for more than 14 hours with a working monitor. There were 1,012 total non-target capture events with 74 injuries, for an injury rate of 7%. There were 9 monitor failures with 4 leading to injury or casualty.[182]

In another experiment where Global System for Mobile communication trap alarms were used when capturing otter, Néill et al. (2007) found that functioning alarms permitted trapped otters to be removed within twenty-two minutes of capture and reduced the injuries suffered by the animals from an average cumulative score of 77.7 to only 5.5 on the trap trauma scale developed by the International Organization for Standardization, ISO 10990-5.[183]

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[179] Patrick A. Darrow & John A. Shivik, USDA APHIS Wildlife Services, Nat'l Wildlife Rsch. Ctr., *A Pilot Evaluation of Trap Monitors by the USDA Wildlife Services Operational Program*, PROCS. 23RD VERTEBRATE PEST CONF. 213, 216 (2008).

[180] David Will et al., *A Trap Monitoring System to Enhance Efficiency of Feral Cat Eradication and Minimize Adverse Effects on Non-Target Endemic Species on San Nicolas Island*, PROCS. 24TH VERTEBRATE PEST CONF. 79 (2010).

[181] *Id.* at 79.

[182] *Id.* at 80.

[183] Lughaidh Ó Néill et al., *Minimizing Leg-Hold Trapping Trauma for Otters With Mobile Phone Technology*, 71(8) J. WILDLIFE MGMT. 2776 (2007).

3. Conibear and Other Body-Crushing Traps

Conibear and other body-crushing traps (i.e., "kill traps") employed in Wildlife Services' field operations are inhumane. Kill traps (1) consistently fail to meet humaneness criteria regarding the amount of time it takes for a trapped animal to be rendered unconscious; (2) frequently strike unintended locations on trapped animals' bodies, reducing their effectiveness and causing additional harm and suffering; and (3) present a significant risk of non-target capture.

a. Kill traps consistently fail to render trapped animals unconscious in time limits considered humane.

According to Iossa et al. (2007),[184] for a kill trap to satisfy humaneness criteria in North America, seventy percent of animals must be rendered unconscious within 70 seconds (for stoats), 120 seconds for marten, lynx, and fisher, and 180 seconds for all other species. As noted in Table 1 (see below) in Iossa et al. (2007), the majority of killing traps tested, including a variety of different models of Conibear traps, failed to satisfy the loss of consciousness standard for humaneness.

[184] Iossa et al., *supra* note 170.

Table 1 Accepted standards of animal welfare for killing traps.

Species	Trap model	Mis-strike	Time limits to unconsciousness					Reference
			Current technology	n	Criterion	Pass	Fail	
Canis latrans	King necksnare[1]	-	> 180 s	-	180 s		×	Garrett 1999; Proulx
	Mosher necksnare[1]	-	> 180 s	-	180 s		×	1999a
*Canis lupus**	-	-	-	-	180 s	-	-	
*Castor canadensis**	Conibear 330™	-	> 180 s	6	180 s		×	Novak 1981a
	Modified Conibear 330™	-	< 180 s	6	180 s	×		
Lontra canadensis	-	-	-	-	180 s	-	-	
Lynx rufus	-	-	-	-	180 s	-	-	
Lynx canadensis	Conibear 330™	1	> 180 s	9	180 s		×	Proulx *et al* 1995
	Modified Conibear 330™	1	67.2 ± 4.0 s	9	180 s	×		
Martes americana	Conibear 120™	3	> 180 s	6	120 s		×	Barrett *et al* 1989;
	Conibear 120 Magnum™	2	68 ± 8.2 s	14	120 s		×	Proulx *et al* 1989a,b
	Conibear 160™	3	> 180 s	16	120 s	×		
	Sauvageau 2001-5™	-	> 180 s	14	120 s		×	
Martes pennanti	Bionic[2]	0	< 55 s	9	180 s	×		Proulx & Barrett
	Conibear 220™	-	> 180 s	4	180 s		×	1993a,b; Proulx
	Modified Conibear 220™	0	> 180 s	4	180 s		×	1999b
*Ondatra zibethicus**	Leprich spring trap	0	31.5 ± 16.3 s	12	180 s	×		Inglis *et al* 2001
	Conibear 110™	3	184.0 ± 31.7 s[3]	12	180 s		×	
*Procyon lotor**	Conibear 160™	-	> 180 s	5	180 s		×	Novak 1981a; Proulx
	Conibear 280™	0	> 180 s	6	180 s		×	& Drescher 1994;
	Conibear 330™	5	> 180 s	5	180 s		×	Sabean & Mills 1994
	Sauvageau 2001-8™	0	> 180 s	3	180 s		×	
Taxidea taxus	-	-	-	-	180 s	-	-	
Castor fiber	-	-	-	-	180 s	-	-	
Lutra lutra	-	-	-	-	180 s	-	-	
Lynx lynx	-	-	-	-	180 s	-	-	
Martes martes	-	-	-	-	120 s	-	-	
Martes zibellina	-	-	-	-	120 s	-	-	
Meles meles	-	-	-	-	180 s	-	-	
Mustela erminea[4]*	Fenn Mk IV	-	> 180 s	-	60 s		×	Warburton *et al*
	Fenn Mk VI	-	> 180 s	-	60 s		×	2002; Poutu &
	Victor Snapback[5]	1	37.3 ± 5.0 s	7	60 s		×	Warburton 2003;
	Waddington backcracker	4	113 s	8	60 s		×	Warburton & O'Connor 2004
Nyctereutes procyonoides	-	-	-	-	180 s	-	-	

Mis-strike refers to the number of animals struck in a non-target body part; time limits to unconsciousness refer to loss of corneal and palpebral reflexes; n is the number of animals tested.
Most of the tests were conducted in North America under the criteria that ≥ 70% of animals should be unconscious in ≤ 60, 120 or 180 seconds (eg Proulx 1999a; review in Powell & Proulx 2003). This is therefore used to assess passes and failures. The line divides North American from European species.
* Species found in both continents; [1] the trap failed because of high number of mis-strikes; [2] not tested in the field: in a different experiment 2/10 animals escaped and 1/10 mis-strike; [3] time to loss of heartbeat; [4] see main text for stoat; [5] the trap failed because of high number of escapes.

The failure of kill traps to meet established welfare standards has been documented by other researchers. Proulx and Barrett (1988)[185] determined that the commercially available Conibear 120 was not effective for killing marten, since it failed to render (greater than/equal to) 5/6 unanesthetized marten struck in the head/neck region irreversibly unconscious within three minutes (based on Canada's General Standards Board (CGSB) performance criteria). Linscombe (1976) compared the killing efficiency of the Victor No. 2 leghold and Conibear 220 traps, and

[185] Gilbert Proulx & Morley W. Barrett, *On the Development and Implications of the Conibear 120 Magnum Trap to Harvest Marten and Mink*, PROCS. NE. FUR RES. TECH. COMM. WORKSHOP 193 (1988).

determined, as expected, that more trapped animals were found alive in the leghold traps, but also found that the Conibear 220 traps did not consistently kill trapped animals, leaving 9.7% of adult nutria and 10.7% of immature nutria alive.[186] Proulx and Barrett (1993) determined that the Conibear 220 trap— a mechanically improved version of the standard Conibear trap—did not consistently render fisher irreversibly unconscious in ≤ 5 minutes, meaning this trap also failed to satisfy the three-minute standard. [187] The Conibear 330 trap also failed the three-minute standard according to Proulx et al. (1995), who observed that one lynx struck in the shoulder and two out of eight lynx struck in the neck were not rendered irreversibly unconscious within three minutes.[188] Proulx (1999) determined that the Conibear 120, 160, 220, 280, and 330 traps did not consistently satisfy the three minute standards for irreversible unconsciousness for multiple species while modified versions of some of these traps (e.g., Conibear 120 Magnum with pitchfork trigger, Conibear 120 Magnum with pan trigger, Conibear 330 with clamping bars) did satisfy the standard. [189] In their assessment of the welfare implications and ethics of multiple trap types, including kill traps, Powell and Proulx (2003)[190] found that no standard or commercially available Conibear traps, or other types of killing traps, consistently killed animals within three minutes absent modification.

Proulx and Rodtka (2019) reviewed the relevant literature and determined that Conibear traps used for marten and mink failed to satisfy both the CGSB criteria or the Agreement on International Humane Trapping Standards (AIHTS) criteria (e.g., for martens the animals must be rendered unconscious and insensible within two minutes).[191] For the standard, commercially available Conibear 120 trap, which is not certified as humane under Canadian standards[192] but is considered acceptable under the BMP trapping criteria, researchers determined that:

> Mechanical evaluations showed that the Conibear 120 trap does not have the potential to render animals unconscious in ≤3 min [15] and thus to meet AIHTS' 2-min time limit. This was further demonstrated in tests with wild animals in simulated natural environments where 2 out of 6 tested animals did not lose consciousness within 5 min (the time limit was 3 min but the research protocol allowed researchers to prolong it to 5 min to learn

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[186] GREG LINSCOMBE, LA. WILDLIFE & FISHERIES COMM'N, AN EVALUATION OF THE NO. 2 VICTOR AND 220 CONIBEAR TRAPS IN COASTAL LOUISIANA (1976).

[187] Gilbert Proulx & Morley W. Barrett, *Evaluation of Mechanically Improved Conibear 220™ Traps to Quickly Kill Fisher (Martes pennanti) in Simulated Natural Environments*, 29(2) J. WILDLIFE DISEASES 317 (1993).

[188] Gilbert Proulx et al., *A Humane Killing Trap for Lynx* (Felis lynx)*: The Conibear 330™ with Clamping Bars*, 31(1) J. WILDLIFE DISEASES 57 (1995). Researchers did find that when the trap is modified by adding two clamping bars, it did satisfy the standard. It is not clear if this is happening in the field.

[189] Gilbert Proulx, *Review of Current Mammal Trap Technology in North America*, *in* MAMMAL TRAPPING 1 (1999).

[190] Roger A. Powell & Gilbert Proulx, *Trapping and Marking Terrestrial Mammals for Research: Integrating Ethics, Performance Criteria, Techniques, and Common Sense*, 44(4) INST. FOR LABORATORY ANIMAL RSCH. J. 259 (2003).

[191] Ex. 15, Proulx & Rodtka, *Killing Traps and Snares in North America*.

[192] As noted by Proulx & Rodtka, mechanically improved Conibear 120 trap models have now been developed and have been certified as humane by the Fur Institute of Canada. *Id.*

> more about traps). This result suggests that, based on the normal approximation to the binomial distribution (one-tailed), the Conibear 120 trap would then be expected to humanely kill (by rendering animals unconscious in ≤3 min as per CGSB), with 95% confidence, >20% of all captured martens of a true population. The poor performance of the Conibear 120 trap to humanely kill martens was further determined on working traplines. At least 4 out of 13 martens captured in Conibear 120 traps were struck in non-lethal regions that would not result in a loss of consciousness in ≤3 min. Thus, on the basis of a one-tailed binomial test, the trap would, with 95% confidence, render <40% of captured martens unconscious in ≤3 min.[193]

For mink, which have greater cervical musculature and stronger bones compared to the American marten, Proulx and Rodtka reported that:

> Mink … cannot be humanely killed, i.e., lose consciousness in ≤3 min as per CGSB, by the Conibear 120 trap. In fact, even the mechanically superior and stronger C120 Magnum failed to humanely kill mink captured by the neck. Furthermore, while the Conibear 120 trap is marketed with a two-prong trigger, its inability to properly strike mink in vital regions was reported nearly 50 years ago. The stronger C120 Magnum trap equipped with a pan trigger humanely killed mink double-struck in the neck and thorax. Because the two-prong trigger fails to ensure strikes in vital regions, and the Conibear 120 trap does not have the striking and clamping forces to produce a humane kill, many mink captured in this trap stay alive for many hours, and sometimes until the following day. Thousands of mink are trapped every year in North America, and many of those captured in the Conibear 120 trap must experience pain and suffering for periods of time exceeding AIHTs' time limit of 5 min.[194]

For the foregoing reasons, Conibear and other kill traps used by Wildlife Services are inhumane. Numerous researchers have concluded that such traps are unable to render target animals unconscious in the time required by CGSB, AIHTS, or by other accepted welfare standards. Petitioners thus seek the issuance of new rules and the amendment of certain existing rules to prohibit Wildlife Services from using Conibear or similar kill traps.

b. Kill traps are inhumane because they frequently strike unintended locations on trapped animals' bodies.

The location where the trap strikes the animal is critical in determining how quickly the trapped animal dies and, in the field, animals do not consistently enter the trap in ways that assure

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[193] *Id.* (emphasis added) (citations omitted).

[194] *Id.* (citations omitted).

a rapid loss of consciousness.[195] Several studies have found misstrikes ranging from eight to fifteen percent.[196] Warburton (2000) found that possums trapped in the field were often found with their necks rotated in the trap and/or with a forelimb caught between the striking bar and the neck reducing the efficiency of the killing traps.[197] When the neck is rotated, Warburton determined that it is unlikely that both carotid arteries would be totally occluded preventing rapid, irreversible unconsciousness. Therefore, for a kill trap to operate effectively, the animal "must, as much as possible, be vertically aligned with no limbs obstructing the striking bar" – a circumstance that is difficult to consistently achieve in the wild.[198]

Warburton (1982) examined two kill traps from New Zealand (the Banya and Kaki traps) and two from North America (the Conibear and Bigelow traps).[199] The two North American traps proved to be the least humane because several common brushtail possums caught by the neck remained alive while others were trapped across the chest, abdomen, or rump. In another study from New Zealand, Warburton and Hall (1995)[200] assessed the impact momentum and clamping force of kill traps. Based on their preliminary tests, they found that:

> [m]ost kill-traps available in New Zealand generate an impact momentum of about 1 kg.m.s^{-1}, much lower than the impact threshold of about 7 kg.m.s^{-1} required to kill a possum when no clamping force is added. It appears unlikely, therefore, that new traps based solely on impact to achieve a humane kill can be developed if the strike location and direction of impact are the same as those used by the simulator.

When the possums struck across the neck were examined, it was determined that death was caused by suffocation and/or cerebral anoxia due to the compression of the trachea and jugular veins. Physical trauma in the form of vertebral or cranial fractures as only found when the impact momentum exceeded c. 5-6 kg.m.s^{-1}. Additionally, Warburton and Orchard (1996) determined that the Conibear 160 trap and the BMI 160 trap failed to satisfy humane criteria for traps contained in the draft standards from the International Organization for Standardization

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195 B. Warburton, *Evaluation of Seven Trap Models as Humane and Catch-efficient Possum Traps*, 9(3) N.Z. J. ZOOLOGY 409 (1982).

196 Robert L. Phillips, *Evaluation of 3 Types of Snares*, *supra* note 165 (reporting misstrikes ranging from eight to fourteen percent); K. Pohlmeyer et al., *[The total efficiency of stunning traps for the capture of stone martens and red foxes in hunting situations]*, 102(3) DEUTSCHE TIERARZTLICHE WOCHENSCHRIFT 133 (1995) (reporting misstrikes ranging from thirteen to fifteen percent).

197 B. Warburton et al., *Effect of Jaw Shape in Kill-traps on Time to Loss of Palpebral Reflexes in Brushtail Possums*, 36(1) J. WILDLIFE DISEASES 92 (2000).

198 *Id.*

199 Warburton, *Evaluation of Seven Trap Models*, *supra* note 195.

200 B. Warburton & J.V. Hall, *Impact Momentum and Clamping Force Thresholds for Developing Standards for Possum Kill Traps*, 22(1) N.Z. J. ZOOLOGY 39 (1995).

because the Conibear 160 trap did not kill enough possums during pen trials, and the BMI 160 trap failed to achieve a sufficiently high number of correct strikes during field trials.[201]

As these studies demonstrate, Conibear and other kill traps used by Wildlife Services often misstrike, resulting in slower loss of conscious and greater animal suffering. Petitioners thus seek the issuance of new rules and the amendment of certain existing rules to prohibit Wildlife Services from using such kill traps.

c. Kill traps present a significant risk of non-target capture.

Kill traps present a significant risk of capture of non-target species. Trap selectivity is assessed by measuring the number of individuals of the target species captured relative to the number of non-target animals.[202] As noted in Table 6 from Iossa et al. (see below), trap selectivity varies widely with trap type. For rotating jaw traps (or Conibear traps), one study found that forty-three percent of the devices set to trap American martens captured non-target species Canada jay's and Northern flying squirrels, all of whom were found dead in the traps. In a second study assessing the selectivity of Conibear traps, thirty percent of the trapped animals were non-target species, including the American crow, rat species, and domestic house cats.

[201] B. Warburton & I. Orchard, *Evaluation of Five Kill Traps for Effective Capture and Killing of Australian Brushtail Possums* (Trichosurus vulpecula), 23(4) N.Z. J. ZOOLOGY 307 (1994).

[202] Iossa et al., *supra* note 170.

Table 6 Selectivity (number of non-target animals relative to total captures), mortality and injury caused to non-target species in various types of traps.

Trap type	Target species	Non-target species	Selectivity	Mortality	Injury	Reference
Killing traps						
Drowning trap	*Ondatra zibethicus*	*Anas platyrhynchos, Rattus spp, Mustela erminea*	1.44-7.40%[1]	-	-	Crasson 1996
Spring trap in tunnels	*Mustela erminea, M. nivalis, M. vison*	*Alectoris rufus, Erinaceus europaeus, Oryctolagus cuniculus, Mustela putorius*	5%	100%[2]	-	Short & Reynolds 2001
Tunnel traps/snare	-	*Mustela putorius*	-	61%	39%	Birks & Kitchener 1999
Spring trap	*Trichosurus spp*	*Erinaceus europaeus, Mustela putorius, Rattus spp*	23%	50%	50%	Warburton & Orchard 1996
Leg-hold snare/coil spring trap	*Oryctolagus cuniculus, Vulpes vulpes*	*Lynx pardinus*	-	64%	22.5%	García-Perea 2000
Neck snare	*Canis latrans*	*Odocoileus hemionus, O. virginianus, Bos taurus*	21%	33-63%	-	Phillips 1996
Neck snare	*Lepus americanus*	*Martes americana*	50%	0%	0%	Proulx *et al* 1994a
Rotating jaw-trap	*Martes americana*	*Perisoreus canadensis, Glaucomys sabrinus*	43%	100%	-	Naylor & Novak 1994
Rotating jaw trap	*Martes americana*	*Corvus brachyrhynchos, Rattus spp, Felis catus*	30%	-	-	Proulx & Barrett 1993a
Restraining traps						
Box trap	*Felis silvestris, Lynx lynx*	*Meles meles, Ursus arctos*	64%	0%	0%	Potočnik *et al* 2002
Box trap	*Canis familiaris*	*Corvus brachyrhynchos, Felis catus, Procyon lotor, Mephitis mephitis*	93%	-	-	Way *et al* 2002
Box trap	*Martes pennanti*	*Martes americana, Gulo gulo, Vulpes vulpes*	94%	1%	-	Weir 1997
Leg-hold snare	*Panthera leo*	*Hyaena hyaena, Crocuta crocuta, Acinonyx jubatus*	32%	0%	17%	Frank *et al* 2003
Leg-hold snare	*Puma concolor*	*Odocoileus hemionus, Canis latrans, Bos taurus*	45%	17%	-	Logan *et al* 1999
Neck snare	*Vulpes vulpes*	*Canis familiaris, Felis catus, F. sylvestris, Meles meles, Martes martes, Lutra lutra, Lepus europaeus*	46%	-	-	Chadwick *et al* 1997

[1] The relative % of injured and dead animals is not known. [2] Mortality and injury combined.

Published literature consistently notes the lack of selectivity of body-gripping traps. Linscombe (1976) documented 57 non-target mammals and 127 non-target birds were captured in No. 2 Victor and No. 220 Conibear traps with more non-target species, particularly birds, captured in the Conibear trap.[203] In a study of multiple trap types in Arkansas, Sasse (2018) found that non-target spotted skunks, a species of "greatest conservation need in Arkansas" that may warrant protection under the Endangered Species Act, were captured in body-gripping traps set for bobcats, raccoons, coyotes, and fox.[204] Neither Linscombe nor Sasse indicated whether any of the non-target animals trapped in their studies were found alive. Nor did they provide any estimates of time to death or unconsciousness. Hill (1987) found that trap mortality in non-target animals taken in No. 220 Conibear traps was "sufficiently high to make them unsuitable for conventional terrestrial trapping in the Southeastern United States, except for special situations such as for control of feral dogs, or predator populations on specific areas during rabies epizootics."[205] No. 120 Conibear traps also captured non-target species but not in the numbers captured in the 220 traps. Davis et al. (2012), in their study of body-gripping traps in the Cape Horn Archipelago that straddles the border of Chile and Argentina, determined that a number of non-target bird species (caracaras, kelp gulls, flightless streamer ducks) and mammal species (domestic cats, feral pigs) were captured when they used an open front configuration for their trap sets.[206]

Non-target capture results in greater suffering and death for animals and can have knock-on effects on ecosystems and wildlife communities. As repeated studies have found, kill traps can capture and kill threatened species and domestic companions alike. For these reasons, Petitioners seek the issuance of new rules and the amendment of certain existing rules to prohibit Wildlife Services from using kill traps.

4. M-44s

Wildlife Services kills thousands of animals each year using M-44s, both intentionally and unintentionally. M-44s are spring-loaded, screwed or pushed into the ground, and topped with scented bait to lure animals to bite. Once the animal's teeth clench on the bait, a spring shoots a pellet of sodium cyanide into the animal's mouth.[207] The sodium cyanide combines with available moisture, including saliva, to produce hydrogen cyanide gas, which is readily absorbed by the lungs and poisons the animal by inactivating an enzyme essential to mammalian cellular respiration.[208] This leads to central nervous system depression, cardiac arrest, respiratory failure,

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[203] LINSCOMBE, *supra* note 186.

[204] D. Blake Sasse, *Incidental Captures of Plains Spotted Skunks* (Spilogale putorius interrupta) *By Arkansas Trappers, 2012-2017*, 72 J. ARK. ACAD. OF SCI. 187 (2018); *see also* 90-Day Finding on a Petition To List the Prairie Gray Fox, the Plains Spotted Skunk, and a Distinct Population Segment of the Mearn's Eastern Cottontail in East-Central Illinois and Western Indiana as Endangered or Threatened Species, 77 Fed. Reg. 71759 (Dec. 4, 2012).

[205] Edward P. Hill, *Catch Effectiveness and Selectivity of Several Traps*, 3 THIRD E. WILDLIFE DAMAGE CONTROL CONF. 23 (1987).

[206] Ernesto F. Davis et al., *American Mink* (Neovision vison) *Trapping in the Cape Horn Biosphere Reserve: Enhancing Current Trap Systems to Control an Invasive Predator*, 49(1-2) ANNALES ZOOLOGICI FENNICI 12 (2012).

[207] For a history of the development and deployment of M-44s, *see* F. SHERMAN BLOM & GUY CONNOLLY, U.S. DEPT. OF AGRIC., INVENTING AND REINVENTING SODIUM CYANIDE EJECTORS: A TECHNICAL HISTORY OF COYOTE GETTERS AND M-44S IN PREDATOR DAMAGE CONTROL (2003).

[208] U.S. FISH & WILDLIFE SERV., BIOLOGICAL OPINION: EFFECTS OF 16 VERTEBRATE CONTROL AGENTS ON ENDANGERED AND THREATENED SPECIES, II-73 (1993) [hereinafter "1993 Biological Opinion"].

and death.[209] M-44s are primarily used to target and kill coyotes, red fox, gray fox, and wild dogs, though the device is occasionally used to target gray wolves as well.

An animal may also be exposed to a sublethal dose either due to M-44 malfunction or if the animal were close to, but downwind from, an M-44 triggered by another animal. According to the USDA, chronic or sublethal exposure to hydrogen cyanide gas include:

> Symptoms of chronic toxicity in mammals may include uncontrolled body movement and increased urination (Towill et al. 1978). A common sublethal symptom in coyotes is vomiting (Blom and Connolly 2003). A WS biologist observed partial paralysis in coyotes exposed to a sublethal dose of NaCN, with speculation that a lack of oxygen to the body's tissues caused damage to the lower spinal cord or some part of the brain (Blom and Connolly 2003).[210]

Sacks et al. (1999) questioned the efficacy of using M-44s for killing coyotes documenting an M-44 susceptibility bias toward younger coyotes on their study site in Northern California while older coyotes demonstrated avoidance behavior.[211] The authors concluded that M-44s would not be effective in controlling coyote depredation because the coyotes responsible for most livestock killings are usually older, breeding animals. This result was similar to what Brand et al. (1995)[212] and Brand and Nel (1997)[213] in their studies of blackbacked jackals, where the older jackals demonstrated avoidance behavior toward the devices.

In addition to being inhumane and ineffective, Petitioners oppose the use of M-44s because these devices pose a high risk to humans, companion animals, and non-target wildlife and M-44s are being used in violations of labeling requirements, which makes these inherently dangerous devices even more concerning.

Over the past twenty years there have been dozens of reported instances of human and companion animals' exposure to sodium cyanide as a result of contact with M-44s, involving at

[209] *Id.*; J.O. Egekeze & F.W. Oehme, *Cyanides and Their Toxicity: A Literature Review*, 2(2) VETERINARY Q. 104 (1980); A.L. Hooke et al., *Clinical Signs and Duration of Cyanide Toxicosis Delivered by the M-44 Ejector in Wild Dogs*, 33(3) WILDLIFE RSCH. 181 (2006).

[210] USDA, APHIS, Wildlife Servs., *The Use of Sodium Cyanide in Wildlife Damage Management*, *in* HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT FOR THE USE OF WILDLIFE DAMAGE MANAGEMENT METHODS BY USDA-APHIS-WILDLIFE SERVICES (2019), available at https://www.aphis.usda.gov/wildlife_damage/nepa/risk_assessment/7-sodium-cyanide-amended-peer-reviewed.pdf [https://perma.cc/3LRK-3EZD].

[211] Sacks et al., *supra* note 101.

[212] D.J. Brand et al., *The Influence of Regular Removal of Black-backed Jackals on the Efficiency of Coyote Getters*, 25(2) S. AFR. J. WILDLIFE RSCH. 44 (1995).

[213] D.J. Brand & J.A.J. Nel, *Avoidance of Cyanide Guns by Black-backed Jackal*, 55(1-2) APPLIED ANIMAL BEHAV. SCI. 177 (1997).

least twenty-six Wildlife Services employees and eighteen members of the public.[214] Additionally, from 2010 to 2016, more than 415 dogs were killed by M-44s.[215] The Humane Society of the United States obtained the following data on M-44 exposure of members of the public from a Freedom of Information Act request to the EPA and other sources. This is not an exhaustive list of incidents.

- In 1994, in Oregon, Amanda Wood Kingsley was exposed to sodium cyanide after her dog triggered an M-44 on her private property. Ms. Wood suffered secondary poisoning after she gave her dog mouth-to-mouth resuscitation.

- In 1998, in Texas, Bill Guerra Addington was exposed to an M-44. He documented his encounter: "I noticed what appeared to be a rusted rod sticking out of the ground about 15 ft from the watering tank. . . . I bent over to pull the rod out of the ground. After I grabbed the top and moved the 'metal rod' back and forth to remove it from the ground, it exploded in my hand. . . . I looked at my hand and saw it was all cut up and burned, and there was yellow powder all over it. The yellow powder was even burnt into the burns and cuts on my hand. My hand was bleeding and was starting to swell from the explosion trauma . . . I was puzzled why a 'coyote getter' would be on our private land. . . . The pain was really bad for about 2 hours. My hand healed slowly. I had a yellow palm for five or six months."

- On March 3, 1999, while irrigating his farm in Crawford, Colorado, along with his three-year-old daughter and his dog, Paul Wright witnessed his dog's death after the dog triggered an M-44 illegally placed on Mr. Wright's private property. A lawsuit was filed February 2000 in federal court and the matter settled in 2001 for $10,000.

- In December of 1999, a private landowner tried to remove an M-44 placed on property that he was leasing and accidentally triggered the device. He tasted the poison and his wife drove him to the hospital, where he received medical attention.

- In November of 2002, a woman accidentally triggered an M-44 placed on her property. She experienced increased respiratory rate and eye irritation but was able to drive herself to the hospital.

- On March 12, 2002, a Wildlife Services specialist transported set M-44s in his truck. He reached for bait, triggering one. The cyanide caused his eyes to burn and he had a bad taste in his mouth. He drove to a stock tank to fill an eye flush bottle which "increased exposure time." He went to an emergency room for treatment.

- On May 3, 2003, Dennis Slaugh, while recreating on federal public land in Utah, triggered an M-44. He thought he was brushing off an old survey stake. The device

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[214] *See The Use of Sodium Cyanide in Wildlife Damage Management*, *supra* note 210; *see also* Tom Knudson, *The Killing Agency: Wildlife Services' Brutal Methods Leave a Trail of Animal Death*, SACRAMENTO BEE (Apr. 29, 2012).

[215] Dipika Kadaba, *The Big Picture: Cyanide Killers*, REVELATOR (Aug. 9, 2017), https://therevelator.org/big-picture-cyanide-killers/ [https://perma.cc/QZ9L-HPRW].

fired onto his chest, and according to a letter written by his wife to Rep. Peter DeFazio, the powder hit his face and went into his eye. He immediately experienced disorientation and was unable to speak. He reports being severely disabled ever since this encounter with cyanide. A blood test found cyanide poisoning. The EPA wrote: "He stated he was unable to work since the incident because of difficulty breathing, vomiting, and weakness." According to his wife, he suffered for many years and had his life cut short because of the incident.[216]

- On February 21, 2006, U.S. Fish and Wildlife Service biologist Sam Pollock was secondarily poisoned from handling his dog, Jenna, who was lethally asphyxiated by an M-44 illegally set by Wildlife Services to kill coyotes on U.S. Bureau of Land Management land in Utah. Pollock became ill with a headache and faintness, and noticed a metallic taste in his mouth.

- In April 2006, Sharyn and Tony Aguiar's two-year-old German shepherd was killed at a rock quarry in Utah. In a June 21, 2006 internal memorandum to colleagues, then-Utah State Director of Wildlife Services Michael J. Bodenchuk, wrote: "After investigation of the M-44 device in this case followed all applicable laws, regulations and policies and no negligence occurred on our part. It is unfortunate that a dog was killed in this area. I have concerns about the government settling cases with dog owners because it is all too easy for someone to intentionally take a dog into an area posted with signs with the intention of getting the dog killed. I recommend against settling this claim."

- On December 23, 2006 a coyote hunter, who had been "calling" coyotes in Utah, sat down near a device that he had not detected. Moments later, his dog pulled the M-44 and died.

- Another incident involved a woman who was exposed to sodium cyanide after trying to resuscitate her dog, who died from an M-44 set on her land without her permission.[217] She tasted the poison and felt disoriented. Over the next several months she experienced tingling in her arms and insomnia.

- On May 17, 2007, a Texas man spraying mosquitoes in an oil field "kicked or stepped" on an M-44 and cyanide was "ejected into his eyes" and he suffered "irritation" and "burning" and was admitted to a hospital. In his Brazoria County Sheriff report, Officer Shanks reports that the victim drove himself to a small business where a woman found him disoriented and asking for help. Officer Shanks was ordered to "go home immediately and take a shower"; he writes: "I informed everyone on the scene who came into contact with the victim to shower immediately also."

[216] Ex. 17, Letter from Dorothy Slaugh to Congressmember Peter DeFazio (Dec. 6, 2006), available at https://www.predatordefense.org/docs/m44_letter_Slaugh_DeFazio.pdf.

[217] Ex. 18, Letter from Amanda Wood Kingsley to Congressmember Peter DeFazio (Jan. 9, 2007), available at https://www.predatordefense.org/docs/m44_letter_Kingsley_DeFazio_01-09-07.pdf.

- On February 16, 2011, a border patrol agent in Kinney County, Texas kicked an M-44 and then pulled it with his gloved hand, which discharged the device. The agent then read a "nearby M-44 individual device warning sign" and called an ambulance and went to the hospital for medical attention.[218]

- On March 11, 2017, in Casper, Wyoming, two dogs on a family hike died after exposure to sodium cyanide placed for coyotes on unmarked public lands. The family members were also exposed to sodium cyanide when they tried to save their dogs by washing them in a creek and when they hugged and kissed their dying pets.[219]

- On March 13, 2017, in Pocatello, Idaho, fourteen-year-old Canyon Mansfield walked up a hill from his house. He found an M-44 and thought it was a sprinkler. He pulled it and the poison caused his dog, Casey, to convulse, asphyxiate, and die within minutes of the device being activated.[220] Canyon and the sheriff's deputy who came to investigate were both hospitalized for cyanide exposure. This incident received considerable public attention both nationally and internationally. Canyon was seriously ill following his exposure to cyanide.

Several other reported incidents include pesticide applicators who were poisoned while setting M-44s. For example, in May 2001, an applicator accidentally triggered a device. He experienced temporary blindness in one eye, as well as blisters on his tongue and lips. He went to the emergency room to receive medical attention. In January 2002, an applicator accidentally triggered a device and the sodium cyanide capsule hit his face and eye. He flushed his eyes and went to the hospital for medical attention. In March 2002, an applicator accidentally triggered an M-44 when he reached into a bucket in his vehicle that held the assembled device. He experienced burning of his eyes and could taste the poison, and he drove himself to the emergency room, where he received medical assistance. In April 2005, an applicator accidentally triggered the device while installing it and then administered the antidote. In January 2007, an applicator in Oklahoma triggered an M-44. He experienced eye irritation and disorientation but was able to administer the antidote and drive himself to the hospital. In November 2008, an applicator accidentally triggered the device and the sodium cyanide capsule hit him in the face. After tasting the poison, he administered the antidote and went to the hospital for medical attention.[221] In 2017, an applicator accidentally triggered the device in Leakey, Texas. He

[218] Ex. 19, Petition from Kelly Nokes, WildEarth Guardians, & Collette Adkins, Ctr. for Biological Diversity, to Scott Pruitt, Adm'r, U.S. Env't Prot. Agency (Aug. 10, 2017), available at https://biologicaldiversity.org/campaigns/carnivore_conservation/pdfs/M44NationwidePetition_08-10-2017.pdf.

[219] *Wyoming Families Out for Pleasant Walk Lose Two Dogs to M-44 "Cyanide Bomb"*, PREDATOR DEF. (2017), https://www.predatordefense.org/features/m44_WY_Amy_dogs.htm [https://perma.cc/4GME-FQYX]; *see Cyanide Bombs: Stopping M-44s From Killing American Wildlife*, CTR. FOR BIOLOGICAL DIVERSITY, https://www.biologicaldiversity.org/campaigns/cyanide-bombs/ [https://perma.cc/73Z4-WJ4T].

[220] Ex. 20, Canyon Mansfield, *My Best Friend, Kasey*, PREDATOR DEF. (Mar. 20, 2017), https://predatordefense.org/docs/m44s_canyons_story.pdf; *see* Taylor Mann, *Public Lands' Indiscriminate Killer: M-44 Cyanide Ejectors*, AM. BAR ASS'N (May 24, 2022), https://www.americanbar.org/groups/environment_energy_resources/publications/plr/20220524-public-lands-indiscriminate-killer/ [https://perma.cc/Y58B-ZJBC].

[221] Ex. 20, Mansfield, at 16.

flushed his exposed eye and went to an emergency room. His symptoms included burning sensation, watery eye, and blurred vision.[222]

These incidents demonstrate that M-44s are being used in violation of labeling requirements. In its 1994 Reregistration Eligibility Decision ("RED") pertaining to the use of sodium cyanide capsules in M-44 units, the U.S. Environmental Protection Agency ("EPA") concluded that M-44s did not pose unreasonable risks to humans or the environment if used in accordance with the twenty-seven use restrictions listed on the label and criteria established by the U.S. Fish and Wildlife Service to protect endangered species likely to be jeopardized by use of M-44s.[223] The labels[224] for registered sodium cyanide products require users to comply with all twenty-six use restrictions outlined in the Use Restriction Bulletin.[225]

Even though the Federal Insecticide, Fungicide, and Rodenticide Act, under which sodium cyanide is registered for restricted use, requires strict adherence to pesticide labels,[226] registered users do not consistently abide by a number of these use restrictions. The 2017 incident in Idaho involving the Mansfields and the 2017 incident in Wyoming provide ample evidence demonstrating how registered users violate the label requirements and other use restrictions when placing M-44s. The incident in Idaho involved violations of the following use restrictions:

1. "The M-44 device shall not be used: (1) in areas within national forests or other Federal lands set aside for recreational use, (2) areas where exposure to the public and family and pets is probable, (3) in prairie dog towns, or (4) except for the protection of Federally designated threatened or endangered species, in National or State Parks; National or State Monuments; federally designated wilderness areas; and wildlife refuge areas";[227]

2. "Bilingual warning signs in English and Spanish shall be used in all areas containing M-44 devices . . . Main entrances or commonly used access points to areas in which M-44 devices are set shall be posted with warning signs to alert the public to the toxic nature of the cyanide and to the danger to pets. Signs shall be inspected weekly to ensure their continued presence and ensure that they are conspicuous and legible . . .

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[222] Memorandum from U.S. Envt. Prot. Agency, Sodium Cyanide: Tier I Update Review of Human Incidents and Epidemiology for Draft Risk Assessment (Aug. 23, 2018), available at https://www.regulations.gov/document/EPA-HQ-OPP-2010-0752-0205.

[223] Ex. 21, USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 2.415, M-44 USE AND RESTRICTIONS (2020) [hereinafter "M-44 Use Restrictions"], available at https://www.aphis.usda.gov/wildlife_damage/directives/pdf/2.415.pdf.

[224] *See, e.g.*, Label for EPA Registration No. 56228-15 ("Users of this product must follow all requirements of product labeling, including but not limited to, all Use Restrictions, Directions for Use, Precautionary Statements, first aid and antidotal measures, information on endangered species, requirements for posting warning signs, and Storage and Disposal instructions."). *See also* Labels for EPA Registration No. 35975-2, EPA Registration No. 39508-1, EPA Registration No. 13808-8, EPA Registration No. 33858-2, and EPA Registration No. 35978-1.

[225] Ex. 21, M-44 Use Restrictions, at 12.

[226] 7 U.S.C. § 136j(a)(2)(G).

[227] Ex. 21, M-44 Use Restrictions, at 3.

An elevated sign shall be placed within 25 feet of each individual M-44 device warning persons not to handle the device";[228] and

3. "In all areas where the use of the M-44 device is anticipated, local medical people shall be notified of the intended use. This notification may be made through a poison control center, local medical society, the Public Health Service, or directly to a doctor or hospital. They shall be advised of the antidotal and first-aid measures required for treatment of cyanide poisoning. It shall be the responsibility of the supervisor to perform this function."[229]

In the Idaho incident, the M-44 was placed in an "area[] where exposure to the public and family and pets is probable." As discussed above, fourteen-year-old Canyon Mansfield was walking the family dog, Casey, on a hill just 300 yards behind their home on public land managed by the Bureau of Land Management.[230] As for the requirement for conspicuous warning signs, Dan Argyle, a captain in the Bannock County Sheriff's Office who responded to the incident, told National Geographic that "no warning signs were observed at the scene . . . ."[231] Canyon Mansfield confirmed as much, reporting that "[n]o signs like these were near the cyanide bomb that took my dog away from me."[232] It has been reported that Wildlife Services made no notifications of the intended use of M-44s to local medical professionals.[233] Canyon Mansfield's father, Dr. Mark Mansfield explains: "We didn't know anything about it. No neighborhood notifications, and our local authorities didn't know anything about them . . . The sheriff deputies who went up there didn't even know what a cyanide bomb was."[234] Records indicate that Wildlife Services notified Idaho hospitals *after* the Pocatello incident, in July 2017, and that Wildlife Services has not made these notifications on an annual basis, as the prior notification to Idaho hospitals occurred in 2013.[235]

The incident in Wyoming also demonstrates a violation of the requirement for warning signs.[236] A media report provides that a "few days after the dogs died in Wyoming, Daniel Helfrick returned to the area, looking for signs they might have missed to warn them of the

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[228] *Id*. at 10–11.

[229] *Id*. at 12.

[230] Todd Wilkinson, *Dog's Death Spotlights Use of Cyanide 'Bombs' to Kill Predators*, NAT'L GEOGRAPHIC (Apr. 20, 2017), http://news.nationalgeographic.com/2017/04/wildlife-watch-wildlife-services-cyanide-idaho-predatorcontrol/. That placement also violated a November 2016 pledge by Wildlife Services in Idaho not to use M-44s on public land in Idaho.

[231] *Id.*

[232] Ex. 20, Mansfield.

[233] Dave Urbanski, *Cyanide Device Explodes, Killing Family's Dog. They Can't Believe Who Planted It Behind Their Home*, BLAZE MEDIA (Mar. 21, 2017), https://www.theblaze.com/news/2017/03/21/cyanide-device-explodes-killing-familys-dog-they-cant-believe-who-planted-it-behind-their-home [https://perma.cc/UK6B-ENS9].

[234] Ex. 19, Petition from Kelly Nokes & Collette Adkins.

[235] *Id.*

[236] Kelsey Dayton, *Cyanide Bomb Kills Two Casper Dogs*, WYOFILE (Mar. 31, 2017), https://wyofile.com/cyanide-bomb-kills-two-casper-dogs/ [https://perma.cc/AM3Q-NMWW].

cyanide traps. He didn't see any."[237] A personal account of the incident by one of the family members involved provides further evidence that no signs were posted.[238]

In the RED, the EPA concluded that M-44s did not pose unreasonable risks to humans or the environment if used in accordance with the twenty-six use restrictions listed on the label.[239] These incidents provide evidence that M-44s are not being used in accordance with the use restrictions, and therefore continued use of the device on public lands poses an unreasonable risk.

Additionally, from 2010 to 2016, more than 415 dogs were killed by M-44s.[240] In 2016 alone, Wildlife Services admitted to unintentionally killing seven domestic animals with M-44s.[241] In addition, in 2016, Wildlife Services reported unintentionally killing twenty-two dogs that were classified as feral, free-ranging or hybrids.[242] Some of these dogs may have been family dogs running off-leash.[243] In 2022 alone, Wildlife Services admitted to killing six dogs with M-44s, including two killed unintentionally.[244] Going back twenty-five years, data from Wildlife Services shows that as many as sixty-three domestic dogs have been killed unintentionally—in a single year—with M-44s.[245]

As demonstrated by the list above, M-44s put people and companion animals at unreasonable risk of being severely injured, or even killed. These incidents highlight the danger of this pesticide, and the inappropriateness of its continued use on public lands.

Only thirteen states still allow some use of M-44 cyanide bombs.[246] In response to incidents like those cited above, Oregon banned the use of M-44s throughout the state in 2019.[247] Similarly, agreements have prohibited the use of M-44 cyanide capsules in Idaho, Colorado, and

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[237] *Id.*

[238] *Wyoming Families Out for Pleasant Walk Lose Two Dogs*, *supra* note 219.

[239] ENV'T PROT. AGENCY, REREGISTRATION ELIGIBILITY DECISION (RED): SODIUM CYANIDE (1994) [hereinafter "Sodium Cyanide RED"].

[240] Kadaba, *supra* note 215.

[241] USDA, APHIS, Wildlife Services 2016 Program Data Report: Table G Animals Taken by Wildlife Services.

[242] *Id.*

[243] *See Featured Incidents of Pet Killings and Human Poisonings Caused by M-44s*, PREDATOR DEF. (Sept. 13, 2018), available at https://www.predatordefense.org/docs/m44_incidents_pet_killings_human_poisonings.pdf [https://perma.cc/5WKU-QTWA].

[244] 2022 Program Data Report, *supra* note 62.

[245] PREDATOR DEFENSE, USDA WILDLIFE SERVICES YEARLY SUMMARY STATISTICS OF DOMESTIC DOG KILLINGS BY M-44S (Sept. 13, 2018), available at https://www.predatordefense.org/docs/m44_WS_dog_killings_yearly_statistics.pdf [https://perma.cc/9AQE-FSDR].

[246] *See* Press Release, Ctr. for Biological Diversity, Five Years After 'Cyanide Bomb' Injures Idaho Teen, Efforts Continue to Ban Deadly Devices (Mar. 16, 2022), https://biologicaldiversity.org/w/news/press-releases/five-years-after-cyanide-bomb-injures-idaho-teen-efforts-continue-to-ban-deadly-devices-2022-03-16/ [https://perma.cc/W5R4-NCY6].

[247] *See* Kale Williams, *Oregon Outlaws Use of So-called 'Cyanide Bombs' as Advocates Move to Take Ban Nationwide*, OREGONIAN (May 8, 2019), https://www.oregonlive.com/environment/2019/05/oregon-outlaws-use-of-so-called-cyanide-bombs-as-advocates-move-to-take-ban-nationwide.html [https://perma.cc/KLY5-2ZNG].

Wyoming.[248] Arizona regulators have prohibited the use of M-44s on public lands statewide.[249] In 2019, citing concerns of the "off-target impacts on both humans and non-predatory animals," EPA withdrew its interim registration review decision to reevaluate the use of M-44 capsules.[250] However, less than six months later, EPA chose to reauthorize the use of cyanide capsule "bombs" nationwide amidst pressure from the Trump administration.[251] In 2020, as part of a settlement with a family whose dog had been killed by a cyanide bomb, Wildlife Services finally admitted negligence for having placed the M-44 on public lands, as a 2016 environmental assessment stated M-44s were only to be placed on private lands.[252]

Over the decades that they have been in use, M-44s have poisoned and killed thousands of non-target wild animals, including federally protected threatened and endangered species.[253] The U.S. Department of Agriculture's Animal Damage Control program[254] recorded 103,255 animals killed by M-44s between 1976 and 1986, including 4,868 non-target animals (representing approximately five percent of all animals killed).[255] The non-target species killed during this timeframe included black bears, mountain lions, badgers, kit and swift foxes, bobcats, ringtail cats, feral cats, skunks, opossums, raccoons, Russian boars, feral hogs, javelinas, beavers, porcupines, nutrias, wild turkeys, rabbits, vultures, ravens, crows, hawks, and a grizzly bear, amongst others.[256]

Between 2003 and 2007, M-44s killed 68,044 animals, including both target and non-target species.[257] Non-target species killed during this time include bald eagles, marmots,

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[248] Settlement Agreement and Stipulation of Dismissal, *W. Watersheds Project v. Grimm* (2020) (No. 1:16-cv-218-BLW); Stipulated Settlement Agreement, *Ctr. for Biological Diversity v. USDA-APHIS Wildlife Services* (2019) (No. 19-CV-20-F); *Government Agrees to Halt use of Cyanide Traps in Colorado*, DENVER POST (Nov. 6, 2017), https://www.denverpost.com/2017/11/06/government-agrees-halt-use-cyanide-traps-colorado/ [https://perma.cc/4K92-7NVG].

[249] *See* Five Years After 'Cyanide Bomb' Injures Idaho Teen, Efforts Continue to Ban Deadly Devices, *supra* note 246.

[250] *See id.*; *see also* Neil Vigdor, *EPA Backtracks on Use of 'Cyanide Bombs' to Kill Wild Animals*, N.Y. TIMES (Aug. 16, 2019), https://www.nytimes.com/2019/08/16/us/epa-cyanide-bombs.html [https://perma.cc/LAN6-JEYU].

[251] *See* Jimmy Tobias, *The Secretive Government Agency Planting 'Cyanide Bombs' Across the US*, GUARDIAN (June 26, 2020), https://www.theguardian.com/environment/2020/jun/26/cyanide-bombs-wildfire-services-idaho [https://perma.cc/WS99-VG8Q].

[252] *See USDA Admits Negligence in Cyanide* Poisoning, AWI Q. (Fall 2020), https://awionline.org/awi-quarterly/fall-2020/usda-admits-negligence-cyanide-poisoning [https://perma.cc/3NA6-Q7R8].

[253] Lisa Hebbelmann, *Livestock Predation and its Management in South Africa: A Scientific Assessment*, 37(3) AFR. J. RANGE & FORAGE SCI. 243 (2020); T.I. Muddler & M.M. Botz, *Cyanide and Society: A Critical Review*, 4(1) EUR. J. MINERAL PROCESSING & ENV'T PROT. 62 (2004).

[254] The Animal Damage Control Program was the predecessor to Wildlife Services.

[255] 1993 Biological Opinion, *supra* note 208, at II-74; Guy Connolly, *M-44 Sodium Cyanide Ejectors in the Animal Damage Control Program, 1976-1986*, PROC. THIRTEENTH VERTEBRATE PEST CONF. 220 (1988).

[256] 1993 Biological Opinion, *supra* note 208, at II-74; R. Eisler, *Cyanide Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*, 85 BIOLOGICAL REP. 6 (1991).

[257] WENDY KEEFOVER-RING, WAR ON WILDLIFE: THE U.S. DEPARTMENT OF AGRICULTURE'S "WILDLIFE SERVICES" 53 (Feb. 2009), available at https://pdf.wildearthguardians.org/support_docs/report-war-on-wildlife-june-09-lo.pdf [https://perma.cc/9QPU-5K34].

badgers, black bears, dogs, kit and swift foxes, opossums, raccoons, feral hots, javelinas, ravens, ringtail cats, skunks, wolves, and bobcats.[258] For a more detailed list of both target and non-target species killed during this timeframe, see Table 12,[259] reproduced below:

Table 12 USDA-APHIS-WS M-44 Mortalities (2003 to 2007)						
	2003	**2004**	**2005**	**2006**	**2007**	**TOTAL**
Badgers	4	3	0	0	0	7
Bald Eagles	1	0	1	0	0	2
Black Bears	1	0	4	2	1	8
Bobcats	1	5	15	1	3	25
Coyotes	13,275	10,630	11,568	12,564	12,871	60,909
Crows	0	0	4	0	2	6
Dogs	108	117	92	112	90	519
Foxes, Gray	527	277	301	450	610	2,165
Foxes, Kit	27	29	25	24	10	115
Foxes, Red	494	387	353	394	368	1,996
Foxes, Swift	16	19	8	24	27	94
Hogs (Feral)	7	4	7	9	10	37
Javelinas	2	0	2	0	0	4
Marmots	0	1	0	0	0	1
Opossums	83	96	64	113	54	410
Raccoons	331	291	218	198	189	1,227
Ravens	4	7	2	2	3	18
Ringtails	4	1	2	1	0	8
Skunks, Striped	167	113	59	76	34	449
Wolves, Gray	1	0	0	1	2	4
TOTAL	**15,053**	**11,980**	**12,726**	**13,971**	**14,274**	**68,004**

[258] *Id.*

[259] *Id.*

According to Wildlife Services' data, from 2010-2016, over 2,600 animals were unintentionally taken by M-44s.[260] Wildlife Services' 2016 data shows that 321 animals were unintentionally killed by M-44s in that year alone,[261] including 101 gray fox, 61 red fox, 57 raccoons, 1 black bear, 1 fisher, and 7 domestic animals, including family dogs.[262]

In 2017, Wildlife Services reports that it killed at least 13,232 animals with M-44s, over two hundred of which were non-target animals, including 110 foxes, a gray wolf, 48 raccoons, 21 opossums, and more.[263] In more recent data, from 2018-2021, 966 animals were unintentionally taken by M-44s, including 680 gray foxes, 166 raccoons, 59 red foxes, 26 Virginia opossums, 12 dogs characterized as feral, free-ranging and hybrids, 9 feral swine, 7 skunks, 3 black bears, and 2 ravens.[264] For example, M-44s killed 217 non-target animals in 2018, including 130 gray fox, 63 raccoons, 7 Virginia opossums, 4 red foxes, 4 striped skunks, 4 feral swine, 3 kit foxes, 1 swift fox, and 1 black bear.[265]

M-44s have unintentionally killed threatened and endangered species, including Grizzly bears, California condors, kit foxes, wolves, and other species protected under the Endangered Species Act.[266] Specifically, in 1978 a threatened grizzly bear in Montana died from an M-44. In 1983, an endangered California condor died from an M-44 in Kern County, California.[267] In 1995, an endangered wolf in the panhandle of Idaho died from an M-44 set for coyotes. A threatened grizzly bear was killed in Montana in 1998.[268] In March of 2001, an endangered wolf died from an M-44 in South Dakota.[269] Two years later, in March of 2003, another wolf died in an undisclosed location.[270] In March of 2005, a bald eagle, protected under the ESA at that time, died from an M-44 in McHenry County, North Dakota. In 2006, one wolf died, and in January of 2007, two wolves died from M-44s in Idaho near Riggins. In December of 2008, an endangered wolf was killed from an M-44 north of Cokeville, Wyoming, in Lincoln County.[271] In May of 2013, a federally protected bald eagle died from an M-44 in Richland County, North Dakota.[272]

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[260] Wildlife Services' 2016 Program Data Report, *supra* note 241.

[261] *Id.*

[262] *Id.*

[263] *Id.*

[264] USDA, APHIS, Wildlife Services' 2018-2021 Program Data Reports: Table G Animals Taken by Wildlife Services.

[265] USDA, APHIS, Wildlife Services' 2018 Program Data Report: Table G Animals Taken by Wildlife Services.

[266] 1993 Biological Opinion, *supra* note 208, at II-74.

[267] Eisler, *supra* note 256.

[268] KEEFOVER-RING, *supra* note 257.

[269] *Nationwide Wildlife Deaths Caused by M-44s, 2003-2014*, PREDATOR DEF. (June 17, 2015), available at https://www.predatordefense.org/docs/M44_Kill_Data.pdf [https://perma.cc/VCW2-P8MA].

[270] *Id.*

[271] *See id.*

[272] *Id.*

Between 2003 and 2014, two hundred kit foxes were killed by M-44s.[273] More recently, in February 2017, a gray wolf died in northeastern Oregon from an M-44 used by Wildlife Services to target coyotes.[274] The incidents detailed here do not include other protected non-endangered wildlife, such as state-listed or "special concern" species, killed by M-44s.

Such verified non-target wildlife deaths almost certainly underestimate the total number of non-target species impacted because the likelihood of locating the carcass of a non-target species is low, as they can die some distance from the M-44.[275] Moreover, other animals killed by M-44s may be found but not reported, especially small birds and small mammals. The number of federally-protected animals killed by M-44s is also likely underrepresented as these incidents only reflect deaths reported to the EPA. This is supported by the fact that one-third of the time that M-44s fire, no bodies are recovered.[276] Yet "[o]nce the device is activated and the animal exposed, the likelihood of mortality is high."[277] Therefore, for those firings, it is likely the exposed animals wandered off-site and died, or died and were moved off-site by scavengers.[278]

This potential for high non-target mortality is supported by Shivik et al. (2014), who in their study examining visitation rates to sites where M-44s had been installed, documented coyotes visiting the sites thirty-four times and investigating the devices eleven times while other species, including black bear, bobcat, domestic cat, domestic cow, crow, white-tailed deer, domestic dog, donkey, red fox, domestic horse, opossum, passerine birds, rabbit, raccoon, domestic sheep, skunk, squirrel, and turkey, visited the sites 1,597 times and investigated the devices on fifty-five occasions.[279] In a related study, the authors documented thirty-nine instances where the M-44s were triggered, including thirty-six times by coyotes, twice by domestic dogs, and once by a red fox (all of which were target species).[280] M-44s put non-target wildlife at unreasonable risk of being killed. The continued use of M-44s on public lands, which provide vital wildlife habitat, is unacceptable.

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[273] *Id.*

[274] Wolves throughout the State of Oregon are considered "a special status game mammal, protected by the Oregon Wolf Plan." *Frequently Asked Questions About Wolves in Oregon*, OR. DEP'T OF FISH & WILDLIFE (Apr. 2023), https://www.dfw.state.or.us/wolves/faq.asp#:~:text=Were%20wolves%20reintroduced%20into%20Oregon,were%20not%20released%20in%20Oregon [https://perma.cc/Q4Y3-F5YE]; Press Release, Or. Dep't of Fish & Wildlife, Wolf Dies in Unintentional Take in Northeast Oregon (Mar. 2, 2017), available at https://www.dfw.state.or.us/news/2017/03_mar/030217.asp#:~:text=%E2%80%94Wolf%20OR48%2C%20a%20Shamrock%20Pack,activated%20device%20containing%20cyanide%20powder [https://perma.cc/T7FS-XUM8].

[275] This is particularly the case if the M-44 is triggered in a manner that delivers only a partial dose of poison or delivers the poison in an area other than the mouth.

[276] During a five-year period studied, bodies were only recovered in 9,759 out of 24,059 total firings. Memorandum from Brian Montague, Biologist, Env't Risk Branch, to Leigh Zimmer et al., Risk Mgmt. & Implementation Branch (Sept. 12, 2018), available at https://www.regulations.gov/document/EPA-HQ-OPP-2010-0752-0094.

[277] *Id.* at 4.

[278] *Id.* at 12.

[279] John A. Shivik, *Animal Attendance at M-44 Sodium Cyanide Ejector Sites for Coyotes*, 38(1) WILDLIFE SOC'Y BULL. 217 (2014).

[280] *Id.*

4. Denning

Denning, which involves the use of gas canisters containing sodium nitrate to kill animals in their dens, is an inhumane practice used by Wildlife Services to target coyotes, red foxes, and skunks.[281] Gas canisters are ignited, placed inside the active den, and then the den opening is covered with soil. When heated to 1,000 degrees, sodium nitrate explodes and produces toxic fumes of nitrous oxide and sodium oxide.[282] Carbon monoxide is thus released, converting the hemoglobin in blood to methemoglobin, which is unable to carry oxygen,[283] suffocating the animals inhabiting the den. This method often kills entire animal families, including young. Furthermore, this method likely kills considerably more animals than Wildlife Services reports. Since Wildlife Services technicians do not excavate burrows/dens to determine the number and species of animals killed using gas canisters, it is unclear how many animals are actually killed by this method. The number of deaths reported are merely estimates based on consideration of the species, time of year, average litter size, and anticipated number of young in the burrows/dens.[284] The actual death toll could be significantly higher based on variations in litter size, and may include non-target species. Notably, EPA labels for large and small gas cartridges warn against harm to a variety of non-target species.[285] For these reasons, as well as the potential impacts of a sub-lethal dose of carbon monoxide to target or non-target species in the event a canister is not set correctly or malfunctions, Wildlife Services should cease to use this device in its field operations.

5. Aerial Gunning

Aerial gunning, which Wildlife Services uses to kill coyotes, as well as gray wolves and red foxes, is inherently inhumane for several reasons. First, this method causes extreme stress due to noise from the aircraft and from gunfire, which can harm the hearing of multiple species. Second, this method forces animals to expend critical energy reserves to escape, which may affect survival and reproduction. Third, target animals are often not killed by the first shot, which prolongs suffering and can allow maimed or "crippled" animals to escape.[286] Lastly, there is a

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[281] Ex. 22, U.S. DEP'T OF AGRIC., ANIMAL & PLANT HEALTH INSPECTION SERV., WILDLIFE SERVS., PRE-DECISIONAL ENVIRONMENTAL ASSESSMENT: PREDATOR DAMAGE MANAGEMENT IN NEBRASKA FOR THE PROTECTION OF LIVESTOCK, WILDLIFE, PROPERTY AND PUBLIC HEALTH AND SAFETY 304 (1997) [hereinafter "1997 Environmental Assessment"]; *see also* USDA, APHIS, Wildlife Services' 2019 Program Data Report: Table G Animals Taken by Wildlife Services, https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/pdr/?file=PDR-G_Report&p=2019:INDEX: (choose "Montana" from dropdown).

[282] *See* U.S. ENV'T PROT. AGENCY, R.E.D. FACTS: INORGANIC NITRATE/NITRITE (SODIUM AND POTASSIUM NITRATES) (1991); *Sodium Nitrite*, NIH NAT'L LIBR. MED., https://pubchem.ncbi.nlm.nih.gov/source/hsdb/757 [https://perma.cc/H6GQ-CAWJ].

[283] *See Sodium Nitrite*, *supra* note 282.

[284] USDA, APHIS, Wildlife Servs., *The Use of Carbon Monoxide in Wildlife Damage Management*, *in* HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT FOR THE USE OF WILDLIFE DAMAGE MANAGEMENT METHODS BY USDA-APHIS-WILDLIFE SERVICES (2019), available at https://www.aphis.usda.gov/wildlife_damage/nepa/risk_assessment/8-gas-cartridge-peer-reviewed.pdf [https://perma.cc/5RJZ-NKQ4].

[285] KEEFOVER-RING, *supra* note 257.

[286] Ex. 22, 1997 Environmental Assessment, at 328.

significant likelihood that dependent young will be orphaned because these operations often coincide with the peak coyote birthing period.

Wildlife Services typically dismisses the impact of noise on wildlife by citing a number of species-specific studies that examined the effect of aircraft (fixed wing and helicopter) overflights of wildlife,[287] but few of these studies involved an assessment of low-flying aircraft engaging in aerial predator control. To truly evaluate this issue, it is imperative that such studies be conducted in different habitat types, at different altitudes, with real or mock gunfire, and accurate monitoring of noise levels, as well as involve third party observers to record wildlife reactions to fully assess the impact of aerial gunning on target and non-target species. Pepper et al. (2003) found, in a study of the impacts of low flying aircraft on wildlife, that aircraft noise, turbulence, and vibrations can adversely impact the hearing of multiple species, while the mere appearance of aircraft can cause a flight response forcing animals to expend critical energy reserves to escape the perceived threat.[288] This energy loss, depending on the availability of food and seasonal timing of the impact, may affect survival or reproduction.[289]

Petitioners are also concerned about how many passes are required to kill targeted animals. National Environmental Policy Act ("NEPA")[290] documents produced by Wildlife Services on predator damage management operations in some states have claimed that aerial gunning results in the death of most target animals after a single pass,[291] yet the agency offered no data or studies to verify that target species are killed in a single pass or even after two passes. There is no data publicly available indicating that Wildlife Services has assessed variations depending on habitat type or shooter experience, nor is it clear how, while flying in an aircraft, Wildlife Services technicians are sure that target animals are killed versus wounded. It is difficult to ascertain whether a target has been killed or merely wounded by the first shot. Targeted animals not killed by one shot prolongs suffering and can allow maimed animals to escape. Lastly, dependent young will be orphaned because of aerial gunning operations, particularly given the timing of many of those operations, which often coincide with the peak coyote birthing period. Wildlife Services has claimed that technicians try to locate coyote dens in areas where aerial gunning occurs in order to kill the pups,[292] but Wildlife Services provides no data on the success of such den location searches, what proportion of estimated dens are found, or how many personnel or hours are utilized in such searches over the course of a year. Nor has Wildlife Services disclosed, discussed, or evaluated the potential fate of dependent young that are not

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[287] *Id.* at 360.

[288] Christopher B. Pepper et al., *A Review of the Effects of Aircraft Noise on Wildlife and Humans, Current Control Mechanisms, and the Need for Further Study*, 32(4) ENV'T MGMT. 418 (2003).

[289] *Id.*

[290] 42 U.S.C. § 4321 *et seq.*

[291] *See, e.g.*, USDA, APHIS, WILDLIFE SERVS., FINAL ENVIRONMENTAL ASSESSMENT: PREDATOR DAMAGE AND CONFLICT MANAGEMENT IN WYOMING 186 (Dec. 2020), available at https://www.aphis.usda.gov/wildlife_damage/nepa/states/WY/wy-2020-predator-mammal-damage-ea.pdf [https://perma.cc/YM7N-E5PJ].

[292] *Id.* at 216.

found. These issues demonstrate that aerial gunning is inhumane, and Wildlife Services should cease using this method in its field operations.

6. Weevil-Cide® Tablets

Wildlife Services uses Weevil-Cide® in its field operations to destroy prairie dog burrows. Weevil-Cide® is a pesticide and is primarily used as a fumigant to kill a variety of insects in above-ground applications as well as burrowing animals.[293] It is highly toxic to animals and can be fatal to humans.[294] Its active ingredient is aluminum phosphide and is commonly formulated as tablets or pellets to kill burrowing animals.[295] Once placed in the burrow system, the tablets or pellets interact with atmospheric and/or soil moisture to create a highly toxic gas (phosphine).[296] According to Hygnstrom and Vercauteren (2000), if applied properly with all burrow entrances sealed, aluminum phosphide reduced black-tailed prairie dog burrow activity by between ninety-five and ninety-eight percent.[297]

The use of Weevil-Cide® is an inhumane method of killing black-tailed prairie dogs. Mason and Litten (2003) provide the following summary of the impact of phosphine on rodents:

> In poisoned rodents, it gives rise to similar signs of respiratory irritation and pain and other forms of discomfort. For example, in one study, rats exposed to phosphine gas showed 'clinical signs indicative of mild respiratory irritation' such as salivation, lacrimation, face-pawing and dyspnoea. A review by the Pesticide Safety Directorate also showed that rats and mice exposed to phosphine gas display face-washing movements suggestive of eye and respiratory irritation, shivering, piloerection, clinging to the walls of the cage, exophthalmos (protruding eyeballs), convulsions, and hind limb paralysis followed by full paralysis and death. Animals may not start being symptomatic until 30 min after

[293] Mohan Gurjar et al., *Managing Aluminum Phosphide Poisonings*, 4(3) J. EMERGING TRAUMA SHOCK 378 (2011).

[294] R. Dua & K.D. Gill, *Aluminum Phosphide Exposure: Implications on Rat Brain Lipid Peroxidtation and Antioxidant Defence System*, 89(6) PHARMACOLOGY & TOXICOLOGY 315 (2001).

[295] USDA, APHIS, Wildlife Servs., *The Use of Aluminum Phosphide in Wildlife Damage Management*, *in* HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT FOR THE USE OF WILDLIFE DAMAGE MANAGEMENT METHODS BY USDA-APHIS-WILDLIFE SERVICES (2020), available at https://www.aphis.usda.gov/wildlife_damage/nepa/risk_assessment/9-aluminum-phosphide.pdf [https://perma.cc/XY86-XFZB].

[296] W.F. ANDELT & S.N. HOPPER, COLO. STATE UNIV., FACT SHEET NO. 6.506: MANAGING PRAIRIE DOGS (2016), available at https://extension.colostate.edu/docs/pubs/natres/06506.pdf [https://perma.cc/7FCA-2PS9].

[297] Scott E. Hygnstrom & Kurt C. VerCauteren, *Cost-effectiveness of Five Burrow Fumigants for Managing Black-tailed Prairie Dogs*, 45(3-4) INT'L BIODETRIORATION & BIODEGRADATION 159 (2000); Gary W. Witmer & Kathleen A. Fagerstone, *The Use of Toxicants in Black-tailed Prairie Dog Management: An Overview*, PROC.10TH WILDLIFE DAMAGE MGMT. CONF. (2003).

> exposure, and die usually within 2 h (the range being 50 min to 3 h, depending on dose)."[298]

Such protracted suffering is unacceptable. Wildlife Services should therefore cease to use this method in its field operations.

E. **Wildlife Services Continues to Lack Transparency and Accountability**

Wildlife Services does not make available reliable, detailed information about its programs or activities to the public.[299] It has "stonewalled" when members of Congress have attempted to engage in legitimate oversight and the agency lacks promptness when responding to FOIA requests.[300] Transparency and accountability are key pillars of democratic governance and are required of Wildlife Services by statutory obligation through FOIA, NEPA, and other laws. For these reasons, petitioners are requesting that Wildlife Services enact procedures to ensure timely responses to FOIA requests and to make publicly available on its eLibrary records such as work plans and field reports, data on the number and species of animals killed, data on non-lethally affected animals, and all environmental review documents.[301]

According to former Wildlife Services agent Carter Niemeyer, the agency's continued use of indiscriminate lethal control methods persists due to a lack of transparency and accountability:

> During my career, it was decades of the same thing repeated to no effect . . . I think the word for this behavior is 'insanity.' But Wildlife Services has not changed, because their activities are under the public radar, and no one knows how to reform them.[302]

In 2006, Texas state director for Wildlife Services, Michael J. Bodenchuck, recommended against settling cases with people whose dogs had been killed by Wildlife Services cyanide bombs "because it is all too easy for someone to intentionally take a dog into an area posted with signs with the intention of getting the dog killed."[303] Perhaps recognizing the preposterousness and callousness of Bodenchuk's statement, Wildlife Services redacted the statement in its fulfillment of WildEarth Guardians' records request. EPA, however, rightfully

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[298] G. Mason & Kate Littin, *The Humaneness of Rodent Pest Control*, 12 ANIMAL WELFARE 1 (2003) (internal citations omitted).

[299] *See*, *e.g.*, USDA, OFFICE OF THE CHIEF INFORMATION OFFICER, CHIEF FREEDOM OF INFORMATION ACT (FOIA) OFFICER REPORT (2012).

[300] *See id.*; Cristina Corbin, *Lawmaker Accuses Federal Agency of 'Stonewalling' Attempts to Investigate Alleged Coyote Torture*, FOX NEWS (Dec. 23, 2015), https://www.foxnews.com/politics/lawmaker-accuses-federal-agency-of-stonewalling-attempts-to-investigate-alleged-coyote-torture [https://perma.cc/HP8N-T6S7].

[301] *See infra* IV.B.

[302] Ex. 23, Christopher Ketcham, *The Rogue Agency*, HARPER'S MAG., (Mar. 2016), https://harpers.org/archive/2016/03/the-rogue-agency/.

[303] Memorandum from Michael J. Bodenchuk, Utah State Director, USDA, APHIS, Wildlife Servs., to Barbara Knotz (June 21, 2006), available at https://www.predatordefense.org/docs/m44_memo_WS_Max_06-21-06.pdf [https://perma.cc/5Y8D-3QCD].

complied with the Freedom of Information Act, disclosing the statement and thus providing a clue into the lengths that Wildlife Services will go to avoid accountability.

In 2020, the Animal Legal Defense Fund filed a lawsuit against the USDA under the Freedom of Information Act over a lack of transparency in a contract between Wildlife Services and a Colorado slaughterhouse that outlines plans for slaughtering geese rounded up in parks across Denver.[304] Wildlife Services initially refused to reveal the number of birds expected to be killed as well as the price per slaughtered bird. In 2019 alone, more than 1,600 geese were rounded up and killed from city parks on Colorado's front range.[305]

Such transparency is especially important, seeing as Wildlife Services erroneously removed and euthanized eighty-six Canada geese in 2020 from Milburn Pond Park in Nassau County, New York, due to what the agency described as an "administrative error."[306] Four years earlier at the same location, Wildlife Services had illegally removed and euthanized 154 Canada geese, which the agency finally acknowledged after the June incident.[307]

As Richard Conniff noted in a New York Times editorial, taxpayers who shell out millions for the Wildlife Services' wildlife damage management operations "deserve transparency."[308] Instead, "the agency reveals little more than its annual body count, listing only the species, the number of dead and the method of killing."[309]

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[304] *See Lawsuit Challenges USDA Redaction of Geese Culling Contract*, ANIMAL LEGAL DEF. FUND (Nov. 23, 2020), https://aldf.org/article/lawsuit-challenges-usda-redaction-of-geese-culling-contract/ [https://perma.cc/2GH6-4H67].

[305] *See* Jessica Seaman, *1,882 Geese Killed in Denver's Now-completed Effort to Control Population in City's Parks* DENVER POST (July 11, 2019), https://www.denverpost.com/2019/07/11/denver-canada-goose-culling-ends/ [https://perma.cc/8Q5M-7CBL].

[306] Scott Eidler, *Feds Admit Error in Removing 86 Canada Geese*, NEWSDAY (Sep. 5, 2020), https://www.newsday.com/long-island/nassau/nassau-geese-c54228 [https://perma.cc/2KUL-KAU4].

[307] Scott Eidler, *Advocates Condemn Feds' Euthanizing of Baldwin Park Geese*, NEWSDAY (Sept. 9, 2020), https://www.newsday.com/long-island/nassau/canada-geese-euthanize-jfk-1.49135798 [https://perma.cc/GKW9-AST6].

[308] Richard Conniff, *America's Wildlife Body Count*, N.Y. TIMES OP. (Sept. 17, 2018). https://www.nytimes.com/2016/09/18/opinion/sunday/americas-wildlife-body-count.html [https://perma.cc/H453-K8BU].

[309] *Id.*

IV. **Petition for Rulemaking**

Wildlife Services manuals and directives set forth the official mission, philosophy and policies of the program.[310] They detail the program's "management philosophy" to "conserve and manage wildlife resources while being responsive to public desires, views, and attitudes" and engaging in "control" of "injurious wildlife" only after "careful assessments" of an identified problem and its resolution, in accordance with "biologically sound, environmentally safe, scientifically valid, and socially acceptable" methods that are designed to minimize risks to humans, wildlife, non-target animals, and the environment.[311] Although it has long been known that it does not do so in practice, Wildlife Services claims that when it does take control actions, "[p]reference is [to be] given to nonlethal methods when practical and effective."[312] The directives also require Wildlife Services to maintain accurate, relevant, and reliable records about program activities, and to make this information readily available to the public.[313] Wildlife Services must also set forth the terms of its engagement on behalf of other Federal agencies, state agencies, and private parties in Memoranda of Understanding and cooperative agreements, and is to administer its cooperative agreements in an open and transparent manner.[314]

Yet, it is plainly evident that these pronouncements do not ensure that Wildlife Services is transparent and in compliance with the law or consistent with prevailing American values. Many key aspects of the program—including standards to ensure program transparency and reliability of information, definitions of key terms, standardized procedures for cooperator agreements, or procedures that fill in the gaps in the regulatory schemes and ensure strict adherence to the requirements of federal environmental laws—lack any policy directives at all. Policy directives that do exist are frequently ignored or circumvented by Wildlife Services, or

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[310] *See* USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 1.101, THE WILDLIFE SERVICES (WS) POLICY MANUAL (June 20, 2013), https://www.aphis.usda.gov/wildlife_damage/directives/pdf/1.101.pdf [https://perma.cc/G37X-D6WG]; *see also* USDA, WILDLIFE SERVICES, PARTNERSHIPS AND PROGRESS 1 (Aug. 2009), https://www.aphis.usda.gov/wildlife_damage/downloads/partnerships%20in%20progress.pdf [https://perma.cc/6F94-JMZ8] (noting that "[w]hile WS' authorizing legislation continues to be the base of its authority, it is the program's policy directives that guide WS personnel daily in responding to requests for assistance.").

[311] USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 1.201, MISSION AND PHILOSOPHY OF THE WS PROGRAM (July 20, 2009), https://www.aphis.usda.gov/wildlife_damage/directives/pdf/1.201.pdf [https://perma.cc/YAY7-ZSEP].

[312] USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 2.101, SELECTING WILDLIFE DAMAGE MANAGEMENT METHODS (July 20, 2009). Despite this, it has been plainly evident that Wildlife Services emphasizes the use of lethal control methods over non-lethal methods. *See* U.S. GOV'T ACCOUNTABILITY OFF., GAO/RCED-96-3, ANIMAL DAMAGE CONTROL PROGRAM: EFFORTS TO PROTECT LIVESTOCK FROM PREDATORS 3 (1995) ("in practice, the role of nonlethal methods in the program's efforts to control livestock predators differs from that indicated by the guidance" and "field personnel rarely use nonlethal methods when controlling livestock predators"); *see also* Ex. 7, Bergstrom et al., *License to Kill* ("there is no downward trend in lethal control, despite GAO (1995) admonishments").

[313] USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 156.1, FREEDOM OF INFORMATION ACT/PRIVACY ACT GUIDELINES § VII (Oct. 19, 1982) (recognizing that FOIA "is a disclosure statute designed to allow easeaccess to documents held by the administrative agencies of the executive branch of the Federal Government" and that "[e]ach Agency has the responsibility to expedite all releasable information as prescribed by the FOIA").

[314] USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 4.135, REQUESTS FOR INFORMATION (Oct. 7, 2005).

merely supplanted by APHIS on occasion, evading the rigorous requirements of the APA including required public notice and opportunities for public comment.[315]

As Wildlife Services has never promulgated substantive regulations codified in the Code of Federal Regulations in accordance with the APA, Petitioners, other interested persons, and the general public have never been afforded an opportunity to properly engage with Wildlife Services' decision-making process in order to ensure that Wildlife Services maintains and adheres to a clear, consistent regulatory scheme that, in turn, ensures that the program is fully transparent and accountable to the public.

A. **Petition to APHIS to Conduct a Formal Rulemaking Under the Administrative Procedure Act to Establish a Regulatory Scheme for the Wildlife Services Program**

Petitioners formally petition USDA and APHIS pursuant to APA § 553(e) and 7 C.F.R. § 1.28, for issuance of new rules and amendment of certain existing rules that govern the Wildlife Services program. USDA and APHIS have legal authority to conduct such a rulemaking,[316] and promulgation of rules is necessary to fill the gaps in the statutory scheme.

The Animal Damage Control Act (ADCA) is the primary statutory authority for the Wildlife Services program.[317] The ADCA was enacted in 1931 to authorize the Bureau of Biological Survey to investigate, experiment, test, determine, demonstrate, and promulgate methods of eradicating, suppressing, or bringing under control mountain lions, wolves, coyotes, bobcats, prairie dogs, gophers, ground squirrels, jack rabbits, and other so-called "injurious" animals.[318] In 1986, administration of the Act was passed from the Secretary of the Interior to the Secretary of Agriculture.[319] An amendment passed in 2000 gave broad authority to the Secretary of Agriculture to control "injurious species"in accordance with agency policies but removed eradication as a goal of the law.[320]

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[315] For example, in July 2013, Wildlife Services quietly replaced its policy directive entitled "Reporting." *See* USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 4.205.1, DATA AND ACTIVITY REPORTING (July 2, 2013). This change was likely in response to the Jamie Olson incident (in which a Wildlife Services employee posted photographs online of his dogs attacking and killing coyotes in leg-hold traps)—which generated public outcry, multiple investigative articles, calls for an investigation by members of Congress, and a petition to terminate Mr. Olson's employment with Wildlife Services on Change.org from Project Coyote. The July 2013 directives includes new requirements, such as that all agency personnel must report all "critical issues or potential problems" "immediately to their supervisor for further action as appropriate." *Id.* at 3. This includes "situations, occurrences, and media events" which "may . . . [r]esult in publicity, substantial/national media and public inquiries, or Congressional inquiries, or . . . [a]ffect WS' relationship with other agencies, States, or cooperators." *Id.* Hence, as this was simply a policy directive, the public was never notified of the revisions or invited to comment (for example, to urge APHIS to prioritize termination of employees who carry out such activities rather than to facilitate program's ability to minimize or control public scrutiny of such incidents).

[316] *See* 7 U.S.C. §§ 426-426c.

[317] *Id.*

[318] *See id.*; 1997 Programmatic FEIS, *supra* note 11, at 1-13.

[319] *Id.*

[320] *Id.*

Wildlife Services is required to comply with many additional federal legal authorities as well.[321] These include laws and policies that:

1. Require access to program records, public participation, transparency, and reliable information, including the Freedom of Information Act, 5 U.S.C. § 552, *as amended*; National Environmental Policy Act, 42 U.S.C. § 4321-4370h, 40 C.F.R. Parts 1500-1508, and the Data Quality Act, Public Law 106–554; H.R. 5658;

2. Protect biodiversity and wildlife, including the Endangered Species Act, 16 U.S.C. §§ 1531-1544, *as amended* ("ESA"), the Bald and Golden Eagle Protection Act, 16 U.S.C. §§ 668-668d, *as amended* ("BGEPA"), the Migratory Bird Treaty Act of 1918, 16 U.S.C. §§ 703-711 ("MBTA"), the Fish and Wildlife Act of 1956, 16 U.S.C. § 742j-l; and the Wilderness Act of 1964, 16 U.S.C. §§ 1131-1136, and

3. Protect public health, including the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. §§ 135-136y, *as amended* ("FIFRA").

In addition to these authorities, Executive Order No. 13112 (Feb. 3, 1999) directs all federal agencies to use their programs and authorities to: "prevent the introduction of invasive species," "detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner," "monitor invasive species populations accurately and reliably," and "conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species."

Wildlife Services maintains a set of Program Directives and Policy Directives that are designed to fill the gaps in the regulatory scheme, and to specify the relevant statutory requirements. On their face, these directives value and emphasize transparency, wildlife conservation, and minimal, direct control only when necessary and according to methods that are humane and socially acceptable.[322]

However, APHIS has never promulgated regulations under the APA to codify any policies and authorities in a regulatory scheme that will ensure program consistency with all applicable authorities. Indeed, Wildlife Services has consistently failed to abide by its own policy

[321] USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 1.210, LEGAL AUTHORITY (Sep. 19, 2003) [hereinafter "Wildlife Services Directive 1.210"]; *see also* WILDLIFE SERVICES DIRECTIVE 2.210, COMPLIANCE WITH FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS (Oct. 27, 2009) ("[a]ll employees . . . are responsible for conducting official duties in compliance with all Federal laws" and "[s]upervisors shall ensure that all employees are aware oflaws applicable to their official duties").

[322] *See* PARTNERSHIPS AND PROGRESS, *supra* note 310, at 1 ("While WS' authorizing legislation continues to be the base of its authority, it is the program's *policy directives* that guide WS personnel daily in responding to requests for assistance.") (emphasis in original); WILDLIFE SERVICES DIRECTIVE 1.201, *supra* note 311; USDA, APHIS DIRECTIVE 1530.1, OTHER GOVERNMENT AGENCY AND NON FEDERAL REVIEWS OF APHIS (Mar. 23, 1993); WILDLIFE SERVICES DIRECTIVE 156.1, *supra* note 313, at §VII (FOIA "is a disclosure statute designed to allow eas[y] access to documents held by the administrative agencies of the executive branch of the Federal Government" and "[e]ach Agency has the responsibility to expedite all releasable information as prescribed by the FOIA"). That said, Petitioners do not suggest here that the existing policy directives cannot not be substantially improved in certain, key respects—such as no longer engaging in ongoing predator control without any "end point." USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 2.201, DECISION MODEL (July 21, 2008).

directives.[323] Accordingly, these policy directives simply underscore the existence of gaps in the statutory scheme that governs the program, and the corresponding need for binding regulations promulgated through a substantive rulemaking under the APA, including with notice and an opportunity for public comment. Therefore, Petitioners formally request that APHIS undertake a substantive rulemaking pursuant to the APA in order to fill the gaps in the existing statutory scheme. Such rules must include:

1. Procedures to ensure program transparency, such as rules specifying the information, documentation, data, and records that will be maintained by program personnel and routinely provided to the public;

2. Criteria for the selection of specific control methods and the circumstances in which they may be utilized, inclusive of the broader public interest, with an emphasis on highly-selective, non-lethal, non-toxic, and non-capture methods, and with the goals of phasing out lethal methods and prophylactic control and of species and ecosystems;

3. Criteria setting forth and requiring a documented correlation between specific wildlife problems that warrant a response by Wildlife Services as well as the appropriate methods that may be employed by program personnel, with an emphasis on and exhaustion of non-lethal measures in each situation;

4. Measures to ensure that "non-target" animals are not harmed or killed;

5. Rules to ensure that all animals affected by the program are treated humanely and that agency personnel who commit acts of animal cruelty are subject to disciplinary action and/or employment termination;

6. Criteria that govern the selection of cooperators, the temporal scope for cooperator status, and cooperator agreements, the circumstances necessitating their modification or revocation, and public participation and disclosure requirements for determinations of cooperator status and cooperator agreements; and

7. Procedures that ensure strict adherence to the requirements of federal natural resources and environmental laws, including rules to clarify the type and frequency of environmental reviews of program work plans.

While Wildlife Services claimed in its Denial of the 2013 Petition that it could not issue rules because neither of the enabling statues "specifically provide for the legal authority to promulgate regulations,"[324] courts have repeatedly acknowledged that rulemaking authority may be implied.[325] Importantly, when Congress creates a program and funds an agency to administer the program, the courts presume that the funded agency will necessarily engage in the

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[323] *See infra* IV.B.

[324] Ex. 3, Denial, at 2.

[325] *See, e.g.*, *United States v. Mead Corp.,* 533 U.S. 218, 229 (2001); *Chevron, U.S.A., Inc. v. Nat. Res. Def. Council,* 467 U.S. 837, 844 (1984).

"formulation of policy and the making of rules to fill any gap left, implicitly or explicitly[] by Congress."[326]

Wildlife Services' statutory authority to conduct its wildlife damage management program derives from the Act of March 2, 1931, which grants to the Secretary of Agriculture the authority to "take any action . . . necessary" to "conduct a program of wildlife services with respect to injurious animal species."[327] This authority falls within the language federal courts have interpreted to grant rulemaking powers.[328] It is well established that a proper delegation of rulemaking authority does not need to explicitly use the words "rule" or "rulemaking," rather, courts have acknowledged that the "power of an administrative agency to administer a congressionally created and funded program necessarily" comes with a general grant of rulemaking authority to carry out its mandated functions.[329] Furthermore, the APA contains the authority for agencies to promulgate rules for "all agency action that falls within the statutory definition of rulemaking," which in the context of Wildlife Services' wildlife damage management program means any prescription for future services practices.[330] Thus, Wildlife Services' clearly has the statutory authority to engage in rulemaking in furtherance of its authority to control "injurious" species.

Nearly sixty years ago, a report by the Special Advisory Board on Wildlife Management authored by A. S. Leopold and others (the "Leopold Report") cited the "need for explicit criteria to guide control decisions [in federal wildlife management practices], something that we find sadly lacking at present."[331] The Leopold Report emphasized that "[u]nder properly enforced *regulations* and constraints the team of trained professional hunters can certainly achieve control with maximum efficiency and potentially with minimum damage to other values."[332]

The fact that Wildlife Services has never promulgated rules before does not justify its refusal to do so now. Rather, the same issues that plagued the program at the time of the Leopold

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326 *Morton*, 415 U.S. at 231.

327 7 U.S.C. §§ 8351-52.

328 *See In re Permanent Surface Mining*, 653 F.2d at 523-24 (upholding general grant of rulemaking authority to "publish and promulgate such rules and regulations as may be necessary to carry out the purposes and provisions of this Act"); *Citizens to Save Spencer Cnty.*, 600 F.2d at 873 (upholding general grant of rulemaking authority "to prescribe such regulations as are necessary to carry out his functions under [the Act]"); *see also Wyoming v. U.S. Dep't of the Interior*, 493 F. Supp. 3d 1046, 1063 (applying general grant of rulemaking authority for any action "necessary to carry out" other provisions of the statute); *Chamber of Com. of U.S. v. Nat'l Lab. Rels. Bd.*, 856 F. Supp. 2d 778, 787-88 (D.S.C. 2012) (same).

329 *Morton*, 415 U.S. at 231 (1974); *see also Five Flags Pipe Line Co. v. U.S. Dep't of Transp.*, No. CIV A 89-0119 JGP, 1992 WL 78773, at *3 (D.D.C. Apr. 1, 1992) (holding that "the failure of Congress to use the words 'rule' or 'rulemaking'" is not dispositive as to whether rulemaking authority has been delegated).

330 5 U.S.C. § 551(c).

331 A. S. LEOPOLD ET AL., USDA NAT'L PARKS SERV., WILDLIFE MANAGEMENT IN THE NATIONAL PARKS (1963) [hereinafter "Leopold Report"].

332 *Id.*

Report have only grown more pronounced, making the need for regulations even more necessary. As the Cain Report aptly noted, "[g]uidelines and good intentions," will not suffice.[333]

Accordingly, Petitioners request promulgation of rules to govern the Wildlife Services program, including rules to ensure legal compliance, as explained below.

B. Substantive Rules Must Ensure that the Program Meets and is Consistent with all Relevant Policies and Legal Authorities, and Should Codify and Make Binding Several Existing Wildlife Services Policy Directives.

Rulemaking must ensure strict compliance with all relevant legal authorities and national policiesthat guide the program. Specifically, rules must ensure: (1) transparency and reliability; (2) an emphasis on non-lethal methods; (3) the humane treatment of animals; and (4) strict adherence to all relevant procedural and substantive legal requirements. In the absence of such a regulatory scheme, the program will continue to render itself out of step with societal values.

1. Rules Must Ensure that All Program Activities are Fully and Accurately Documented and Disclosed to the Public

In its regular course of activities, Wildlife Services does not make available to the public basic information or records regarding its activities, only broad summaries.[334] The program does not document specific requests of the service or any efforts to emphasize non-lethal control methods. Its field reports and work plans and monetary expenditures are obscure, inconsistent, and difficult to obtain.

Wildlife Services does not post its work plans or many environmental reviews—which were prepared to satisfy NEPA and/or the ESA many years ago—on its website.[335] Even when it makes completed NEPA documents available, many are heavily redacted.[336] Other programmatic environmental reviews are not easily accessible. Nor are agency handbooks, policy statements, guidance manuals, or best practices manuals. Many such documents must be requested under the Freedom of Information Act ("FOIA"), but APHIS does not necessarily respond to FOIA

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[333] Cain Report (1971), *supra* note 145, at 2.

[334] *See* USDA, APHIS, Wildlife Services' 2020 Program Data Report, https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_reports/sa_pdrs/PDR-Home-2020 [https://perma.cc/R8GB-P7P8] (providing only summary data regarding resources and agency expenditures and omitting information or records about non-target mortalities and harm such as geographic areas of operation, results from monitoring to assess program efficacy, adverse effects incident reports or summaries, cooperative service agreements; cooperative agreements; interagency agreements; material transfer agreements, confidentiality agreements; memoranda of understanding; all WS-related environmental reviews under NEPA, the ESA, or other laws).

[335] *See, e.g.*, *Wildlife Services – National Environmental Policy Act (NEPA) Documents*, USDA APHIS, https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa (making available only recent environmental assessments and other NEPA documents available); *see also FOIA Reading Room*, USDA APHIS, https://www.aphis.usda.gov/aphis/resources/foia/CT_FOIA_reading_room ("APHIS maintains an electronic reading room only.").

[336] *See* USDA, APHIS, WILDLIFE SERVS., FINAL ENVIRONMENTAL ASSESSMENT: PREDATOR DAMAGE MANAGEMENT ON FEDERAL PUBLIC LANDS IN ARIZONA (Nov. 1998).

requests in a timely manner.[337] On multiple occasions since the 2013 Petition, nonprofit organizations have not received responses from Wildlife Services to their FOIA requests, forcing those organizations to file suit to compel Wildlife Services to comply with the Act.[338] Members of the news media are not permitted to observe agency personnel in the field.[339]

Wildlife Services' lack of transparency and accountability extends even to its interactions with other wildlife agencies. Doug McKenna, who retired in 2012 after twenty-five years as a wildlife-crimes enforcement officer at FWS, described Wildlife Services' refusal to assist in the investigation of a man who had been poisoning bald eagles because Wildlife Services viewed the man as a "client":

> We went to Wildlife Services and asked them for help with the investigation. The trappers told us, 'We can't talk to you because this guy is a client of ours.' I was shocked. We're a federal agency asking another federal agency for help in a criminal investigation, and we were stonewalled. We eventually prosecuted the rancher, and his federal grazing lease was revoked, but we got no help from Wildlife Services.[340]

In its denial of the 2013 Petition, Wildlife Services claimed that it "carefully considers method selection and conducts programs to avoid nontarget animals" such that "[a] combination of these non-lethal methods and selective removal of species allows WS to effectively reduce while minimizing impact on nontarget species."[341] Yet, for decades, the program has continued to mistakenly kill a "great many" animals "as innocent victims of the control operation."[342] Indeed, the extensive list of non-target animals that are indiscriminately killed and maimed by Wildlife Services personnel includes Mexican wolves, bald and golden eagles, San Joaquin kit foxes, swift foxes, Hawaiian ducks and geese, scores of migratory birds that are protected under

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[337] Rob Davis, *Congresswoman Pushes for Transparency from Secretive Agency: The Wildlife Killers*, VOICE OF SAN DIEGO (Aug. 2, 2012), https://voiceofsandiego.org/2012/08/02/congresswoman-pushes-for-transparency-from-secretive-agency-the-wildlife-killers/ [https://perma.cc/M5VE-S737] (reporting that Wildlife Services "hasn't promptly released numerous public documents about the animals it's killed [in San Diego]"); Ex. 25, Memorandum from Administrator Kevin Shea & Deputy Administrator William H. Clay, Wildlife Services to APHIS Management Team & Program Leaders Group (June 19, 2009) [hereinafter "Shea and Clay Memorandum"] ("we still have much work ahead of us" to reduce the "FOIA backlog").

[338] *See* Complaint, W. Watersheds Project v. USDA-APHIS Wildlife Services (D. Idaho 2018) (No. 1:18-cv-335); Complaint, WildEarth Guardians v. USDA APHIS (D.D.C. 2017) (No. 1:17-cv-01153); Complaint, W. Watersheds Project v. USDA-APHIS Wildlife Services (D. Idaho 2015) (No. 1:15-cv-219); *Challenging USDA Redaction of Geese Culling Contract*, ANIMAL LEGAL DEF. FUND (Nov. 23, 2020), https://aldf.org/case/challenging-usda-redaction-of-geese-culling-contract/ [https://perma.cc/7ADN-T9JX].

[339] Knudson, *The Killing Agency*, *supra* note 214 (noting that "[e]ven the military allows reporters into the field"); *see also* Davis, *supra* note 337 (reporting that Wildlife Services "doesn't allow reporters to watch its trappers in action and it hasn't promptly released numerous public documents about the animals it's killed [in San Diego], despite a formal requestwe filed under [FOIA]" and "[w]hen I asked for a database of kills it maintains, two of its employees laughed out loud at my request").

[340] Ex. 23, Ketcham, *The Rogue Agency*.

[341] Ex. 3, Denial, at 5.

[342] Leopold Report, *supra* note 331, at 8; *see* Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

the MBTA, as well as coyotes, river otters, black bears, beavers, porcupines, mountain lions, wolves, pronghorn antelopes, mule deer, badgers, white-fronted geese, great blue herons, wild turkeys, hog-nosed skunks, black-tailed jack rabbits, and dogs.[343] Public records from Idaho have further revealed that in "some years the number of nontarget animals caught [in wolf traps] is similar to, or even exceeds, the number of wolves trapped" as part of the wolf hunting program in the state.[344] The non-target impacts of Wildlife Services' activities extend to domestic pets as well, which become injured and/or die horrible deaths in Wildlife Services'traps or from ingesting the program's poisons.[345]

Former agency trappers acknowledge that much of this non-target catch goes unreported.[346]Animal carcasses are "usually tossed behind a bush or into a ravine."[347]As one former program trapper characterized the status quo, "[t]he field guys do not report even a fraction of the non-target animals they catch."[348] A 2012 *Sacramento Bee* investigative series about the program documented 7,800 accidental killings of 85 non-target wildlife species from

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[343] *See* Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

[344] Ex. 11, Kareiva et al., at 4.

[345] *See* Knudson, *The Killing Agency*, *supra* note 214 (personal account of the day her German Shepherd was lured to a Wildlife Services-set M-44 cyanide trap set on public lands, where no warning signs were posted, as follows: "I kneeled at the top of his head, bending over him, crying and trying to figure out what happened to him. I remember crying out '1 don't understand, I don't understand' as I looked at his mouth. Hismouth had a pinkish/salmonish colored foam coming from it.") (citing Letter from Sharyn Aguiar to Joy Schnackenbeck, EPA (Sep. 14, 2007)); *see also* Letter from A. Wood Kingsley to Whom it May Concern (Nov. 15, 2003) (thanking Predator Defense for helping to pursue answers in connection with the death of family dog by cyanide gas from a trap set on Ms. Wood Kingsley's family farm in the Willamette Valley); Affidavit of Paul Wright (Sep. 19, 2001) (describing death of family dog from M-44 placed by Wildlife Services on neighbor's property); Tom Knudson, *M-44s Lure Animals with Smelly Bait, Kill with Cyanide*, SACRAMENTO BEE (Apr. 30, 2012) ("On that windy afternoon in Utah in 2006, Max joined the ranks of thousands of non- target animals – wild and domestic – that have been mistakenly killed by one of the most lethal tools in Wildlife Services' arsenal: spring-loaded metal cylinders that are baited with scent and fire sodium cyanide powder into the mouth of whatever tugs on them."); *id*. (noting that Ms. Aguiar's claim for $1,500 compensation from Wildlife Services for Max's death was rejected); Tom Knudson, *Efforts to Investigate Wildlife Services' Methods Continue*, SACRAMENTO BEE (June 25, 2012) (describing death of a family dog in Texas from M-44 cyanide trap: "It was a horrible thing. She had thrown up. You could tell it had been a horrible death. Itwas really, really heart-wrenching."). Members of the petitioning organizations have had their companion animals harmed, maimed, and killed by traps set by Wildlife Services, and/or avoid areas that they would otherwise frequent because of the risk to their companion pets.

[346] U.S. FISH AND WILDLIFE SERV., LAW ENFORCEMENT REPORT (Dec. 29, 2003) (describing illegal, unreported killing of a golden eagle in a steel-jaw leghold trap set by Wildlife Services in the Henry Mountains in Utah, and subsequent shooting); WILDLIFE SERVS., MIS LEGACY REPORT (Mar. 4, 2005) (reporting necksnaring and killing of golden eagle on BLM lands in Lincoln County, Nevada in 2005); Knudson, *Neck Snare*, *supra* note 18 (former Wildlife Services trapper Gary Strader stating that "[t]he field guys do not report even a fraction of the non- target animals they catch.").

[347] Knudson, *Neck Snare*, *supra* note 18 (quoting Dick Randall); *id*. (account of Wildlife Services manager stating: "We really don't have to tell anybody what we're doing."); *see also* Knudson, *The Killing Agency*, *supra* note 214 (relating case in which federally-protected golden eagle was caught in a Wildlife Services strangling neck snare, and supervisor directedagency trapper to "go get a shovel and bury it and don't say nothing to anybody").

[348] Knudson, *Neck Snare*, *supra* note 18 (quoting former agency trapper).

steel body-grip trapssince 2006, reflecting an accuracy rate of only five percent.[349] These details are only known today because *Sacramento Bee* reporter Tom Knudson conducted extensive investigative reporting, sent multiple FOIA requests, and interviewed experts, pet owners, and former agency employees.[350]

Indeed, Wildlife Services' own reported data is unreliable. It is incomplete and does not account for substantial numbers of unreported catch and/or non-target catch, nor does it account for animals that are injured or maimed from program activities.[351]

There are, in addition, many aspects of the program for which the agency does not provide reported data at all—for instance, the agency does not specifically correlate its control actions with instances of injurious wildlife, the cooperators on whose behalf control actions were carried out, or the geographic areas where control actions occurred. Nor does the agency maintain data about how many animals are injured but not necessarily killed—as portrayed by a former agency trapper Gary Strader:

> Some of the gunners are real good and kill coyotes every time. And other ones wound more than they kill. Who wants to see an animal get crippled and run around with its leg blown off? I saw that a lot.[352]

APHIS refuses to provide specific details about the cooperators on whose behalf the program kills so many animals.[353] It is unclear whether the agency even records such data.[354]

Wildlife Services stated in its denial of the 2013 Petition that it "does not agree with Petitioners that the existing statutory and regulatory scheme governing cooperative service

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[349] *See* Knudson, *The Killing Agency*, *supra* note 214; *see also Body Grips Often Snag Non-target Animals*, HERALD & NEWS (May 19, 2012), https://www.heraldandnews.com/members/bonus_content/body-grips-often-snag-non-target-animals/article_de8cbb26-a232-11e1-8504-001a4bcf887a.html [https://perma.cc/465G-H7HG].

[350] *See* Knudson, *The Killing Agency*, *supra* note 214.

[351] *See supra* note 346.

[352] Tom Knudson, *Wildlife Services' Deadly Force Opens Pandora's Box of Environmental Problems*, SACRAMENTO BEE (Apr. 30, 2012).

[353] Tom Knudson, *Wildlife Services Meets With its Critics*, SACRAMENTO BEE (July 19, 2012) (describing exchange during public meeting to address program critics, during which agency officials stated that it is official agency policy not to inform the public who its cooperators are or what they contribute to the program); *see also* WILDLIFE SERVS., SELECTED ADVANCE QUESTIONS FROM AMERICAN SOCIETY OF MAMMOLOGISTS IN PREPARATION FOR FORUM WITH APHIS OFFICIAL ON WILDLIFE SERVICES (WS) (June 2012) (noting that the program does not maintain information about the proportion of its expenditures go toward non-lethal versus lethal control methods, cooperator types (including public versus private cooperators), or updated information aboutthe cost versus the benefits of its activities).

[354] For instance, the agency stated that it cannot provide information about how much it spends on aerial gunning of coyotes and wolves. Katherine McGill, *Wildlife Services Exterminates Over 4.1 Million Animals in 2009*, EXAM'R (Oct. 12, 2010). The agency claims that it "does not have a managerial need" for basic facts. *Id.*; *see also* WILDLIFE SERVS., SELECTED ADVANCE QUESTIONS, *supra* note 353 (noting that the program does not know the proportion of its expenditures that go toward non-lethal versus lethal control methods, cooperator types (including public versus private cooperators), or updated information about the cost versus the benefits of its activities).

agreements and work plans is insufficient to govern its agreements."[355] However, the program itself has admitted problems with its cooperative agreements, such as in 2005, when APHIS identified many problems with the program's cooperative agreement process.[356] The final report of the agency's "Cooperative Agreements Process Improvement Team," known as the CAPIT Report, found that the cooperative agreement process had become decentralized "due to [an] increase in cooperative agreements," and that communication, guidance, and follow up have not kept pace."[357]

The CAPIT Report also found APHIS's processing of cooperative agreements to be internally inconsistent, with differences in planning, information sharing, communication, and paperwork as well as in how "working relationships are developed and how finances and results are monitored and reported."[358] The CAPIT Report concluded that cooperative agreements should be retained "as an approach to achieving program objectives and agency goals," but that the cooperative agreement process should be standardized, streamlined, and simplified, with a consistent message regarding expectations and practices and improved follow up.[359] In other words, Wildlife Services has itself acknowledged that something akin to regulations should be implemented to improve and standardize cooperative agreements.

It is likewise unknown whether Wildlife Services possesses all permits and licenses that are necessary to carry out Wildlife Services activities consistent with the ESA, BGEPA, MBTA, FIFRA, and other authorities. Wildlife Services does not make such permits or any required records easily available to the public or even notify the public or interested persons of its intent to pursue such permits and licenses from FWS or EPA.[360]

Members of Congress have repeatedly demanded program transparency. In 2015, Representative Susan Davis (D-CA-53) reintroduced H.R. 2236, the Transparency for Lethal Control Act.[361] During Rep. Davis' introductory remarks to the House of Representatives when reintroducing the bill in 2013, she called for Wildlife Services to publish "clear and accessible information."[362] Rep. Davis noted that the public and Congress "need to have the opportunity for vigorous oversight" and that "[t]his lack of transparency and public reporting makes oversight

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[355] Ex. 3, Denial, at 13.

[356] USDA, APHIS, COOPERATIVE AGREEMENTS PROCESS IMPROVEMENT TEAM FINAL REPORT 1-2 (2005) [hereinafter "CAPIT Report"].

[357] *Id.* at 1.

[358] *Id.*

[359] *Id.* at 2-3.

[360] Wildlife Services has a track record of not being transparent with the public regarding methods of killing wild animals. *See, e.g.*, Complaint, Friends of Animals v. Lowney et al, No. 1:2019cv02110 (2019) (detailing Wildlife Services' lack of transparency about the method of slaughter of geese in Denver, Colorado and distribution of slaughtered deer for human consumption).

[361] Transparency for Lethal Control Act, H.R. 2236, 114th Cong. (2015).

[362] Introducing Transparency for Lethal Control Act, H.R. 2074, 112th Congress (Aug. 2, 2012) (statement of Rep. Davis).

impossible," as "USDA could be acting inappropriately or recklessly and without this data, we can't know."[363]

Representative John B. Campbell (R-CA-45) also criticized APHIS for thwarting attempts to investigate Wildlife Services. Rep. Campbell stated, "[t]hey appear to be stonewalling every attempt by everybody to investigate why they're doing it."[364] In advocating for elimination of the lethal predator control program, Congressman DeFazio remarked that it is "ineffective, indiscriminate, inhumane . . . [and] it's incredibly important that we bring the actions of this agency out of the shadows."[365] Rep. DeFazio has also remarked, "I've served on the Homeland Security Committee, and Wildlife Services is more difficult to get information from than our intelligence agencies."[366]

Indeed, the absence of basic information about its activities stands in stark contrast with Wildlife Services' avowed commitment to "openness and transparency" and to making information readily available to the public.[367] It is also inconsistent with FOIA and NEPA—laws that require Wildlife Services to be transparent.

FOIA's "core purpose" is to allow the public to be informed about "what their government is up to."[368] FOIA requires every agency to proactively "make available for public inspection and copying" "statements of policy and interpretations" that are not published in the Federal Register, "administrative staff manuals and instructions to staff that affect members of the public[,]" and "copies of all records, regardless of form or format" as well as a "general index"of all records "which have been released to any person" that "have become or are likely to become the subject of subsequent requests for substantially the same records[.]"[369]

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363 *Id.* In introducing the legislation, Congresswoman Davis also stated that that "efforts to gather adequate information regarding Wildlife Services operations have been difficult" and criticized Wildlife Services for not making detailed data regarding "where, why, how and which animals have been killed." *Id*.

364 Corbin, *supra* note 300.

365 *Id.*

366 Ex. 23, Ketcham, *The Rogue Agency*.

367 *See* Ex. 25, Shea and Clay Memorandum (characterizing President Obama's FOIA Memorandum as a "tallorder" and stating that "we still have much work ahead of us" to reduce the "FOIA backlog" and "to operate in an exceedingly open, transparent, and accessible way for all the customers and stakeholders we serve"); *FOIA Reading Room*, *supra* note 335 (stating that under FOIA, APHIS must make available, among other records, "statements of policy and interpretations adopted by the agency").

368 *U.S. Dep't of Just. v. Reporters Comm. for Freedom of the Press*, 489 U.S. 749, 772-73 (1989); *see also Dep't of Air Force v. Rose*, 425 U.S. 352, 361 (1976) (Congress enacted FOIA to "open agency action to the light of public scrutiny") (quotation omitted).

369 5 U.S.C. § 552(a)(2).

NEPA, one of the nation's preeminent environmental protection statutes, mandates federal transparency as well.[370] NEPA is, in part, a disclosure statute.[371] It requires all agencies, for every action that they propose to undertake that will significantly affect the quality of the human environment, to prepare a "detailed statement" on the environmental impact of the proposed action and its adverse and unavoidable environmental effects, in order to inform the public and decisionmakers about the environmental consequences of federal actions before it is too late to reverse those consequences.[372] In a 1993 report, the Council on Environmental Quality ("CEQ") recommended that all federal agencies"[a]cknowledge the conservation of biodiversity as national policy and incorporate its consideration in the NEPA process."[373]

Additionally, the Data Quality Act was enacted in 2005 to "ensur[e] and maximize[e] the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies."[374]

Guidelines issued by the Office of Management and Budget ("OMB") urge agencies to "issue guidelines" to meet these objectives.[375] OMB updated the guidelines on February 22, 2002 and March 4, 2002.[376] Pursuant to these guidelines, USDA has issued "information quality guidelines" that "apply to all types of information disseminated by USDA agencies and offices," specifying that these agencies and offices will set a "basic standard of quality" for information

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[370] 42 U.S.C. § 4331(a) (declaring as the "continuing policy of the Federal Government" "to use practicable means and measures . . . to create and maintain conditions under which man and nature can exist in productive harmony").

[371] "The purpose and function of NEPA is satisfied if . . . the public has been informed regarding the decision-making process." 40 C.F.R. § 1500.1(a). Environmental assessments prepared under NEPA are explicitly defined as "public document[s]." *Id.* § 1508.1(h). Furthermore, NEPA requires that "the underlying environmental data relied upon to support the expert conclusions *must be made available to the public*." *Pac. Coast Fed'n of Fishermen's Ass'ns v. U.S. Dep't of the Interior*, 929 F. Supp. 2d 1039, 1056 (E.D. Cal. 2013) (emphasis added) (citing *Klamath–Siskiyou Wildlands v. Bureau of Land Mgmt.*, 387 F.3d 989, 993-96 (9th Cir. 2004)); *see also Nat. Res. Def. Council v. U.S. Army Corps of Eng'rs*, 457 F. Supp. 2d 198, 218 (S.D.N.Y. 2006).

[372] 42 U.S.C. § 4332(c).

[373] COUNCIL ON ENV'T. QUALITY, INCORPORATING BIODIVERSITY CONSIDERATIONS INTO ENVIRONMENTAL IMPACT ANALYSIS UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT 23 (1993).

[374] Treasury and General Government Appropriations Act for Fiscal Year 2001 § 515, Pub. L. No. 106-554, 114 Stat. 2763.

[375] Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Republication, 67 Fed. Reg. 8451 (Feb. 22, 2002).

[376] Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, 67 Fed. Reg. 9797 (Mar. 4, 2002); Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, 67 Fed. Reg. at 8451; Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, 66 Fed. Reg. 49718 (Sep. 28, 2001). OMB also issued supplementary guidance that discussed important issues, identified noteworthy approaches for consideration, and provided guidance on those provisions that need to be adopted uniformly in all agency guidelines. *See* Memorandum from John D. Graham for the President's Management Council, Agency Final Information Quality Guidelines (Sep. 5, 2002); Memorandum from John D. Graham for the President's Management Council, Agency Draft Information Quality Guidelines (June 10, 2002).

they disseminate and ensure the information meets this standard, and that such information will be accurate, reliable, unbiased, useful, and transparent.[377]

In contrast to these mandates, as explained above, Wildlife Services does not currently make available reliable, detailed information about its activities or programmatic environmental reviews, or disclose records promptly when requested under FOIA.[378] This is a deviation from the approach taken by other agencies that publish FOIA procedures and processes.[379] Therefore, when completing a substantive rulemaking pursuant to the APA, APHIS must promulgate binding rules to clarify the categories of information that it will making readily available to the public on its website. Moreover, the service should clarify where such information will be provided to the public, such as on the agency's eLibrary website. Accordingly, Petitioners request that USDA and APHIS amend the FOIA implementing regulations at 7 C.F.R. Part 1 in order to maintain and routinely make available, on the agency's "eLibrary," the following categories of agency records:

1. All information regarding its practices and activities, including work plans[380] and field reports that document non-lethal controls attempted or used prior to lethal methods being deployed;

2. Complete, accurate data regarding the numbers and species of animals killed, maimed, andinjured on a periodic basis;

3. Data reflecting all non-lethally affected animals, both wild and domestic, as well as geographic areas where it conducts activities and all species located within those geographic areas;

4. All environmental reviews and supporting documents (without redactions), including but not limited to work plans, environmental assessments, environmental impact statements, biological opinions, biological assessments,letters of concurrence, conference reports, incidental take statements and/or permits, and underlying documents; and

5. Specific information that disclose the identities and affiliations of the cooperators on whose behalf Wildlife Services carries out control actions.

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377 *Information Quality Activities*, USDA OFFICE OF THE CHIEF INFORMATION OFFICER, https://www.usda.gov/ocio/guidelines-and-compliance-resources/information-quality-activities [https://perma.cc/GU4L-ZYYJ].

378 *See* CHIEF FREEDOM OF INFORMATION ACT (FOIA) OFFICER REPORT, *supra* note 299.

379 *See, e.g.*, U.S. FISH & WILDLIFE SERV., FREEDOM OF INFORMATION ACT PROCESSES AND PROCEDURES HANDBOOK (2018), available at https://www.fws.gov/sites/default/files/policy/files/FWSFOIAHandbook_9_2018.pdf [https://perma.cc/27NH-FRDQ].

380 The Work Plan "outlines the mission-related goals, objectives, anticipated outcomes," and approaches for conducting activities proposed. USDA-APHIS, Work Plan Template, available at https://www.aphis.usda.gov/animal_health/animal_diseases/cwd/downloads/cwd-foa-work-plan-template.docx.

Proactively making such information available for public inspection on the agency's website is the most effective way to bring agency practice in line with its purported commitment to transparency, national policy, FOIA's disclosure mandate, and the Data Quality Act.[381] It is impossible for the program to demonstrate—and therefore, for the American people to be assured—that Wildlife Services is fully complying with the law without specific information being available that identifies the wildlife problems the service responds to and efforts that were made to solve those problems without lethal methods. Indeed, the public simply cannot assess the program's efforts to employ non-lethal methods without greater transparency. Binding regulations could also work to ensure that Wildlife Services' is consistent with Congressional calls for greater transparency.

2. Rules Must Set Professional, Ethical Standards for the Humane Treatment of Animals, and a Clear, Consistent Disciplinary Process for Violations of Such Rules by Program Personnel

In its denial of the 2013 Petition for Rulemaking, Wildlife Services states that promulgation of rules for the humane treatment of animals is not necessary because Wildlife Services "must comply with all Federal Statutes," including statutes that APHIS itself enforces such as the Animal Welfare Act.[382]

Wildlife Services erroneously claims that regulations for humane treatment are not necessary because service personnel are "required to follow the American Veterinary Medical Association ("AVMA") Guidelines on Euthanasia."[383] In spite of this statement, Wildlife Services is seemingly directly violating the AVMA Guidelines. For example, the AVMA Guidelines on Euthanasia maintain that "[d]rowning is not a means of euthanasia and is inhumane."[384] Yet, Wildlife Services sets traps in or near water that are designed to drown aquatic animals.[385] The AVMA also opposes the use of conventional (non-padded, non-offset) steel jawed foothold traps,[386] yet Wildlife Services continues to kill animals through this

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381 *See* Ex. 25, Shea and Clay Memorandum.

382 Ex. 3, Denial, at 7.

383 *Id.*

384 AM. VETERINARY MED. ASS'N, AVMA GUIDELINES ON EUTHANASIA (2007), https://olaw.nih.gov/sites/default/files/Euthanasia2007.pdf [https://perma.cc/LD7B-UJF6].

385 *See* Tom Knudson, *Suggested Reforms for Wildlife Services Run the Gamut*, WICHITA EAGLE (June 25, 2012), https://www.kansas.com/latest-news/article1094440.html (noting that federal trappers sometimes leave traps near or in water that drown wolves); *see also* John W. Ludders et al., *Drowning is Not Euthanasia*, 27(3) WILDLIFE SOC'Y BULL. 666 (1999); JAMES E. MILLER, USDA-APHIS, WILDLIFE DAMAGE MANAGEMENT TECHNICAL SERIES: MUSKRATS (2018) (APHIS document explaining to federal trappers that if traps are "placed in deep enough water . . . the muskrat will drown in the trap.").

386 *Trapping and Steel-jawed Leghold Traps*, AVMA, https://www.avma.org/resources-tools/avma-policies/trapping-and-steel-jawed-leghold-traps [https://perma.cc/73VB-9CFF].

method.[387] Given the lack of binding regulations as to humane treatment, it is unsurprising that egregious acts of cruelty continue to be perpetrated by Wildlife Services employees.

Jamie Olson, the Wildlife Services employee who posted photographs on his Facebook page depicting his dogs attacking and killing coyotes in leg-hold traps, and who left his traps unchecked for up to sixty-nine days, has not been fired or even disciplined.[388] Instead of disciplining Mr. Olson, Wildlife Services has chosen to supplant a policy directive on the use of dogs and create an entirely new directive that, among other things, prohibits Wildlife Services personnel from "post[ing] or shar[ing] photographs taken or documents developed, during the course of their or their colleagues' official duty"—such as on Facebook—unless first cleared "through official channels."[389] Thus, instead of addressing the inhumane conduct, Wildlife Services has taken steps to make future misconduct harder to uncover.

In another example of Wildlife Services' failure to hold its employees accountable, Russell Files, the trapper who deliberately trapped a neighbor's dog, was not disciplined by USDA.[390] Neither was Kyle Traweek, another trapper who deployed M-44 cyanide capsules in areas frequented by humans or domestic dogs.[391] Nor was the agency employee who killed a Mexican wolf in January 2013.[392] A former agency trapper has indicated that these incidents are not unusual or isolated; indeed, there are many examples of professional program hunters and trappers committing similar acts of animal cruelty or illegal behavior.[393]

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[387] *See* USDA, APHIS, Wildlife Servs., *The Use of Foothold Traps in Wildlife Damage Management*, *in* HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT FOR THE USE OF WILDLIFE DAMAGE MANAGEMENT METHODS BY USDA-APHIS-WILDLIFE SERVICES (2019), available at https://www.aphis.usda.gov/wildlife_damage/nepa/risk_assessment/4-foothold-trap-peer-reviewed.pdf [https://perma.cc/837P-VZMW].

[388] Documents leaked by Rep. Campbell showed that the USDA investigation into Mr. Olson's conduct was concluded without any disciplinary action taken. *See Government Trapper Let Dogs Attack Live Coyotes Caught in Leg Traps*, PREDATOR DEF. (2015), https://www.predatordefense.org/features/ws_olson.htm [https://perma.cc/G2E4-7MAS].

[389] USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 4.104, PERSONAL USE OF NEW MEDIA BY WS PERSONNEL (June 20, 2013).

[390] Mr. Files was federal charged with criminal animal cruelty charges in 2012 for deliberately setting traps to capture a neighbor's dog, reportedly using Wildlife Services equipment and on agency time. *See Arizona v. Files*, 36 F. Supp. 3d 873 (D. Ariz. 2014).

[391] Similar to Mr. Files, Mr. Traweek was not disciplined by USDA-APHIS but was later reprimanded and fined by the Texas Department of Agriculture. *See* Letter from Dee Marlo Chico, Assistant Gen. Couns., Texas Dep't of Agric., to Kyle Traweek (June 6, 2012).

[392] Wildlife Services stated that the killing of the Mexican wolf "was a case of mistaken identity." Rene Romo, *Wildlife Services Employee Investigated in Wolf Death*, ALBUQUERQUE J. (Apr. 4, 2013).

[393] *See* UTAH DIV. OF WILDLIFE RES., INITIAL REPORT OF INVESTIGATION (Dec. 2, 2003) (reporting 2003 discovery of trapping and shooting by Wildlife Services trapper of a golden eagle caught in Wildlife Services' leg-hold trap in Utah, and of decomposing carcasses of red fox and coyote trapped nearby); *supra* note 345 (describing instances of dogs becoming caught in Wildlife Services traps and being injured or killed); *see also* Cristina Corbin, *Animal Torture, Abuse Called a 'Regular Practice' Within Federal Wildlife Agency*, FOX NEWS (Nov. 21, 2015), https://www.foxnews.com/us/animal-torture-abuse-called-a-regular-practice-within-federal-wildlife-agency [https://perma.cc/785C-78SH] (former trapper describing situation when he and supervisor found nine coyotes

Charles Brown, who was described as engaging in heinous acts of cruelty in an article in Harper's, later rose up the ranks to Eastern Regional Director for Wildlife Services. Per the article,

> Brown brandished an M-44 cartridge. He forced the dog's mouth open and, with his thumb, released the trigger on the device. It sprayed a white dust of cyanide into the collie's mouth.
>
> The dog howled. It convulsed. It coughed blood. It screamed in pain. The animals in the truck heard its wailing. They beat against their cages and cried out.
>
> "All right," said Brown to his trappers. "See, this stuff may be out of date, but it still works." He opened a capsule of amyl nitrite under the collie's nose. Amyl nitrite is an immediate antidote to cyanide poisoning.
>
> The collie heaved and wheezed. Brown then seized it and unleashed another M-44 dose. The dog screamed again. Shaddox started yelling, telling Brown to stop. Brown kicked the collie into the garbage pit.[394]

When domestic pets were accidentally killed by poisons that had been distributed by Wildlife Services, a former Wildlife Services agent stated the service's motto was "[s]hoot, shovel, and shut up."[395] Charles Brown reportedly ordered agents to "cover up the killing of these nontarget dogs, to remove the collars and bury the dead animals, and make sure always to separate the collars and the bodies."[396]

The culture of animal cruelty at Wildlife Services hangs like a dark cloud over American wildlife management practices, and runs counter to values and the policies that support laws to protect animals. A rulemaking must, at long last, correct this problem and bring Wildlife Services into compliance with all relevant national policies, federal laws, its own policies, and prevailing societal values. If Wildlife Services cannot operate in a humane manner, then it should not continue to operate at all.[397]

Therefore, in conducting a rulemaking, USDA and APHIS must "completely reassess [the program's] function and purpose in the light of changing public attitudes toward wildlife,"

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caught in leg hold snares and, "[a]s was routine" he "signaled his dogs to attack" while his supervisor "watched and laughed as the dogs circled the coyotes and ripped into them"); *id*. (quoting former trapper as stating that "[t]hat was regular practice").

394 Ex. 23, Ketcham, *The Rogue Agency*.

395 *Id.*

396 *Id.*

397 The ADCA provides authority for a wildlife services program, but does not mandate its existence. *See* 7 U.S.C. § 426 ("The Secretary of Agriculture *may* conduct a program of wildlife services") (emphasis added).

as the Leopold Report recommended several decades ago.[398] Petitioners request promulgation of regulations that strictly prohibit acts such as those committed by Mr. Olson, Mr. Files, Mr. Traweek, and others, set forth legal and ethical standards for the treatment of animals by agency personnel, and set forth a clear and consistent process for ensuring that employees who violate such prohibitions are subjected to a disciplinary process and terminated. In addition, Petitioners seek rules that provide a transparent process for program selection of control methods, with opportunities for the public to provide input and otherwise participate, as well as the development of method selection criteria that would barthe use of methods that – by design or in practice – are either known to or may cause pain or suffering to wildlife, companion animals, or members of the public.

3. Rules Should Phase Out Lethal Control, Restore Predators to Ecosystems, and Set Substantive and Procedural Criteria Inclusive of the Public Interest for Determinations of Wildlife Services' Response to Injurious Wildlife Problems

As observed in the Leopold Report nearly sixty years ago:

> Particularly when professional hunters are employed, control tends to become an end in itself, and following Parkinson's law, the machinery for its accomplishment can easily proliferate beyond real need.[399]

In 1979, the Department of the Interior ("DOI") issued a policy recommending the long-term "phase out" of "the use of lethal preventative controls."[400] But a quarter-century later, Wildlife Services still routinely engages in "preventative" (prophylactic) predator control, and does not limit its activities to situations in which "substantial [livestock] losses are established on a basis of irrefutable evidence."[401] For example, the program does not justify killing the approximately 75,000 coyotes that it kills every year—often prophylactically, prior to lambing season, and before any damage has been verified.

In 1990, the Government Accountability Office ("GAO") issued a report which acknowledged Wildlife Services' "heavy emphasis on protecting sheep from coyotes" and public criticism for its killing of predators to minimize losses for livestock producers "who use public lands in an already heavily subsidized manner," as well as its failure to emphasize nonlethal, prophylactic techniques and the pain and suffering that lethal techniques cause.[402] In a 1995

[398] *See* Leopold Report, *supra* note 331.

[399] *Id*. at 2.

[400] *See* Memorandum from Secretary, U.S. Dep't of the Interior to Assistant Sec'y, Fish and Wildlife and Parks, U.S. Department of the Interior (Nov. 8, 1979).

[401] *Id*. at 8; *see also id.* at 2 (setting near-term goal of limiting "preventative control" to"specific situations where unacceptably high levels of losses have been documented during the preceding 12 months").

[402] USDA, APHIS, ANIMAL DAMAGE CONTROL PROGRAM, DRAFT ENVIRONMENTAL IMPACT STATEMENT (1990); U.S. GOV'T ACCOUNTABILITY OFFICE, RCED-90-149, WILDLIFE MANAGEMENT: EFFECTS OF ANIMAL DAMAGE CONTROL PROGRAM ON PREDATORS (1990).

report, the GAO confirmed that,despite its rhetoric, the program primarily employs lethal control methods and that "field personnel rarely use nonlethal methods when controlling livestock predators."[403] The 1995 GAO Report also noted that "an operator's use of nonlethal control methods is not a prerequisite for receiving program assistance."[404] Twenty-six years later, the program refuses to phase out—or even meaningfully limit—its prophylactic lethal control, despite decades of criticism of this practice.

While Wildlife Services claims that it follows Policy Directive 2.101, which ostensibly requires that preference be given to non-lethal methods, the service has in practice refused to operate in this way, even when the requestor specifically demands as much. In the case of cooperator Marin County, Stacy Carlsen, Marin's agricultural commissioner, requested that Wildlife Services kill predators only as a last resort, yet Wildlife Services rejected the proposal, with one official writing it would "hamper the effectiveness of providing needed services."[405]

Thus, despite Wildlife Services' claim that "[o]nce WS receives a request for lethal or non-lethal control assistance, WS does not immediately accept the requestor's suggested control action,"[406] in practice this claim applies only if the requestor seeks non-lethal control (as Marin County did). If the requestor seeks lethal control, Wildlife Services obliges without proper investigation or adequate justification.

In 2020, for example, the *Albuquerque Journal* reported that investigations conducted by the Western Watersheds Project revealed that the methods used by Wildlife Services to determine when endangered Mexican gray wolves are responsible for livestock predation are "speculative" and "insufficient."[407] According to the investigation, Wildlife Services has determined that Mexican gray wolves are the species of issue in wildlife-livestock conflicts in cases when "there is literally nothing left but a scrap of hide or a few bones, or a few bite marks whose dimensions overlap with coyotes, mountain lions and feral dogs."[408]

As former Wildlife Services agent, Carter Niemeyer, noted:

> A rancher calls up and says, 'Goddamn wolves killed twenty-eight of my stock,' but he can't prove a thing. And we say, 'All right, Charlie, we'll get 'em.' The trapper shows up to the site and toes the carcass of the animal with his boot. 'Yep. Wolf did it.' And that's

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[403] GAO, EFFORTS TO PROTECT LIVESTOCK FROM PREDATORS, *supra* note 312.

[404] *Id.*

[405] *See* Camilla H. Fox, Analysis of the Marin County Strategic Plan for Protection of Livestock & Wildlife: An Alternative to Traditional Predator Control (Jan. 2008) (unpublished M.A. thesis, Prescott College) (on file with Project Coyote).

[406] Ex. 3, Denial, at 3.

[407] Cyndi Tuell, *Is US Wildlife Crying Wolf on Livestock Deaths?*, ALBUQUERQUE J. (Sept. 6, 2020).

[408] *Id.*

> the investigation. Of course a wolf did it — the rancher says so, which makes it the truth.[409]

Additionally, in its denial of the 2013 Petition, Wildlife Services ignores the entirety of literature submitted that documents the clear scientific evidence that lethal predation control does not work. Wildlife Services instead cites only two studies, both over twenty years old, in support of prophylactic lethal control, each of which were also conducted by Wildlife Services' own scientists and one of which has been thoroughly criticized as flawed in design.[410]

In addition to the flawed Wagner and Conover study, Wildlife Services cites a 2001 study of Utah of coyote predation of mule deer and antelope to justify prophylactic killing.[411] However, Wildlife Services' own Texas Cooperative Extension notes that in Texas, "the largest deer ('trophy bucks') typically occur where coyote densities are highest (south Texas and the Rolling Plains)." [412] In the face of mounting scientific evidence to the contrary, these two twenty-plus-years old, flawed studies of limited particularized application (as acknowledged by the agency itself) cannot continue to justify Wildlife Services' ongoing prophylactic lethal control throughout the country that results in the frequently inhumane killings of millions of animals annually.

The sole other study cited by Wildlife Services in its petition denial also took place in Utah and related to predation of sage grouse by red fox. Yet, Wildlife Services' own National Wildlife Research Center concluded that predation was not the chief factor in sage-grouse decline, finding instead that "[s]olutions to address declining sage-grouse numbers must consider the multitude of influential factors affecting sage-grouse ecology (livestock grazing, fire regime, disease, predation and oil and gas development)."[413]

Not a single "gold-standard" experiment (i.e., those in which an "intervention be used to protect a livestock herd (treatment) and that its effectiveness is compared against a livestock herd that is not exposed to the intervention (placebo control)") on lethal control of carnivores to prevent predation on domestic animals or protect other wildlife have proven reliable.[414] Indeed, only non-lethal control methods "have been tested numerous times with high standards of

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409 Ex. 23, Ketcham, *The Rogue Agency*.

410 *See* Ex. 3, Denial, at 5 (citing one study by WS' Utah State Director and another by researchers at the Utah-based Institute for Wildlife Damage Management).

411 *See id.* (citing Michael J. Bodenchuck et al., *Economics of Predation Management in Relation to Agriculture, Wildlife, and Human Health and Safety*, *in* PROCEEDINGS OF THE 1ST INTERNATIONAL SYMPOSIUM ON THE ECONOMICS OF WILDLIFE DAMAGE (2001)).

412 TEXAS A&M AGRILIFE EXTENSION, PREDATOR CONTROL AS A TOOL IN WILDLIFE MANAGEMENT 4, http://counties.agrilife.org/gillespie/files/2013/02/Predator-Control-as-a-Tool-in-Wildlife-Management.pdf [https://perma.cc/9JZY-9EBM].

413 Orning & Young, *supra* note 127.

414 Ex. 8, Treves et al.; *see also* Ex. 9, van Eeden et al.

evidence and have been found effective," among them: livestock guardian animals, enclosures for livestock, and fladry.[415]

Accordingly, Petitioners seek promulgation of regulations that would phase out all lethal control methods in all but the rarest of circumstances involving serious, verified, and documented injurious predator problems. Moreover, promulgation of regulations should involve a delineation—based on public comment and the best, most reliable data and information—of the narrow circumstances, if any, in which a lethal method by Wildlife Services may be considered to be acceptable. Promulgated regulations should also make clear, in the narrow circumstances where lethal methods shall be considered acceptable, the procedures by which Wildlife Services must verify and document the presence of such circumstances as well as the specific methods that may be utilized.

Moreover, such a rulemaking should conclude that Wildlife Services shall not provide lethal, subsidized control on public lands. Rather, the risk of livestock losses to predators on public lands should be borne by the livestock producer(s) who use public lands and resources.[416] Wildlife Services rejected this request in its denial of the 2013 Petition, claiming it "has no statutory authority to regulate grazing on public lands or to determine the conditions under which livestock occurs on public lands." Yet, Wildlife Services misunderstood Petitioners' request, as Petitioners seek to limit Wildlife Services operations—in particular, its type of predator control—on public lands to non-lethal methods. Should ranchers on public lands demand lethal control, Wildlife Services clearly has the authority to refuse to perform those services that do not comport with Wildlife Services' priorities.[417]

Furthermore, such rules should clarify that no control method—for example, leg-hold traps, which catch only an estimated *five percent of the intended targets*—should be deemed acceptable if it kills a significant number of non-target animals.[418]

Finally, whatever methods it ultimately employs, Wildlife Services should follow a regulatory scheme that requires it to carry out its activities in a fully transparent manner. Wildlife Services' methods should be based on reliable information, and should account for the public

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[415] Ex. 9, van Eeden et al.

[416] *See* Knudson, *Long Struggles*, *supra* note 18 (" A growing body of science has found the agency's war against predators, wagedto protect livestock and big game, is altering ecosystems in ways that diminish biodiversity, degrade habitat and invite disease.").

[417] From Wildlife Services' Denial of the 2013 Petition for Rulemaking:

> WS does not provide services for every cooperator who wishes to engage the program. WS has national priorities that include both High Priority Core Functions and Lower Priority Core Functions. The WS Deputy Administrator's office reviews every prospective cooperator—and the service(s)—they require, and provides its approval, as appropriate, based on whether performing the service(s) comports with WS' strategic priorities.

Ex. 3, Denial, at 13.

[418] *See* Knudson, *Long Struggles*, *supra* note 18 (investigative journalism reporting that out of 80,800 animals captured in leg-hold traps between 2006 and 2011, only five percent (4,300 animals) were the intended targets); Leopold Report, *supra* note 331, at 9 ("No method isacceptable if it results in the inadvertent death of a great number of animals during the process of killing a few that are causing damage.").

interest including the environmental, ethical, health, and economic benefits of thriving populations of predators, beavers, prairie dogs, and other species. These methods should only be deployed in response to specific, local situations involving injurious animals that have been verified and documented based on irrefutable evidence and/or where necessary to minimize the adverse effects of invasive animals or plants to endangered and threatened species. Such rules should set a standardized, rigorous, and complete process for verifying and documenting specific injurious wildlife problems and the use of non-lethal methods to address them, and should clarify the procedures by which records of such problems shall routinely be made available to Congress and the public at large. As explained above, such rules should clearly identify and phase out specific lethal control methods that are known to be ineffective and non-selective. For those control methods that remain, petitioners request that Wildlife Services require all traps and snares to be checked every 24 hours.[419] Moreover, such rules should extend to all control activities that are carried out by the program.

Such rules may codify Wildlife Services' "management philosophy"—i.e., to "control" "injurious wildlife" only after "careful assessments" of an identified problem, as well as its resolution, in accordance with "biologically sound, environmentally safe, scientifically valid, and socially acceptable" methods that are designed to minimize risks to humans, wildlife, non-target animals, and the environment.[420]

There is a plethora of evidence, generated over several decades, illustrating the ineffectiveness of the program's existing lethal control methods.[421] Immediate cessation of such lethal control methods is thus warranted, or at minimum, cessation of the general blanket use of lethal methods over large areas. A rulemaking with the opportunity for public comment will allow interested members of the public at large—including Petitioners as well as other experts in the fields of academia, science, and law—to advise the agency on how to effectively achieve the important objectives of careful management, ecosystem preservation, and the biologically, scientifically sound control of certain truly injurious wildlife. Marin County, California is a prime example how non-lethal measures can be implemented successfully. Between fiscal years 2002 and 2010, coyote depredations on sheep steadily declined from 236 to 90—with fourteen ranchers not losing any sheep at all—and program costs fell as the county shifted away from

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[419] *See supra* note 168.

[420] WILDLIFE SERVICES DIRECTIVE 1.201, *supra* note 311. Furthermore, as the authors of the Leopold Report criticized nearly sixty years ago:

> [T]he justification for each local control program should be documented far better than at present, and suchproof of need should be available when requested by the Advisory Board or the Secretary. The mere appeal for additional control by local groups of ranchers or the offer to help pay for a control program by a county or state is not of itself deemed justification that the program should be undertaken. As a form of justification, narrative descriptions of damage should be supplemented with quantitative statistics on the true extent of damage.

Leopold Report, *supra* note 331, at 24.

[421] *See supra* III.A-B.

lethal towards non-lethal alternatives.[422] As Marin County demonstrates, there are viable non-lethal and alternative measures that can be implemented, thereby eliminating altogether or substantially reducing any need both to kill, injure, or maim any wildlife, including protected animals and domestic pets, and put species, animals, pets, and humans at risk.

4. Rules Must Ensure that Wildlife Services is in Strict Compliance with All Legal Authorities and Policies Which Protect Wildlife and the Public

APHIS is required to comply with procedural and substantive requirements of many federal laws in administering the Wildlife Services program, including the ESA, BGEPA, MBTA, FIFRA, NEPA, the Fish and Wildlife Act, 16 U.S.C. § 742j-l ("FWA"), and the Wilderness Act. Wildlife Services policy directives require compliance with these laws.[423]

The ESA, BGEPA, and MBTA impose strict permitting requirements to conserve and protect certain species.[424] These laws make it unlawful for any person to "take," "depredate," or commit other detrimental acts against protected animals or species without a permit from FWS. These statutes also apply specific regulatory criteria, terms and conditions, and impose record-keeping and monitoring requirements on permittees.[425] FIFRA imposes conditions on the use of registered pesticides such as M-44s.[426] NEPA requires Wildlife Services to take a hard look at the consequences of its actions, publicly disclose what it is doing, allow the public to participate and to inform USDA and APHIS decision-making regarding the program, and ensure that program choices are based on current law, knowledge, and societal values.[427] The FWA imposes a permit requirement for aerial gunning to help ensure public safety and provides enforcement authority to FWS.[428] In so doing, the ESA, BGEPA, MBTA, FIFRA, NEPA, and FWA further a national policy of transparency, wildlife protection and conservation, the humane treatment of animals, and protection of the public health and welfare.[429]

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[422] *See* Peter Fimrite, *Ranchers Shift from Traps to Dogs to Fight Coyotes*, SF GATE (Apr. 27, 2012), https://www.sfgate.com/science/article/Ranchers-shift-from-traps-to-dogs-to-fight-coyotes-3514405.php [https://perma.cc/96ZK-RSPM].

[423] WILDLIFE SERVICES DIRECTIVE 1.210, *supra* note 346.

[424] 16 U.S.C. § 668a (prohibiting take of protected bald or golden eagleswithout permit from the Secretary of Interior); *id*. at § 703 (prohibiting take of protected migratory birds); *id*. § 704 (setting forth circumstances when migratory birds may be taken, killed, or possessed); *id.* at § 1538(a)(1)(B) (ESA take prohibition).

[425] *See also* 50 C.F.R. Part 13 (general permit requirements); *id.* Part 17 (imposing permitting andconditions for take of endangered and threatened species); *id.* at Part 20 (permitting and reporting requirements for BGEPA take permits); *id.* at Parts 20-21 (general management regulations and MBTA control order for Canada geese); *id*. §§ 21.43, 21.44, 21.48 (MBTA depredation orders).

[426] *See, e.g.*, 7 U.S.C. § 136(j)(a)(2)(F) (prohibiting the distribution or sale of any registered pesticide other than in accordance with § 136a(d)).

[427] 42 U.S.C. § 4321; 40 C.F.R. Parts 1508-1525 (CEQ regulations).

[428] 16 U.S.C. § 742j-l.

[429] *See* 16 U.S.C. § 1531(a)(1) (ESA declaring as the "policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act"); *see also* 16 U.S.C. § 668a (controlling the take, possession, and transportation of bald and

Wildlife Services regularly takes and/or depredates (i.e., it kills, harms, and harasses) animals that are protected under the ESA, BGEPA, and MBTA.[430] This includes gray wolves, Mexican gray wolves, red wolves, grizzly bears, black-footed ferrets, Hawaiian ducks, Hawaiian geese, swift foxes, San Joaquin kit foxes, bald and golden eagles, as well as scores of protected migratory birds.[431] Yet, Wildlife Services has not been able to demonstrate that it has all of the necessary authorizations to conduct its control actions consistent with the requirements of the ESA, BGEPA, and MBTA.

a. Endangered Species Act

Petitioners seek substantive rules that specify the conservation measures and procedures by which Wildlife Services will strictly satisfy its obligations under the Endangered Species Act.

ESA § 9 prohibits the unauthorized "take" of listed animals, which includes any attempt "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any listed species.[432] ESA § 7(a)(1) requires all federal agencies to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species."[433] ESA section 7(a)(2) requires all federal agencies to "insure that any action" that they authorize, fund, or carry out "is not likely to jeopardize" any listed species.[434]

The only way that APHIS can satisfy these mandatory duties is through strict compliance with the procedural requirements set forth in the ESA's implementing regulations at 50 C.F.R. Part 402.[435] These procedures require strict adherence to permitting requirements for all "take[s]" as defined by the Act, and requires consideration of all relevant factors and the effects of the agency's actions, based on the best scientific information, to endangered and threatened species, including both "direct" and "indirect" effects as well as "cumulative" effects.[436] This can only be achieved through consultation with FWS and re-initiation of consultation when new species become listed, circumstances change, or new information about the agency's impacts comes to light.[437]

Wildlife Services routinely engages in activities that adversely affect the survival and recovery of endangered and threatened species. For example, Wildlife Services engages in the "control" of critically-endangered Mexican gray wolves in the American Southwest at the behest

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golden eagles); *id*. at § 703 (prohibiting take of protected migratory birds). In addition, NEPA declares as the "continuing policy of the Federal Government" "to use practicable means and measures . . . to create and maintain conditions under whichman and nature can exist in productive harmony." 42 U.S.C. § 4331(a).

430 *See* GAO, EFFECTS OF ANIMAL DAMAGE CONTROL PROGRAM ON PREDATORS, *supra* note 402.

431 *Id.*

432 16 U.S.C. §§ 1532(19), 1638(a)(1)(B).

433 *Id*. § 1536(a)(1).

434 *Id*. § 1536(a)(2).

435 *Id*. §§ 1536(c)-(d); 50 C.F.R. Part 402 (ESA consultation procedures).

436 50 C.F.R. Part 402.

437 *Id.* §§ 402.16, 402.24.

of the livestock industry.[438] According to the FWS, the Mexican wolf is "the rarest subspecies of gray wolf in North America" and one of the rarest land mammals on the continent.[439] The latest population counts put the Mexican gray wolf's population size at just 241 individuals, with only 31 breeding pairs identified across the entire United States.[440] Notably, 100 wolves is considered the bare minimum population size for survival.[441] Therefore, the loss of even one Mexican wolf is detrimental to the species' overall survival.[442] Despite the fragility of the Mexican gray wolf's wild population, in fiscal year 2020 Wildlife Services killed five Mexican gray wolves.[443]

In 2013, a FWS investigation concluded that an Wildlife Services' employee shot and killed a critically-endangered Mexican wolf on January 19, 2013.[444] Like many prior Mexican wolf killings committed by Wildlife Services, the killing of this wolf was inadvertent—i.e., it was not done because the wolf was "injurious"—and, hence, the killing of this wolf was out of compliance with any "take" coverage under ESA § 9.[445] Moreover, by taking Mexican wolves, Wildlife Services prevents healthy populations from re-establishing in ecosystems where they are sorely needed.

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[438] The Mexican wolf has been listed as endangered since 1978. In a recent proposed rule to reclassify its listing statusunder the ESA, FWS reiterated the dire status of the Mexican wolf. Endangered and Threatened Wildlife and Plants; Proposed Revision To the Nonessential Experimental Population of the Mexican Wolf, 78 Fed. Reg. 35719 (June 13, 2013) https://www.federalregister.gov/documents/2013/06/13/2013-13977/endangered-and-threatened-wildlife-and-plants-proposed-revision-to-the-nonessential-experimental [https://perma.cc/72H8-2JQQ].

[439] *Conserving the Mexican Wolf,* U.S. FISH & WILDLIFE SERV., https://www.fws.gov/program/conserving-mexican-wolf#:~:text=The%20Mexican%20wolf%20is%20the,efforts%20to%20conserve%20the%20species [https://perma.cc/CB77-QTQX]; *see also Saving the Mexican Gray Wolf*, CTR. FOR BIOLOGICAL DIVERSITY, https://www.biologicaldiversity.org/species/mammals/Mexican_gray_wolf/index.html [https://perma.cc/X4GQ-MLM8].

[440] Press Release, U.S. Fish & Wildlife Services, Mexican Wolf Numbers Soar Past 200 in Latest Count (Feb. 28, 2023), available at https://www.fws.gov/press-release/2023-02/mexican-wolf-numbers-soar-past-200 [https://perma.cc/J3W8-YDDM].

[441] Scientists recommend a recovery target of a minimum of 750 Mexican wolves in three interconnected populations. *See* U.S. FISH & WILDLIFE SERV., MEXICAN WOLF CONSERVATION ASSESSMENT 78 (2010).

[442] Ex. 10, Ripple & Beschta, *Trophic Cascades in Yellowstone*; *see* MEXICAN WOLF CONSERVATION ASSESSMENT, *supra* note 441, at 61; *see also* 1997 Programmatic FEIS, *supra* note 11, at 4-17 ("As defined by the Act an impact to even one individual of the species could constitute an unacceptable impact.").

[443] Wildlife Services' 2020 Program Data Report, *supra* note 19. It should be noted that in both 2021 and 2022, Wildlife Services killed zero Mexican gray wolves. Wildlife Services' 2021 Program Data Report: Table G Animals Taken by Wildlife Services; 2022 Program Data Report, *supra* note 62.

[444] *See* Renee Blake, *One Mexican Wolf Killed; Two Pairs Transferred for Release into the Wild*, PUB. NEWS SERV. (May 2, 2013), https://www.publicnewsservice.org/index.php?/content/article/32211-1 [https://perma.cc/UD54-RHYB]; *see also Feds Confirm Employee Killed Mexican Gray Wolf*, ALBUQUERQUE J. (Apr. 24, 2013) (confirming canine mortality in New Mexico in January 2013 was a Mexican wolf).

[445] Blake, *supra* note 444; *see also* U.S. DEP'T OF THE INTERIOR, U.S. FISH & WILDLIFE SERV. OFF. OF L. ENF'T, REPORT OF THE INVESTIGATION #2013200634R003 62 (Aug. 14, 2013) (biological opinion termsand conditions requiring that "WS personnel who conduct . . . Program activities in occupied wolf range shall be knowledgeable at a professional level in identification of Mexican wolf").

The Mexican wolf is just one example of many. According to Wildlife Services' own data, the program has killed hundreds of ESA protected species since the 2013 Petition, including 122 swift foxes.[446] In fiscal year 2020 alone, the program killed six grizzly bears.[447] The program killed six grizzly bears again in 2021,[448] and seven in 2022.[449]

The program also uses a variety of methods—including "pyrotechnics" such as shell crackers, bombs, firecrackers, rockets, and Roman candles—to "disperse" thousands of endangered Hawaiian ducks, Hawaiian geese, Hawaiian coots, Hawaiian hawks, Newell's shearwaters, Hawaiian stilts, pearly-eyed thrashers, and wood storks every year.[450] While dispersing these species may not necessarily (immediately) kill them, such acts still constitute a "take" under the ESA absent an incidental take permit. The ESA's definition of "take" is broadly defined to include the harassment or harm of endangered and threatened species.[451] Courts have held that actions ranging from the Navy's peacetime use of low-frequency sonar to a roadside zoo's forced social isolation constitute a take by significantly disrupting normal behavior patterns.[452] Wildlife Services' "dispersing" of these birds is a form of harm and/or harassment, and as such constitutes a take of these threatened animals.

It is worth noting that the total killings and other takes cited in this petition come from Wildlife Services program data reports, which as highlighted above are not reliable and undoubtedly undercount the true number of animals taken by the service annually.[453] A substantial number of killings are simply not reported at all, and there is a lack of any information about sub-lethal takes (e.g., injuries) that result from attempts to kill or disperse protected wildlife.[454] Whatever the true numbers may be, many endangered and threatened

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446 Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

447 Wildlife Services' 2020 Program Data Report, *supra* note 19.

448 Wildlife Services' 2021 Program Data Report, *supra* note 443.

449 Wildlife Services' 2022 Program Data Report, *supra* note 62.

450 *See* U.S. DEP'T OF THE INTERIOR, U.S. FISH & WILDLIFE SERV., ANIMAL DAMAGE CONTROL "MAY AFFECT" DETERMINATIONS FOR FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES, USFWS BIOLOGICAL OPINION 3 (1997) [hereinafter "1997 Programmatic BiOp"] (stating that dispersals involve the use of pyrotechnics); *see also* Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

451 The ESA's definition of "harm" includes "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." 50 C.F.R. § 17.3. The term "harass" means "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." *Id.* The ESA's legislative history supports "the broadest possible" reading of "take." *Babbitt v. Sweet Home Chapter of Cmtys. for a Great Or.*, 515 U.S. 687, 704-05 (1995).

452 *E.g.*, *Kuehl v. Sellner*, 161 F. Supp. 3d 678, 710-11 (N.D. Iowa 2016); *Nat. Res. Def. Council v. Evans*, 279 F. Supp. 2d 1129, 1154-57 (N.D. Cal. 2003).

453 *See* Knudson, *Neck Snare*, *supra* note 18.

454 For example, a grizzly bear carcass was discovered southwest of Helmville, Montana in August 1998. The bear had evidently been poisoned many months prior by a cyanide gun that had been set for coyotes by Wildlife Services. *See* J. J. JONKEL, MONT. FISH, WILDLIFE & PARKS, PRELIMINARY OVERVIEW OF GRIZZLY BEAR MANAGEMENT AND MORTALITY 1998-2005. LIVING WITH PREDATORS PROJECT WORKING PAPER 004 29 (2006).

species that are killed or harmed by Wildlife Services cannot afford to lose even a few individuals and still meet recovery objectives, as the take of even a minimal number of individuals can jettison their survival.[455]

Direct killings and animal dispersals are not the only ways in which Wildlife Services takes listed species—Wildlife Services also does so through its "indirect effects."[456] For example, Wildlife Services has killed approximately 23,000 beavers per year since 2013,[457] notwithstanding the fact that several endangered wildlife species use habitats created by beavers, including Chinook salmon, steelhead,[458] coho salmon,[459] southwestern willow flycatcher,[460] tidewater goby,[461] and Oregon spotted frog.[462]

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[455] 1997 Programmatic FEIS, *supra* note 11, at 4-17 ("As defined by the Act an impact to even one individual of the species could constitute an unacceptable impact.").

[456] *See* 50 C.F.R. § 402.02 (an action's "indirect effects" are "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur").

[457] Wildlife Services' 2013-2022 Program Data Reports, *supra* note 6.

[458] The final recovery plan for the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and the distinct population segment of California Central Valley steelhead explains that they need freshwater rearing sites like beaver dams that provide natural cover. *See* RECOVERY PLAN FOR CHINOOK SALMON, *supra* note 90.

[459] In the Final Rule designating critical habitat for Central California Coast and Southern Oregon/Northern California Coasts coho salmon, NMFS explained, "NMFS agrees with the statements by one commenter that beaver dams and their associated habitat changes (e.g., channel flooding, and flow and siltation changes) often create ideal conditions for coho salmon. Some of the beneficial habitat effects from beaver activity include improved rearing and overwintering habitat, increased water volumes during low flows, and backwater habitat refuge areas during floods . . . NMFS will identify beaver removal as an activity potentially requiring special management consideration, and encourages landowners and agencies to promote beaver habitation as one means by which to support coho salmon recovery." Designated Critical Habitat for Coho Salmon, *supra* note 91. In the Final Rule listing the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of coho salmon, NMFS explained that "eradication of beaver have adversely modified fish habitat" and that "beaver trapping" is one of the "major activities responsible for the decline of coho salmon in Oregon and California." Threatened Status for Southern Oregon/Northern California Coast ESU of Coho Salmon, *supra* note 91. The final recovery plan for that ESU of coho salmon provides a detailed discussion of the importance of beavers to coho salmon, explaining, for example, "[b]eaver ponds provide high quality winter and summer rearing habitat for coho salmon." FINAL RECOVERY PLAN FOR COHO SALMON, *supra* note 91.

[460] In the Final Rule listing the southwestern willow flycatcher, FWS explained, "[b]eavers cut and use willow and cottonwood, but may also be important in creating quietwater riparian habitats by damming smaller and steeper creeks." Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher, *supra* note 92. In the Final Rule designating its critical habitat, FWS further explained, "[l]ands with moist conditions that support riparian plant communities are areas that provide flycatcher habitat. Conditions like these typically develop in lower elevation floodplains as well as where streams enter impoundments, either natural (such as beaver ponds) or human-made (reservoirs)." Designation of Critical Habitat for Southwestern Willow Flycatcher, *supra* note 92.

[461] The Final Rule designating critical habitat for the tidewater goby explained that the fish are "sometimes in beaver impounded sections of streams." Designation of Critical Habitat for the Tidewater Goby, *supra* note 93.

[462] The Final Rule designating critical habitat for the Oregon spotted frog explained that removal of beavers and features created by beavers threatens "physical or biological features that are essential to the conservation of this species." Designation of Critical Habitat for the Oregon Spotted Frog, *supra* note 94.

Similarly, the 1997 Programmatic Biological Opinion ("BiOp") acknowledges that northern aplomado falcons can be indirectly affected by Wildlife Services' reduction in the "the number of available blackbirds … through the use of avicides and rodenticides."[463] In Fiscal Year 2019, the program eliminated 19,356 red-winged blackbirds in Texas, part of the northern aplomado falcon's range.[464] The widespread killing of red-winged blackbirds reduces the number of animals on which the aplomado falcon can depend to prey on for survival and recovery from the threat of extinction.[465]

As a related matter, it is estimated that only ten percent of the bodies of poisoned animals are ever recovered, and the other ninety percent are left to enter the ecosystem as food for other animals, leading to the "secondary poisoning of thousands of innocent companion animals and unoffending wildlife, including threatened and endangered species."[466] Consequently, it is reasonable to conclude that reported figures regarding the take of animals such as red-winged blackbirds represents only a small fraction of the total animals affected by Wildlife Services conduct which does not properly account for the secondary effects of poisoning, including (possibly) to other protected species. Thus, Wildlife Services' reported numbers do not reflect actual take given the inability of agency personnel to recover all poisoned animals.

Wildlife Services may claim that it routinely consults with FWS under the ESA to consider the effects of its activities to listed species, but it cannot establish that this is in fact the case.[467] Wildlife Services has been operating under the same programmatic EIS since 1997, when consultation with FWS under § 7(a)(2) with respect to the programmatic effect of Wildlife Services' activities was last conducted.[468] At that time, a programmatic biological opinion (the 1997 Programmatic BiOp) concluded that programactivities adversely affect many endangered and threatened species, including the Utah prairie dog, northern aplamado falcon, whooping crane, desert tortoise, blunt-nosed leopard lizard, eastern indigo snake, and San Francisco garter snake.[469] For these species, the 1997 BiOp includes an "incidental take statement" ("ITS") with mandatory terms and conditions.[470] However, there are substantial gaps in information about: the agency's activities; unreported killings, injuries, and maimings; non-target catch; secondary

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[463] 1997 Programmatic BiOp, *supra* note 450.

[464] Wildlife Services' 2019 Program Data Report, *supra* note 281.

[465] Another example is the black-footed ferret. The 1997 Programmatic BiOp states that program activities can adversely affect black-footed ferrets by using gas cartridges and other toxic chemicals and leg-hold traps to kill prairie dogs—specifically, black-tailed or white-tailed prairie dogs—which are the primary prey base of the black-footed ferret, and that this will adversely impact the ferret's survival and recovery. 1997 Programmatic BiOp, *supra* note 450, at 14.

[466] Camilla Fox, *The Case Against Poisoning Our Wildlife*, HUFFPOST (Aug. 6, 2010), https://huffpost.netblogpro.com/entry/the-case-against-poisonin_b_672878/amp [https://perma.cc/YA5C-JTB7].

[467] For example, Wildlife Services failed to consult with FWS concerning the impact of its operation on endangered ocelots. *See* Press Release, Ctr. for Biological Diversity, Feds to Analyze Wildlife Services' Impacts on Endangered Ocelots in Arizona, Texas (June 26, 2017), https://www.biologicaldiversity.org/news/press_releases/2017/ocelot-06-26-2017.php [https://perma.cc/9UAV-AFQZ].

[468] 1997 Programmatic BiOp, *supra* note 450.

[469] *Id.*

[470] *Id.*

(indirect) and cumulative effects; and the effects from harassing activities such as dispersals. Hence, there is simply no documentation that could demonstrate that Wildlife Services is in strict compliance with these conditions or the ESA.[471]

Additionally, the 1997 Programmatic BiOp concluded that Wildlife Services activities are likely to *jeopardize* the continued existence of six endangered and threatened species that are protected under the ESA, including the black-footed ferret, San Joaquin kit fox, Attwater's prairie chicken, Mississippi sandhill crane, California condor, and Wyoming toad.[472] Considering the ITS terms and conditions that are set forth in the 1997 Programmatic BiOp and in light of the agency's lack of transparency, Wildlife Services simply cannot establish that it is in compliance with its mandatory "reasonable and prudent alternatives."

The agency's activities are also actively contributing to the need to list species under the ESA. For example, FWS proposed listing the American wolverine as threatened in February 2013 in accordance with an historic settlement agreement reached between the Center for Biological Diversity and FWS in 2011.[473] In the preamble to the proposed rule to list the wolverine as threatened, FWS noted that Wildlife Services trapped and killed a wolverine in Montana in 2010.[474] According to FWS, this was "possibly locally significant for wolverines in [this] area" because it occurred near a population that occurs in a small, isolated mountain range.[475] A study by Squires et al. further confirmed that trapping and killing even one wolverine (whether intentional or accidental) could seriously harm isolated mountain populations.[476]

Wolverines are naturally curious and, as scavengers and hunters, are "likely to check out novel things" such as traps and snares.[477] Their population in the entire lower forty-eight states is estimated to be between 250-300 individuals.[478] Climate change and continued habitat loss are expected to continuing putting pressure on the dwindling population of wolverines. Yet, Wildlife Services concedes that, in Montana alone, it has unintentionally captured several wolverines in recent decades.[479] In 2010, Wildlife Services shot another wolverine that had been caught in a

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[471] 50 C.F.R. § 402.16.

[472] *Id.*

[473] Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States, 78 Fed. Reg. 7864 (Feb. 4, 2013) (proposed rule to list the wolverine as threatened species); *see also Saving the American Wolverine*, CTR. BIOLOGICAL DIVERSITY, https://www.biologicaldiversity.org/species/mammals/American_wolverine/ [https://perma.cc/CH7Y-5EVE].

[474] Threatened Status for the Distinct Population Segment of the North American Wolverine, 78 Fed. Reg. at 7881.

[475] *Id.*

[476] John R. Squires et al., *Sources and Patterns of Wolverine Mortality in Western Montana*, 71(7) J. WILDLIFE MGMT. 2213 (2007).

[477] *A Wolverine's 15 Minutes of Fame*, WYOMING UNTRAPPED (Mar. 27, 2018), https://wyominguntrapped.org/news/a-wolverines-15-minutes-of-fame/ [https://perma.cc/BH4K-AXW4].

[478] *See* Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States, 79 Fed. Reg. 47522, 47534 (Aug. 13, 2014).

[479] USDA, APHIS, WILDLIFE SERVICES – MONTANA, PRE-DECISIONAL ENVIRONMENTAL ASSESSMENT: PREDATOR DAMAGE AND CONFLICT MANAGEMENT IN MONTANA 276 (Jan. 2021).

leg-hold trap in Idaho.[480] Despite all this, the agency has failed to confer with FWS to consider the impacts of Wildlife Services' activities to the wolverine.[481]

In addition to the wolverine, the fisher is declining toward extinction due in part to trapping, including by Wildlife Services.[482] Fisher populations are particularly sensitive to the effects of trapping because of their life-history traits, including slow reproductive rate, the sensitivity of population numbers to prey fluctuations, and the strong influence of adult survival on fisher life history.[483] Removing adults from populations even by light levels of trapping can cause local extirpation, and biologists suspect that incidental trapping mortality is limiting fisher recovery in Idaho.[484]

In Fiscal Year 2020, for example, Wildlife Services reported killing one fisher and freeing twelve unintentionally caught fishers.[485] In 2021, Wildlife Services unintentionally killed two fishers and released another thirty-one.[486] Fishers are difficult to remove from traps when found still alive, and they regularly suffer broken bones, hemorrhage, self-mutilation, or predation as a consequence of capture.[487] The estimated survival rate for incidentally-captured fishers after release is as low as fifty percent.[488] Thus, in addition to the fisher that was reported to have been intentionally killed by Wildlife Services in Fiscal Year 2020, at least another six were likely also killed beyond the killing recorded. Wildlife Services' killing and injuring of

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480 Knudson, *The Killing Agency*, *supra* note 214. Incidentally, only one of these wolverine deaths–the killing in Idaho–was reported in the program data for Fiscal Year 2010. *See* USDA, APHIS, Wildlife Services' 2010 Program Data Report: Table G Animals Taken by Wildlife Services.

481 16 U.S.C. § 1536(d) (requiring federal agencies to confer to consider the impacts of federal activities to species that are proposed for listing).

482 Fishers are classified as furbearers under state codes in both Idaho and Montana. In addition to trapping by individual permit holders, however, fishers are also caught in traps set by Wildlife Services. *See* MONT. FISH, WILDLIFE & PARKS, FURBEARER AND TRAPPING (2021) (legally defining "furbearing animals" to include fishers); IDAHO DEP'T FISH & GAME, FURBEARER TRAPPING AND HUNTING SEASONS BY REGION (2018-19) (defining "furbearing animals" to include fishers). Given fisher populations sharp decline in recent years, FWS listed the Southern Sierra Nevada Distinct Population Segment of Fisher as endangered in 2020. *See* Endangered Species Status for Southern Sierra Nevada Distinct Population Segment of Fisher, 85 Fed. Reg. 29532 (May 15, 2020).

483 Steven W. Buskirk et al., *Chapter 5: Population Biology and Matrix Demographic Modeling of American Martens and Fishers*, *in* BIOLOGY AND CONSERVATION OF MARTENS, SABLES, AND FISHERS: A NEW SYNTHESIS (Keith B. Aubry et al. eds., 2012); Roger A. Powell & William J. Zielinski, *Chapter 3: Fisher*, *in* THE SCIENTIFIC BASIS FOR CONSERVING FOREST CARNIVORES: AMERICAN MARTEN, FISHER, LYNX, AND WOLVERINE IN THE WESTERN UNITED STATES 38-73 (1994).

484 *See* ROGER A. POWELL, THE FISHER: LIFE HISTORY, ECOLOGY, AND BEHAVIOR (1982); Roger A. Powell, *Fishers, Population Models, and Trapping*, 7 WILDLIFE SOC'Y BULL. 149 (1979); Kimberly S. Heinemeyer, Temporal Dynamics in the Movements Habitat Use Activity and Spacing of Reintroduced Fishers in Northwestern Montana (1993) (unpublished M.S. thesis, University of Montana); Jeffrey L. Jones, Habitat Use of Fisher in Northcentral Idaho (May 1991) (unpublished M.S. thesis, University of Idaho).

485 Wildlife Services' 2020 Program Data Report, *supra* note 19.

486 Wildlife Services' 2021 Program Data Report, *supra* note 443.

487 J.C. Lewis & W.J. Zielinski, *Historical Harvest and Incidental Capture of Fishers in California*, 70(4) NW. SCI. 291 (1996).

488 *Id.*

fishers threatens the population of fishers in the northern Rocky Mountains and is one of the reasons that the fisher now warrants protection under the ESA.[489]

As another example, Wildlife Services uses Weevil-Cide® to kill black-tailed prairie dogs. This practice is both inhumane[490] and poses a significant risk to non-target species. Weevil-Cide® is highly toxic and Wildlife Services has itself acknowledged that "[a] primary concern of the use of fumigants is nontarget species take."[491] Between FY 2011 and FY 2015, "WS annually averaged the known take of 54,096 target rodents and an estimated *2,333 vertebrate nontarget species* with aluminum phosphide in 9 states."[492] Killing black-tailed prairie dogs negatively affects other species as well. Importantly, it reduces the prey base for the black-footed ferret, a species listed as endangered under the ESA.[493] It also affects other avian and mammalian predators that prey on prairie dogs or are dependent upon prairie dog colonies for habitat, such as badgers, coyotes, ferruginous hawks, golden eagles, prairie falcons, burrowing owls, prairie rattlesnakes, mountain plovers, and horned larks.[494]

For the foregoing reasons, Petitioners request that Wildlife Services issue substantive rules that codify procedures by which the agency will comply with the ESA. These rules should specify the means by which Wildlife Services will implement the ESA, including both the procedures of permitting and consultation with FWS and the National Marine Fisheries Service ("NMFS") and substantive provisions detailing how Wildlife Services will ensure that its activities do not violate its affirmative duty to prevent jeopardizing the continued existence of endangered or threatened species.

Absent substantive rulemaking, Wildlife Services should, at minimum, issue public guidance documents detailing the above, including how the agency will comply with the ESA and ensure that its activities do not result in the unlawful take of any protected species. Other agencies whose action may result in the taking of listed species already issue such public guidance. The U.S. Army Corp of Engineers ("Corps"), for example, publishes written guidance on its implementation and compliance with the ESA.[495] The Corps' guidance provides instructions and clarifications on how the ESA applies to the agency and how the agency will

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[489] Indeed, trapping is one of the primary threats to the Northern Rockies fisher population, according to a recent petition to list the Northern Rocky Mountain population of fishers that was submitted to FWS by the Center for Biological Diversity and numerous other organizations pursuant to the ESA's citizen petition process. *See* Ctr. for Biological Diversity et al., Petition to List the Northern Rockies Distinct Population Segment of Fisher (Pekania Pennanti) as Threatened or Endangered Under the Endangered Species Act (Sept. 23, 2013).

[490] *See supra* III.D.7.

[491] *The Use of Aluminum Phosphide in Wildlife Damage Management*, *supra* note 295.

[492] *Id.*

[493] *See* Endangered and Threatened Wildlife and Plants; Black-Footed Ferret Draft Recovery Plan, 78 Fed. Reg. 23948 (Apr. 23, 2023).

[494] *See* Kotliar et al., *supra* note 64.

[495] *E.g.*, U.S. Army Corps of Eng'rs, Memorandum for all Counsel, HQ, Divisions, Districts, Centers, Labs & FOA offices, subject: ESA Guidance (June 11, 2013).

comply with the requirements of the act.[496] District offices also release further guidelines on how the Corps will submit take permits to FWS/NFMS.[497] Petitioners request that Wildlife Services use its rulemaking authority to codify the procedures and applications of the ESA to its work, similar to the Corps.

b. Bald and Golden Eagle Protection Act and Migratory Bird TreatyAct

Petitioners seek promulgation of regulations to specify the substantive conservation measures and the procedures by which Wildlife Services will ensure that it strictly complies with the BGEPA[498] and MBTA.[499] The MBTA provides that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg or any such bird, unless authorized under a permit issued by the Secretary of the Interior.[500] Over 800 species are currently on the list of protected migratory birds.[501]

Wildlife Services kills thousands of protected migratory birds every year.[502] Reported data shows that the services' non-target take of migratory birds—such as bald and golden eagles, which are protected under the BGEPA and the MBTA—is frequent.[503] In 2020, Wildlife Services unintentionally killed a golden eagle and in 2021 unintentionally killed a bald eagle.[504] The unreported catch is likely far greater.[505]

Lead poisoning due to ingestion of spent shot or bullet fragments is a particular concern for bird species with low recruitment rates, depressed populations, or those in recovery, such as the California condor, bald and golden eagles, trumpeter swan, sandhill crane, and spectacled

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[496] For example, the guidance defines what agency conduct constitutes an "action" under the ESA—e.g., regular upkeep/maintenance of a structure such as a dam is not agency action under the ESA as it is mandatory not discretionary.

[497] *E.g.*, U.S. Army Corps of Eng'rs, Sacramento District, ESA Information Guidelines for the Regulatory Program (2018).

[498] 16 U.S.C. §§ 668-668d.

[499] *Id.* §§ 703-711.

[500] 50 C.F.R. § 10.13.

[501] *Id.*

[502] Wildlife Services' 2013-22 Program Data Reports, *supra* note 6.

[503] *See* INITIAL REPORT OF INVESTIGATION, *supra* note 393 (describing illegal, unreported killing of golden eagle in steel-jaw leghold trap set by Wildlife Services in the Henry Mountains in Utah); Wildlife Services, MIS Legacy Report (Mar. 4, 2005) (describing death of golden eagle in snare trap on BLM lands in Nevada in 2005); Letter from R. Merrell,Wildlife Services to Interested Parties (May 24, 2011) (describing deaths of two golden eagles from snare traps set in Wyoming in 2009).

[504] Wildlife Services' 2021 Program Data Report, *supra* note 443.

[505] An investigation by FWS in 1990 revealed a covert operation—performed, condoned, and/or promoted by Wildlife Services supervisors and personnel—using poisons to kill bald and golden eagles suspected to bepreying on sheep herds, including Compound 1080 (which had been prohibited for sale or use in Wyoming). Memorandum from Regional Director, FWS, Region 6 to Director, FWS, Washington, D.C. (Nov. 11, 1990).

eider.[506] Bald and golden eagles that ingest lead shot embedded in the tissues or the intestinal tract of waterfowl demonstrate acute and chronic symptoms of lead poisoning, and many studies have found high percentages of eagle populations across the United States that have elevated lead levels in their blood and organs.[507] Lead poisoning's effects on eagles included emaciation, evidence of bile stasis, myocardial degeneration and necrosis, and renal tubular nephrosis and necrosis.[508] In some areas of the country, approximately fifteen to twenty percent of all bald eagle deaths are due to lead poisoning, usually from eating animals that were wounded with lead ammunition or from scavenging gut piles during and after the deer hunting season.[509] Wildlife Services conducts a significant amount of its wildlife damage management with firearms, which, similar to hunting activities, contributes to lead in the environment.

Wildlife Services must comply with the BGEPA and the MBTA by obtaining all necessary permits prior to taking such species or otherwise committing prohibited acts in connection with controlled activities. Yet, neither Wildlife Services nor FWS notify the public when Wildlife Services submits an application to obtain such a take permit. FWS has, however, published a number of general permit requirements—including for the taking of eagles by wind energy infrastructure projects.[510] These FWS rules contain substantive requirements, including preconstruction monitoring requirements and studies into local unauthorized takes of eagles. Even assuming that Wildlife Services does have the requisite permits, such coverage cannot and does not apply to unreported and/or non-target catch.

For these reasons, Petitioners request that Wildlife Services issues substantive regulations regarding the processes it follows to submit BGEPA and MBTA applications, as well as details on how it will ensure compliance with its permits and prevent unlawful unreported and non-target catch. These rules should include substantive requirements of the agency, such as active

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[506] Molly E. Church et al., *Ammunition is the principal source of lead accumulated by California condors re-introduced to the wild*, 40(19) ENVT. SCI. TECH. 6143 (2006); James B. Grand et al., *Effect of Lead Poisoning on Spectacled Eider Survival Rates*, 62(3) J. WILDLIFE MGMT. 1103 (1998); Oliver H. Pattee et al., *Lead hazards within the range of the California condor*, 92(4) BULL. COOPER ORNITHOLOGICAL CLUB 931 (1990); Steve K. Hennes, Lead shot ingestion and lead residues in migrant bald eagles at the Lac Qui Parle Wildlife Management Area, Minnesota (1985) (Master's thesis, University of Minnesota).

[507] N.C. Coon et al., *Causes of bald eagle mortality, 1960-1965*, 6(1) J. WILDLIFE DISEASES 72 (1970); Alan R. Harmata & Marco Restani, Environmental Contaminants and Cholinesterase in Blood of Vernal Migrant Bald and Golden Eagles in Montana, 1(1) INTERMOUNTAIN J. SCIS. 1 (1995); D.J. Hoffman et al., *Effects of lead shot ingestion on delta-aminolevulinic acid dehydratase activity, hemoglobin concentration, and serum chemistry in bald eagles*, 17(3) J. WILDLIFE DISEASES 423 (1981); G.W. Kaiser et al., *Ingestion of Lead Shot by Dunlin*, 61(1) MURRELET 37 (1980); M.J. Miller et al., *Hemograms for and nutritional condition of migrant bald eagles tested for exposure to lead*, 37(3) J. WILDLIFE DISEASES 481 (2001); Oliver H. Pattee et al., *Experimental Lead-Shot Poisoning in Bald Eagles*, 45(3) J. WILDLIFE MGMT. 806 (1981).

[508] J. Christian Franson & Robin E. Russell, *Lead and eagles: demographic and pathological characteristics of poisoning, and exposure levels associated with other causes of mortality*, 23(9) ECOTOXICOLOGY 1722 (2014).

[509] Sean M. Strom et al., *Lead Exposure in Wisconsin Birds*, *in* INGESTION OF LEAD FROM SPENT AMMUNITION: IMPLICATIONS FOR WILDLIFE AND HUMANS (R.T. Watson et al. eds., 2009); A.J. Clark & A.M. Scheuhammer, *Lead Poisoning in Upland-Foraging Birds of Prey in Canada*, 12(1-4) ECOTOXICOLOGY 23 (2003); Janet L. Kramer & Patrick T. Redig, *Sixteen years of lead poisoning in eagles, 1980-1995: an epizootiologic view*, 32 J. RAPTOR RSCH. 327 (1997); *see also* T. Eisele, *Time to Get the Lead Out of All Hunting, Fishing*, CAP TIMES (Mar. 12, 2008).

[510] Permits for Incidental Take of Eagles and Eagle Nests, 87 Fed. Reg. 59598 (Sept. 30, 2022).

monitoring and reporting on Wildlife Services' unauthorized catch or monitoring studies in the region where it is operating.

c. Federal Insecticide, Fungicide and Rodenticide Act

Petitioners seek promulgation of regulations to specify the substantive measures and the procedures by which Wildlife Services will ensure that it strictly complies with FIFRA.[511]

The authors of the Leopold Report identified the need for regulatory restrictions on the use of toxicants by Wildlife Services nearly sixty years ago. Concerned about the use of Compound 1080 in 1964, the report's authors urged regulation of the "distribution and the use of 1080 or any other poison capable of having a secondary effect" and admonished the program for the "need for much stricter adherence to operational rules" for its use.[512]

The Federal Environmental Pesticide Control Act was passed eight years later in 1972.[513] It amended FIFRA and mandated the EPA to regulate the use and sale of pesticides to protect public health and the environment.[514] To that end, FIFRA § 3 requires that all new pesticides be registered by EPA before they may be used within the United States.[515] The EPA must classify pesticides for general or restricted use, depending on their particular risks, and must classify (or reclassify) a pesticide as "restricted" when necessary to guard against unreasonable adverse environmental effects.[516] Restricted use pesticides may only be applied by a certified applicator or under the direct supervision of a certified applicator, and application of a restricted use pesticide must follow all limitations on the frequency, type, location, and protective measures associated with its use.[517]

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[511] 7 U.S.C. §§ 135-136y.

[512] Leopold Report, *supra* note 331, at 26-27.

[513] *Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Federal Facilities*, EPA, https://www.epa.gov/enforcement/federal-insecticide-fungicide-and-rodenticide-act-fifra-and-federal-facilities#:~:text=FIFRA%20prohibits%20registration%20of%20pesticides,applicable%20Worker%20Protection%20Standards%20(WPS) [https://perma.cc/Q5UM-P64Z] (last updated Mar. 7, 2023).

[514] *Id.*

[515] 7 U.S.C. § 136a. To be registered as a pesticide, EPA must determine that:

- Its composition is such as to warrant the proposed claims for it;
- Its labeling and other material required to be submitted comply with the requirements of the Act;
- It will perform its intended function without unreasonable adverse effects on the environment; and
- when used in accordance with widespread and commonly recognized practice, it will not generally causeunreasonable adverse effects on the environment.

Id. § 136a(c)(5).

[516] *Id.*

[517] 7 U.S.C. §§ 136 *et seq*.

EPA classified sodium cyanide, which is used in M-44s, as a restricted use pesticide in 1994.[518] EPA classified sodium fluoroacetate, which is used in Compound 1080 (livestock protection collars), as a restricted use pesticide in 1995.[519] The agency placed both sodium cyanide and sodium fluoroacetate intoToxicity Category 1, reflecting the "highest degree of acute toxicity."[520] Although Wildlife Services employs strychnine to poison rodents in underground burrows today, EPA has maintained restrictions on the use of above-ground, non-arboreal field use of this toxicant.[521] The EPA has set forth twenty-six "Use Restrictions" for M-44s.[522] Hence, under FIFRA, Wildlife Services may use these poisons only in accordance with the enumerated restricted conditions and protective measures.[523]

Wildlife Services claims that it is in compliance with FIFRA, yet the EPA and state agricultural agencies have notified the agency of multiple violations of EPA restrictions in connection with using M-44s on federal public lands, in recreational areas, on private property without permission from landowners, in standing water, and close to roads.[524] Citizen enforcement led the EPA to fine Wildlife Services for multiple violations of FIFRA in New Mexico.[525] Notwithstanding whatever compliance with FIFRA's requirements Wildlife Services may claim it adheres to, Wildlife Services cannot justify the thousands of accidental animal deaths caused by Wildlife Services' M-44s or Compound 1080.[526]

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[518] Sodium Cyanide RED, *supra* note 239.

[519] ENV'T PROT. AGENCY, REREGISTRATION ELIGIBILITY DECISION (RED): SODIUM FLUROACETATE (1995).

[520] *Id.*

[521] *See* ENV'T PROT. AGENCY, REREGISTRATION ELIGIBILITY DECISION (RED): STRYCHNINE (1996); MICHAEL J. ROBINSON, PREDATORY BUREAUCRACY: THE EXTERMINATION OF WOLVES AND THE TRANSFORMATION OF THE WEST 330 (2005); Memorandum from Jane Smith, Risk Characterization and Analysis Branch, Health Effects Div., EPA to Jay Ellenberger, Branch Chief, Accelerated Reregistration Branch, Special Review and Reregistration Division, EPA (Jan. 22, 1996).

[522] *See EPA Announces Revised Interim Decision for M-44 Predator Control Devices*, EPA (Dec. 5, 2019), https://www.epa.gov/newsreleases/epa-announces-revised-interim-decision-m-44-predator-control-devices [https://perma.cc/A8EK-ZRZ8].

[523] When EPA reregisters a compound under FIFRA, it can set requirements that restrict its use to ensure human safety and limited damage to the environment. *See, e.g.*, *id.* (promulgating restrictions on the use of M-44 cyanide devices to "reduce the potential for unintended impacts on humans, pets, and other non-target animals"). Lethal control methods, including strychnine and sodium cyanide, clearly meet the definitions of "pesticide" as applied by WS. *See* 7 U.S.C. § 136(t) (defining "pest"); *id.* § 136(u) (defining "pesticide").

[524] *See* Letter from Mark Chalfant & David Janik, Region 8, EPA to Mike Linnell, Utah State Dir., Wildlife Servs. (Mar. 20, 2008); Texas Dep't of Agric., Notice of Violation, TDA Incident No. 02414-00006891 (June 6, 2012) (notifying APHIS- Wildlife Services employee of violations of use restrictions for M-44, which was placed "less than six-tenths of a mile from [a] house near roadways that [resident], her family, and family's dog frequently traveled" and which killed the family dog); Affidavit of Paul Wright (Sep. 19, 2001) (explaining how M-44 that killed family dog was "sitting in a pool of waterthat was overflow from the irrigation ditch," in violation of EPA Use Restriction 12).

[525] New Mexico Department of Agriculture, Investigative Report, Consent Agreement and Final Order for Case No. 96-24 (fining Wildlife Services $1,000 in 1994 for illegally placing several M-44s in the Gila National Forest).

[526] Knudson, *M-44s Lure Animals*, *supra* note 345 ("Agency records show that more than 3,400 animals have been mistakenly killed by M-44s since 2006, including black bears, bobcats, raccoons, opossums, ravens, ringtails, red

Indeed, according to Samuel Sanders, a trapper who worked for Wildlife Services until 2011, "[v]iolating both federal and state law when it comes to the application of pesticides is encouraged by Wildlife Services."[527] Sanders also stated that Wildlife Services employees were not properly certified for the use of poisons in the field: "The certification test was fixed so that employees always pass. The supervisor reads the answers off to employees."[528]

Moreover, in many circumstances the use of pesticides to control predators simply does not comport with the purpose of FIFRA. A pest is defined as an animal that is "deleterious to man or the environment."[529] Yet, given their ecosystem benefits, apex predators and mesopredators such as wolves and coyotes are not "deleterious to man or the environment"—to the contrary, they have tremendous environmental benefits.[530] Therefore, they cannot accurately be classified as "pests" under FIFRA.

For these reasons, Petitioners request that Wildlife Services promulgate substantive rules codifying agency policies regarding its use of pesticides. Other natural resource management agencies have published comprehensive documents listing their requirements and restrictions around pesticide use. For example, BLM's National Training Center has published a Chemical Pest Control Handbook, a lengthy document covering everything from general pesticide precautions to storage protocols, spill emergency plans, water monitoring, and more.[531] Similarly, the U.S. Forest Service has codified its pesticide use policies in FSM 2150. This manual creates substantive restrictions and requirements for the agency—for example, pesticides must go through a use-approval process that includes environmental analysis prior to being used, and each National Forest Supervisor must submit annual reports of all pesticides during that year.[532] Furthermore, the Forest Service's clear directive is only to use pesticides "when necessary to protect land or restore significant resource value."[533]

Thus, Petitioners request Wildlife Services engage in rulemaking to ensure that the service complies with FIFRA. These implementing regulations should detail the circumstances in which toxicants and the mechanisms that deploy them, such as M-44s, Compound 1080, strychnine, or any new toxicants may be used, if at all, as well as how such toxicants are to be

fox, gray fox, kit fox, swift fox, turkey vultures and dogs."); 1997 Programmatic FEIS, *supra* note 11, at 3, 46-47 (acknowledging that non-target species may be inadvertently attracted to baits placed for other species"; for example, "swift foxes may be attractedto the bait placed for coyotes or other canids, resulting in . . . death by an M-44").

527 Ex. 23, Ketcham, *The Rogue Agency*.

528 *Id.*

529 40 C.F.R. § 152.5(a).

530 *See supra* III.A.

531 Bureau of Land Mgmt., Nat'l Training Ctr., H-9011 Chemical Pest Control Handbook.

532 U.S. Forest Serv., FSM 2150 – Pesticide Use Management and Coordination [hereafter "FSM 2150"]; *see also* U.S. Forest Serv., Pacific Southwest Region, FSM 2100 – Environmental Management, Chapter 2150 – Pesticide Use Management and Coordination (2019).

533 FSM 2150, *supra* note 532.

stored, used, and cleaned up. Wildlife Service should also codify the consequences for agency personnel who violate such rules.

d. National Environmental Policy Act

Petitioners seek promulgation of regulations to specify the procedures by which Wildlife Services will ensure strict compliance with NEPA.

NEPA requires federal agencies to analyze the environmental impact of a particular federal action before proceeding with that action.[534] NEPA is designed to "insure that environmental information is available to public officials and citizens before decisions are made and actions are taken," and to "help public officials make decisions that are based on understanding of environmental consequences."[535] "Public scrutiny [is] essential to implementing NEPA."[536]

To accomplish these purposes, NEPA requires all federal agencies to prepare a "detailed statement" regarding all "major federal actions significantly affecting the quality of the human environment."[537] This is known as an environmental impact statement ("EIS"). The EIS is the cornerstone of NEPA.[538] An EIS is required for all "major Federal actions significantly affecting the quality of the human environment."[539] An agency may first prepare an environmental assessment ("EA") to determinewhether an EIS is required.[540]

An EA must take a "hard look" at the potential consequences of the proposed action and provide enough evidence and analysis for determining whether to prepare an EIS or to instead issue a "finding of no significant impact." After preparing an EA or EIS, NEPA requires an agency to prepare a supplemental NEPA analysis when "[t]he agency makes substantial changes in the proposed action that are relevant to environmental concerns; or...[t]here are significant new circumstancesor information relevant to environmental concerns and bearing on the proposed actions or its impacts."[541]

The most recent "programmatic" final EIS ("FEIS") for the Wildlife Services program is more than twenty years old and is outdated.[542] Currently, Wildlife Services routinely prepares EAs under NEPA to consider the effects of its activities in various areas around the country. The focus of these EAs is generally limited to activities related to the killing of predators and other

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[534] 42 U.S.C. § 4332(2)(C).

[535] *Id*. § 1500.1(b)-(c).

[536] *Id.*

[537] *Id.* § 4332(C).

[538] *Young v. Gen. Servs. Admin.*, 99 F. Supp. 2d 59, 67 (D.D.C. 2000) ("The cornerstone of NEPA's procedural protections is the Environmental Impact Statement.").

[539] 42 U.S.C. § 4332(2)(C).

[540] *See id.* § 1501.4(b).

[541] 40 C.F.R. § 1502.9(c)(1).

[542] 1997 Programmatic FEIS *supra* note 11.

so-called injurious animals—these EAs do not encompass the full scope of Wildlife Services' activities or consider the consequences of these activities on biodiversity. Indeed, Wildlife Services is already aware that it is out of compliance with NEPA with regard to numerous old EAs.[543]

For example, Wildlife Services' EAs do not provide any information about the cumulative impact of Wildlife Services' activities to ecosystems or rigorously analyze or consider alternatives to standard agency practices. The risk assessment for the 1997 Programmatic FEIS assumed that "no individual application" of any one of the dozens of chemical control methods used by Wildlife Services will cause an "adverse nontarget exposure," and therefore, the total, programmatic exposure from the program would be negligible.[544] As discussed above, however, this stands in stark contrast to numerous examples of adverse non-target exposures that have occurred since 1997 when the programmatic FEIS was issued.

Wildlife Services EAs are also often out of date and do not reflect changes in state trapping laws. For example, in California, Wildlife Services relies on four district EAs that have not been updated since the 1998 passage of Proposition 4, which prohibited certain traps and poisons statewide.[545]

While Wildlife Services has stated it "believes no additional regulations are needed to codify NEPA compliance," recent case law suggests otherwise, with courts finding that Wildlife Services has failed to comply with NEPA requirements on multiple occasions. In *Wildlands v. Woodruff,* a Washington District Court concluded that (1) "Wildlife Services failed to take a hard look at the effects of lethal removal on gray wolf populations," (2) "Wildlife Services deliberately failed to consider the ecological effects of lethal wolf removal," and (3) "Wildlife Services acted arbitrarily and capriciously and contrary to law by not preparing an EIS.[546]

Similarly, in *Western Watersheds Project v. USDA APHIS Wildlife Services*, the District Court of Idaho took issue with Wildlife Services' dismissive response to numerous experts, finding that "if the Final EA demonstrates anything, it is that Wildlife Services has serious disagreements with leading experts, and has not given their studies the full attention they deserve."[547] The court in this case also noted that three agencies—BLM, the Forest Service, and the Idaho Department of Fish and Game ("IDFG")—all commented critically on WS' Draft EA, stating the document was not an objective analysis of the environmental impacts.

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[543] *See*, *e.g.*, Email from Alton Dunaway, Wildlife Servs., to William H. Clay, Wildlife Servs. (July 13, 2010) ("O[regon] has done almost nothing to help with their predator EA for the last 6-8 months and has not even cooperated in establishing a time schedule to complete the EA."); Email from Alton Dunaway, USDA, APHIS, Wildlife Servs., to William H. Clay, Wildlife Servs. (July 8, 2010) (noting legal vulnerability of several outdated EAs).

[544] 1997 Programmatic FEIS, *supra* note 11, at 4-29.

[545] *See* CAL. FISH & GAME CODE § 3003.1-2.

[546] 151 F. Supp. 3d 1153, 1164-66 (W.D. Wash. 2015).

[547] 320 F. Supp. 3d at 1149.

BLM commented in response to the Wildlife Services' Draft EA that "[t]he document thus far does not read like a real analysis of the potential [Predator Damage Management] outside of lethal methods. Instead, it sounds like a pre-decisional defense of lethal methods, and fails to consider the real benefits of alternative approaches."[548] The IDFG's large carnivore coordinator, Steve Nadeau, echoed that comment:

> This is a very complete look at the potential impacts of control actions from one perspective and builds a nice case for conducting [Predator Management] in Idaho. It does not however provide an adequate perspective of enormous availability of literature and research that shows the ineffectiveness or neutral benefit of the actions, thus bringing into question the objectiveness of the EA.[549]

The Forest Service similarly commented "[t]here is a weakness in this document in that by portraying only one side of the issue, and cherry-picking papers, it is assuming that there is no controversy."[550] As the court remarked, "it is rare for the Court to encounter such an unanimity of critical comments from other agencies."[551]

For the foregoing reasons, Petitioners are requesting that Wildlife Services:

1. Issue a new nationwide programmatic Environmental Impact Statement.

   It has been over twenty years since the last programmatic FEIS and it is outdated. Petitioners request that Wildlife Services issue a new programmatic FEIS that considers the cumulative impact of its activities on ecosystems at the county level and carefully evaluates alternative actions to its standard practices that result in untargeted and unnecessary killings and threaten biodiversity.

2. Enact implementing regulations to codify Wildlife Services' compliance with NEPA.

   Petitioners request that Wildlife Services codify regulations to govern the service's compliance with NEPA.[552] To alleviate the agency problems identified by courts in *Western Watersheds Project* and *Woodruff*, these rules should include specific details of the processes by which Wildlife Services will take the requisite "hard look" at its actions, as well as properly consider scientific evidence and a range of possible alternative actions, including actions that do not involve killing wild animals.

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548 *Id.* at 1141.

549 *Id.*

550 *Id.*

551 *Id.* at 1150.

552 Other agencies within USDA, such as the Farm Service Agency, have already issued NEPA implementing regulations. *E.g.*, 7 C.F.R. § 799.

e. Fish and Wildlife Act

The FWA prohibits anyone from shooting any animal from an aircraft without a license or permit.[553] Wildlife Services engages in aerial gunning of wildlife, including wolves and coyotes—primarily on behalf of livestock and hunting interests. However, it is not clear that the agency has obtained the necessary permission to carry out these activities under the FWA.[554] Therefore, a rulemaking is necessary to set the regulatory procedures for FWA compliance as well.[555]

f. Wilderness Act

The Wilderness Act provides for a National Wilderness Preservation System to ensure that man does not occupy or modify all lands within the country, leaving no lands designated for "preservation and protection of their natural condition."[556] Wilderness Areas must be administered in a manner that will leave them "unimpaired for future use and enjoyment as wilderness," and that will provide for "the protection of these areas" and "the preservation of their wilderness character."[557] The definition of "Wilderness" is an area where the community of life is "untrammeled" by man and the land retains its primeval character and influence, and which is "protected and managed so as to preserve its natural conditions."[558] These are areas "affected primarily by the forces of nature" that have outstanding opportunities for "solitude or a primitive" type of recreation.[559]

Agencies administering Wilderness Areas are "responsible for preserving the wilderness character of the area."[560] Section 1133(c) of the Act further prohibits uses of Wilderness that are not consistent with this mandate, and specifically provides that use of motor vehicles, motorized equipment, aircraft landings, or other forms of mechanical transport are prohibited in designated Wilderness except in narrow circumstances, as necessary to meet minimum requirements for administration.[561] Thus, preservation of wilderness character must be predominant, and courts have narrowly interpreted the exception for motor vehicle use, landing of aircraft, or structures in Wilderness only to those situations that are of urgent necessity, rather than mere convenience or benefit.

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553 16 U.S.C. § 742j-l.

554 Evidently, Wildlife Services does not even know how much it spends on aerial gunning,so it pushes belief that that is all of the necessary permits to carry out this activity. *See* Knudson, *Wildlife Services meets with its critics*, *supra* note 353.

555 Note that other agencies already have regulations implementing the Fish and Wildlife Act of 1965, including the Fish and Wildlife Service. *See* 50 C.F.R. Subpart B.

556 16 U.S.C. § 1131(a).

557 *Id.*

558 *Id.* § 1131(c).

559 *Id.*

560 *Id.* § 1133(b); 36 C.F.R. § 293.2.

561 16 U.S.C. § 1133(c).

g. Invasive Species Control

As a final note, Petitioners acknowledge the adverse impact that some invasive species have on endangered and threatened species. Petitioners define "invasive species" as an introduced, non-native species that does or is likely to cause environmental or economic harm or harm to human, animal, or plant health.[562] A "non-native species" is defined as a species that historically did not occur within a particular ecosystem, and is currently living outside its natural geographic range, as a direct result of human activity, whether deliberate or accidental.[563] Notably, few non-native species become invasive species.[564] Invasive species have been identified as one of the greatest threats to imperiled species in the United States.[565] Petitioners note the efforts of Wildlife Services to study and control invasive species to mitigate such impacts.

That said, Petitioners note two important guiding principles. First, it is imperative that regulations are promulgated to guide the program's invasive species control activities informed by comment from the public including non-governmental organizations, the scientific community, experts, ethicists, and academics. Second, such regulations must include criteria for transparent determinations of whether specific invasive species conflicts warrant a response by Wildlife Services and how such conflicts should be addressed, ensuring humane treatment of animals, and when possible, using non-lethal methods, while reducing/eliminating impacts on non-target species. Petitioners recognize the value of invasive species control using humane, effective, and selective techniquesat the site and species-specific level in order to protect and recover federally listed endangered and threatened species, but do not favor the preventative killing of species over large geographicareas at the behest of livestock, agricultural, or other interests under the auspices of invasive species control.

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[562] *See* Exec. Order No. 13,112, § 1(a), 64 Fed. Reg. 6183 (Feb. 3, 1999); U.S. DEP'T OF INTERIOR, INVASIVE SPECIES DEFINITION CLARIFICATION AND GUIDANCE 2 (2006), available at https://www.doi.gov/sites/doi.gov/files/uploads/isac_definitions_white_paper_rev.pdf [https://perma.cc/A4EL-N5WH]; INT'L UNION FOR CONSERVATION OF NATURE, INVASIVE ALIEN SPECIES AND CLIMATE CHANGE (Nov. 2017), available at https://www.iucn.org/sites/dev/files/ias_and_climate_change_issues_brief_final.pdf; Kirsty Park, *Assessment and Management of Invasive Alien Predators*, 9 ECOLOGY & SOC'Y 12 (2004).

[563] *See, e.g.*, *See* Exec. Order 13112, Section 1(a), 64 Fed. Reg. 6,183 (Feb. 3, 1999); INT'L UNION FOR CONSERVATION OF NATURE, *supra* note 562.

[564] *Supra* note 562.

[565] *See* Meredith L. McClure et al., *A Globally-Distributed Alien Invasive Species Poses Risks to United States Imperiled Species*, 8 SCI. REP. 5331 (2018) (noting that "non-native species are a driving factor in many imperiled species' decline"); David S. Wilcove et al., *Quantifying Threats to Imperiled Species in the United States*, 48 BIOSCIENCE 607 (1998) (finding "the spread of alien species" to be the second greatest threat to biodiversity).

V. Conclusion

For all of the foregoing reasons, Petitioners seek promulgation of rules to set forth a clear, consistent regulatory scheme for Wildlife Services, to ensure program transparency, reliability, humaneness, and compliance with all federal laws that protect and conserve wildlife, including the ESA, BGEPA, MBTA, FIFRA, FWA, NEPA, the Wilderness Act, and other authorities.

Thank you for your consideration. We look forward to a timely response.

Respectfully submitted,

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WILDEARTH GUARDIANS

Exhibit List

Exhibit	Item
1	Signatures from ALDF Members.
2	Petition from Ctr. for Biological Diversity et al., to Tom Vilsack, Sec'y, U.S. Dep't of Agric. et al. (Dec. 2, 2013).
3	USDA, Wildlife Services, Response to December 2, 2013 Petition for Rulemaking (Nov. 14, 2014).
4	N. J. Colman et al., *Lethal Control of an Apex Predator has Unintended Cascading Effects on Forest Mammal Assemblages*, 281 PROC. ROYAL SOC'Y B 1 (2014).
5	Bradley J. Bergstrom, *Carnivore Conservation: Shifting the Paradigm from Control to Coexistence*, 98 J. MAMMALOGY 1, 1-6 (2017).
6	Eric M. Gese, *Demographics and Spatial Responses of Coyotes to Changes in Food and Exploitation*, *in* PROCS. OF THE 11TH WILDLIFE DAMAGE MGMT. CONF. 271 (2005).
7	Bradley J. Bergstrom et al., *License to Kill: Reforming Federal Wildlife Control to Restore Biodiversity and Ecosystem Function*, 7 CONSERV. LETTERS 131 (2013).
8	Adrian Treves et al., *Predator Control Should Not Be a Shot in the Dark*, 14 FRONTIERS ECOLOGY & ENV'T 380, 388 (2016).
9	Lily M. van Eeden et al., *Carnivore conservation needs evidence-based livestock protection*, 16(9) PLOS BIOLOGY e20005577 (2018).
10	William J. Ripple & Robert L. Beschta, *Trophic Cascades in Yellowstone: The First 15 Years After Wolf Reintroduction*, 145 BIOLOGICAL CONSERVATION 205 (2012).
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13	Omar Ohrens et al., *Non-Lethal Defense of Livestock Against Predators: Flashing Lights Deter Puma Attacks in Chile*, 17 FRONTIERS ECOLOGY & ENV'T 32 (2019).
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15	Gilbert Proulx & Dwight Rodtka, *Killing Traps and Snares in North America: The Need for Stricter Checking Time Periods*, 9(8) ANIMALS 570 (2019).

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17	Letter from Dorothy Slaugh to Congressmember Peter DeFazio (Dec. 6, 2006).
18	Letter from Amanda Wood Kingsley to Congressmember Peter DeFazio (Jan. 9, 2007).
19	Petition from Kelly Nokes, WildEarth Guardians, & Collette Adkins, Ctr. for Biological Diversity, to Scott Pruitt, Adm'r, U.S. Env't Prot. Agency (Aug. 10, 2017).
20	Canyon Mansfield, *My Best Friend, Kasey*, PREDATOR DEF. (Mar. 20, 2017).
21	USDA, APHIS, WILDLIFE SERVICES DIRECTIVE 2.415, M-44 USE AND RESTRICTIONS (2020).
22	U.S. DEP'T OF AGRIC., ANIMAL & PLANT HEALTH INSPECTION SERV., WILDLIFE SERVS., PRE-DECISIONAL ENVIRONMENTAL ASSESSMENT: PREDATOR DAMAGE MANAGEMENT IN NEBRASKA FOR THE PROTECTION OF LIVESTOCK, WILDLIFE, PROPERTY AND PUBLIC HEALTH AND SAFETY (1997).
23	Christopher Ketcham, *The Rogue Agency*, HARPER'S MAG., (Mar. 2016), https://harpers.org/archive/2016/03/the-rogue-agency.
24	A. S. LEOPOLD ET AL., USDA NAT'L PARKS SERV., WILDLIFE MANAGEMENT IN THE NATIONAL PARKS (1963).
25	Memorandum from Administrator Kevin Shea & Deputy Administrator William H. Clay, Wildlife Services to APHIS Management Team & Program Leaders Group (June 19, 2009).

Exhibit 1

13,129 individuals signed a petition, opposing Wildlife Services' practice of killing wildlife and supporting non-lethal methods of management, to be included with a petition for rulemaking.

Friend Friend - Santa Clara, CA 95050
Gary Guarniere - Bethpage, NY 11714
Rachel Klingberg - New York, NY 10019
Rollin Blanton - Pasadena, CA 91104
Kaayla Roth - Beverly Hills, CA 90210
Lee Tury - Highland, MI 48357
G Tomlin - Moraga, CA 94556
Betty Chan - Sunbury, OH 43074
Rich Speer - Wexford, PA 15090
Karol Long - Spokane Valley, WA 99216
Marissa Gonzalez - Woodbridge, VA 22193
Chemen Ochoa - Santa Fe, NM 87508
Ellen Wertheim - Rockaway Park, NY 11694
Wayne Person - Mount Laurel, NJ 8054
Julie Moylan - Tacoma, WA 98402
Cindy Girgenti - Danbury, CT 6811
Chris Grill - Albany, NY 12208
Dorothea Stephan - San Leandro, CA 94577
A. Michelle Perez - Sunnyvale, CA 94085
Kevin Laliberte - North Chelmsford, MA 1863
Julia Mitchell - Mill Valley, CA 94941
Stacy Bell - Hampton, VA 23663
J K - Saint Louis, MO 63105
Amanda Miller - Toano, VA 23168
Sandra Steinle - Saint Peters, MO 63376
Jaye Trottier - Bedford, NH 3110
Debra Rogers - Nicasio, CA 94946
Amy Sanders - Dayton, NV 89403
Karen Lyons kalmenson - Great Nck Plz, NY 11021
ingrid de Baintner MD - Dover, MA 2030
Frank Pilholski - Framingham, MA 1701

Stephen Flynn - Blairstown, NJ 7825
Joyce Barringer - Cambridge, MA 2140
Marilyn Bartnicki - Derry, NH 3038
Alison Robbins - Washington, DC 20036
Lynn Wilkinson - Port St Lucie, FL 34952
Dianne Lang - Toms River, NJ 8757
Erika Kugler - Fürth, AK 90766
Patricia PERRON - Seattle, WA 98119
Marina Sagardua - Boston, MA 2163
Annica Eriksson - Täby, AP 18750
Karin Tompkins - Yarmouth, ME 4096
Renelle Hebert - Woburn, MA 1801
Cynthia Barber - Algonquin, IL 60102
Paul Falon - Ann Arbor, MI 48104
Jamie Greer - West Orange, NJ 7052
Cindy Driscoll - Spring, TX 77379
Ann Hansen - Fredericksburg, IA 50630
Karen Rosa - Ellenton, FL 34222
Linnell Krikorian - Manchester, NH 3103
Virginia Hein - Goose Creek, SC 29445
steven nasta - New City, NY 10956
Kathy Alcott - South Portland, ME 4106
Carol And Barry Meehan - Wappingers Falls, NY 12590
Tammy Ebers-Radtke - Greenwood Lake, NY 10925
Gary Edwards - New York, NY 10011
Pamela Alvesteffer - Fremont, MI 49412
Dolores Grande - New York, NY 10010
Joanne Stovall - Covington, LA 70433
Dawn Petry - Gansevoort, NY 12831
Michael Trunk - Monroeville, NJ 8343
Dominic Percopo - West Haven, CT 6516
Elizabeth Chiribi - Medford, MA 2155
Cindy Borske - Manchester, IA 52057
Mary Nostramo - Massapequa, NY 11758
Merrie Thornburg - Attica, IN 47918
Terry Sarandrea - Lowell, MA 1852
Elizabeth Meszaros - New York, NY 10025
Dinah Chandy - Los Gatos, CA 95030
Elaine Green - Bellingham, WA 98229
Sylvia Vairo - Santa Cruz, CA 95062
Dolores Proubasta - Fayetteville, AR 72701
S Ward - Abilene, TX 79605
Barbara Rogers - Brier Hill, NY 13614
Vanessa Grosko - Deerfield, IL 60015

Todd Fisk - Las Vegas, NV 89183
Leila Ahmed - Littleton, CO 80127
Mike Wise - Littleton, CO 80127
Rosemary delPino - Baden, PA 15005
Stacey Mitchell - Catonsville, MD 21228
Jennifer Southee - Midlothian, VA 23112
DEBRA JONES - Yukon, OK 73099
Tiffany Nicol - Rio Rancho, NM 87124
deborah lancman - La Mesa, CA 91941
Carol Devoss - Saint Charles, IL 60174
Mark Strunk - Westminster, CO 80031
RANDI BRINKLEY - Canby, OR 97013
Catherine Cerqua - Telford, PA 18969
Brian Field - Thornton, CO 80260
Brittany Bannerman - West Peoria, IL 61604
Nanette Kazarian - Las Vegas, NV 89178
Kathryn Armstrong - Indian Trail, NC 28079
Lauren Spear - Alpine, TX 79830
Heidi Ludwick - Papillion, NE 68046
Robert Umbreit - Loveland, CO 80538
Christina Peterson - Kansas City, MO 64114
dee buttimer - Mattydale, NY 13211
Beverly Fowler - Cottage Grove, WI 53527
marcia sliwinski - Kenmore, NY 14217
Laura Guttridge - Vero Beach, FL 32963
JUDITH KAMON - Middleboro, MA 2346
Donna Noyes - Huntington, NY 11743
Katherine Solomita - Leland, NC 28451
Richard Kite - Washington, DC 20001
Susan Babbitt - Philadelphia, PA 19107
Katrina Shadix - Geneva, FL 32732
Tamar Diana Wilson - La Mesa, CA 91941
Melanie Newby - Bradenton, FL 34209
Dina Duffy - Waynesville, NC 28786
Tonya Demirjian - North Las Vegas, NV 89031
Jan Marie Moore - Dunedin, FL 34698
John mulder - Grand Rapids, MI 49504
Nancy Carl - Carlton, OR 97111
Lynn Webber - Spring Valley, CA 91977
Nicole Navratil - Arvada, CO 80002
Mia Hickey - Flagstaff, AZ 86001
Marcia Ouellette - Lafayette, IN 47905
Carol Boyd - Escondido, CA 92027
Anne Tomasko - Erie, CO 80516

Paul Corbeil - Thornton, CO 80229
Jan Karpel - Hopkins, MN 55305
Richard Gillaspie - White Bluff, TN 37187
Melissa Lederer - Port Angeles, WA 98363
Alexis Heflin - Clarksburg, WV 26301
Jaszmene Smith - Bridgeton, NJ 8302
Denise Inkel - Bal Harbour, FL 33154
Abby Causey - Kokomo, IN 46901
janese hexon - Pittsburgh, PA 15217
Jan Stark - Westminster, CA 92683
Kay Toth - San Saba, TX 76877
Ana-Paula Martins-Fernandes - North Andover, MA 1845
Roseann Trezza - Matawan, NJ 7747
Julie Griffith - Saint Charles, IL 60174
mary ruliffson - Victor, NY 14564
Barbara Wasserman - Chatsworth, CA 91311
Graciela Mella - Miami, FL 33186
Nancy Rupp - Glen Burnie, MD 21060
Ruta Soltanpour - Santa Monica, CA 90403
Catherine Sims - Durham, NC 27713
Denise Martini - Las Vegas, NV 89183
Tracy Cole - Glendale, AZ 85302
Laurel Brewer - West Hollywood, CA 90069
Sheri Randall - North Canton, OH 44720
Rosalind Ager - Madison, WI 53703
April Louis - San Diego, CA 92131
Nancy Drockelman - Batesville, IN 47006
Kristi Joy - Apache Junction, AZ 85119
Barbara Hanson - Tucson, AZ 85748
Harriet Shalat - Forest Hills, NY 11375
Elaine Frech - Downingtown, PA 19335
Tracy Ryland - Riegelsville, PA 18077
Stephen Sokol - Fairfax, VA 22032
Teresita Martinez - Miami, FL 33176
Julia N Allen PhD DVM - Edmonds, WA 98020
Nancy Nowak - Amherst, WI 54406
cecilia nevel - Saint Augustine, FL 32086
Jeb Fries - Fredonia, NY 14063
ASHLEE Savage - Norwood, MA 2062
Gregory Strauss - Chapel Hill, NC 27516
Ruth Arnone - Savannah, GA 31419
Ruth Arnone - Savannah, GA 31419
Janice WRIGLEY - Chicago, IL 60610
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Aleda Richardson - West Des Moines, IA 50266
tom connors - Arvada, CO 80004
Kathryn Nathan - New Orleans, LA 70117
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Annette Dekanich - Maryville, TN 37804
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Deborah Stegeman - Lone Tree, CO 80124
Luis Irizarry - Brandon, FL 33511
Dixie Springer - Chandler, IN 47610
STEPHEN CRANE - Paige, TX 78659
Karen Kennedy - Lombard, IL 60148
Dennis Morley - Old Bridge, NJ 8857
Jeffrey Nytko - Charlotte, NC 28209
Janet Christian - Beavercreek, OH 45430
Katherine Aker - Tujunga, CA 91042
Malisa Harding-DeOchoa - Pasco, WA 99301
Julie Roedel - Kirkwood, MO 63122
Natalya Cooke - Indianapolis, IN 46235
Disa Balderama - Downey, CA 90241
Leigh Anne Chavez - Albuquerque, NM 87111
Jamie Smith - Louisville, KY 40291
Carolyn Taylor - Wilmette, IL 60091
Ronald MacArthur - Port Orchard, WA 98366
Mary Walls - Jacksonville, FL 32218
Rosa Strayer - Jurupa Valley, CA 91752
Janet Heinle - Santa Monica, CA 90403
Sue Ross - Mansfield, OH 44907
Sofia Moya - San Juan, PR 918
Donna Ruehlow - Johnson Creek, WI 53038
Debra Plishka - Baldwinsville, NY 13027
Ken Ayres - Rockville, MD 20850
Gina LoBiondo - Havertown, PA 19083
Laura Blanchette - Aiken, SC 29801
John Schmittauer - Millfield, OH 45761
Erin Braybrook - Arlington, WA 98223
Aurora Caiano - Elizabeth, NJ 7201
Cecilia Correia - Elizabeth, NJ 7201
M Cecilia Correia - Elizabeth, NJ 7201
Ruth Correia - Elizabeth, NJ 7201
Maria Cecilia Correia - Elizabeth, NJ 7201
Diana Coppola - Boca Raton, FL 33498
Philipp Dines - Cleveland, OH 44106
Kelly Henderson - Los Angeles, CA 90064
Rochelle Massey - Peyton, CO 80831

R. William Tallichet - Breinigsville, PA 18031
James Dawson - Davis, CA 95618
Patty Gashlin - East Greenville, PA 18041
Sandi Allred - Wellington, FL 33414
Eugenia Mariano - Cheltenham, PA 19012
Rhonda Reichel - San Antonio, TX 78209
Laurel Kornfeld - Highland Park, NJ 8904
Michael Paul - Hopewell, NJ 8525
Cheryl Bulbach - New York, NY 10011
Robin morgan - Phoenix, AZ 85037
Carlos Zarur - Lafayette, CO 80026
Michelle Fox - Downey, CA 90241
Tanya Koester-Radmann - Chisago City, MN 55013
Wendy Johnson - Hammond, OR 97121
Ernest Boyd - Sunnyvale, CA 94087
Ketra Bock - Rio Rancho, NM 87144
Scott Neuhaus - Cincinnati, OH 45220
P Montgomery - Jasper, TN 37347
JACKIE Gray - Carrboro, NC 27510
Patrick Meleco - Warner Robins, GA 31093
Dominique Edmondson - Upper Marlboro, MD 20772
Mary Fekete - North Hollywood, CA 91602
Debra Swartz - Los Angeles, CA 90034
WILLIAM HARRIS - Los Angeles, CA 90024
Kim Nesgoda - Lake Elmo, MN 55042
Christy Carosella - Ozone Park, NY 11417
Gillian Parker - Fairfax, VA 22030
Vicki Johnson - Kansas City, MO 64137
Jolayne Justice - Las Vegas, NV 89166
Stacey Larson - Highlands Ranch, CO 80126
Julie Oakes - Henderson, NV 89002
KATHRYN WATKINS - Damascus, MD 20872
Kathi Geukes - Cedar Springs, MI 49319
Judith Ferrell - Elkhart, IN 46514
Jessica Dietrich - San Diego, CA 92131
Lisa Bolognese - San Diego, CA 92124
Dawn Spero - Enola, PA 17025
Mary Ann Dalton - Weirton, WV 26062
Doreen Mann - Lisbon, ME 4250
Cheryl Dare - Memphis, TN 38104
Robert Schicker - Crestview, FL 32539
susan tucker - Warren, PA 16365
Deb Sands - Deforest, WI 53532
S Murray - Moorestown, NJ 8057

Julie S - Concord, CA 94518
Paul Slack - Cutler Bay, FL 33157
Stacy Lang - Roscoe, IL 61073
Alexa Pallas - Encinitas, CA 92024
Peggy Carlson - Pinckney, MI 48169
Probyn Gregory - Tujunga, CA 91042
Stephen Maxwell - Kula, HI 96790
Brad Beldner - Palo Alto, CA 94303
Patty Duffy - Canal Winchester, OH 43110
John Di Biase - Morris, CT 6763
Mona Boggio - Columbia, SC 29212
Gabriele Naumann - Sacramento, CA 95838
Kim Munchel - Jupiter, FL 33458
Missy Harris - Nashville, TN 37205
Patricia Dangle - Montoursville, PA 17754
Melanie Stopyra - Syracuse, NY 13210
Wendy Bradish - Irwin, PA 15642
Karen Brown - Gilbert, AZ 85234
hazel davis - Cecilia, KY 42724
Patricia Vander Kamp - Calimesa, CA 92320
Katlyn Grieve - Akron, OH 44310
Mary Ann McFarland - Keswick, VA 22947
Judith Arayaes - Portland, OR 97223
Barbara Jackson - Saint Albans, WV 25177
Anita Schreiner-Weishaar - Free Union, VA 22940
Diane Gaertner - Commack, NY 11725
Don Thompson - Cambridge, MA 2139
Rhianna Heaster - Irvine, CA 92612
Debra Bartlett - Billerica, MA 1821
Theresa Winters - Enfield, CT 6082
michael dinoto - Burlington, NJ 8016
Paul Wick - Greenville, NY 12083
Denise Triest - Lebanon, PA 17046
Bernadine Smith - Perry Hall, MD 21128
Theodora Boura - Boston, MA 2135
Joseph Stegner - Cambridge, MA 2140
Sue McNally - Andover, NJ 7821
Tara Chambers - Concord, MA 1742
Joseph Kenosky - Mount Pocono, PA 18344
Patricia Heard - Center Sandwich, NH 3227
Takako Ishii-Kiefer - Matawan, NJ 7747
maureen cusa - Highland, NY 12528
Valerie Paterson - Pocahontas, AR 72455
Jonette Bronson - Telluride, CO 81435

Melanie Baldwin - Rockwell, NC 28138
Gwendolyn Kent - Mullica Hill, NJ 8062
Janet McCalister - Winston Salem, NC 27103
joan ryan - Fayetteville, GA 30215
Linda Kobler - Denton, TX 76209
Leslie Michetti - Parsippany, NJ 7054
Linda Maslin - Blue Bell, PA 19422
Laura Benassi - Woodbury, MN 55129
Martha Anderson - Albuquerque, NM 87112
Wynona Constance - Burns, TN 37029
Pamela Kane - Bedminster, NJ 7921
Alice Jena - Richmond Hill, NY 11418
Donald Daly - Chicago, IL 60655
Catherine Krug - Hendersonville, NC 28791
Rachel Clark - Hesperia, CA 92345
lorene altamore - Hollywood, FL 33026
Debora Moon - Saint Johns, FL 32259
Stephen Boletchek - Apex, NC 27502
Janet Robinson - Jacksonville, FL 32223
Nancy McBride - Palm Beach Gardens, FL 33418
R Daghighian - Foster City, CA 94404
Jerry Banks - Decatur, GA 30030
Brian Slosek - Durham, NC 27701
Donette Erdmann - Sheboygan, WI 53081
Alex Kowtun - Hornell, NY 14843
Francesca Rago - Pleasant Hill, CA 94523
Carole King - Glen Carbon, IL 62034
Leann Jones - Hollister, MO 65672
Ellen Ervin - Brooklyn, NY 11201
James Knott - Rankin, PA 15104
Rocky Ohnemus - Norfork, AR 72658
Patricia Vance - Tucson, AZ 85701
Danielle Varon - Sussex, NJ 7461
Keely Parr - Darien, CT 6820
James Mulcare - Clarkston, WA 99403
Elizabeth Butler - Henderson, KY 42420
Karen Carson - Rogers, AR 72758
Richard Barker - Beaverton, OR 97007
John Hawkins - Newbury Park, CA 91320
Karla Taylor - Olympia, WA 98502
Kristen Murray - Glenville, NY 12302
Wendy Adams - Chandler, AZ 85224
Lenore Beck - Tampa, FL 33612
Nancy Duncan - Walnut Creek, CA 94595

Elke Eggers - Albuquerque, NM 87112
Kalita Gunter - Erin, TN 37061
Laurie Grady - Binghamton, NY 13901
Edie Bruce - El Cerrito, CA 94530
James Henriksen - Prescott Valley, AZ 86314
Patricia Poole - Lake Isabella, MI 48893
Toby Ann Reese - Valley City, OH 44280
barbara cunningham - Glendale, CA 91205
Dymphna Agos - Trenton, NJ 8610
Bob Senko - Cape Coral, FL 33993
Cheri Siewert - Wausau, WI 54401
Lisa Lewis - Garner, NC 27529
lynn silvers - Amherst, MA 1002
Ye Shen - Daly City, CA 94014
Jane Rutkoski - Wilkes Barre, PA 18706
Jon Styre - Robins, IA 52328
Mariana Wittich - Columbus, OH 43228
Jennifer Eliker - Venetia, PA 15367
Terry Keil - Glen Burnie, MD 21061
Linda Ricks - Beaufort, NC 28516
Desiree Nagyfy - Deer Park, WA 99006
Timothy Post - Osawatomie, KS 66064
marlena tzakis - Milwaukee, WI 53227
Jerrilynn Tzakis - West Allis, WI 53227
Linda Saunders - Saginaw, TX 76131
Melanie Wenz - Provo, UT 84606
Esther Garcia - Los Angeles, CA 90015
Pamela Mcdonald - Riverside, CA 92505
Lisa Bedker-Madsen - Arlington, WA 98223
Dawn Lull - Waukee, IA 50263
Patricia Aker - Tigard, OR 97223
Leticia Malagon-Henderson - Lutz, FL 33549
Becky Connors - Galesburg, IL 61401
Dottie Lee - Austin, TX 78721
Jan Leath - Glendale, CA 91205
Tabby Dimock - Leroy, MI 49655
Christina Covello - Perry, GA 31069
naomi cohen - Albrightsville, PA 18210
Joey Cueto - Port Saint Lucie, FL 34984
Lorie Brock - Bomoseen, VT 5732
Florence Harty - White Salmon, WA 98672
Ingrid LeBlanc - Medford, OR 97504
Jaime Skizas - Mokena, IL 60448
Judith Mick - Kailua, HI 96734

Vanessa Richie - Vancouver, WA 98682
Pat Iacobucci - Montgomery, TX 77356
Lawrence Holtzman - Miami, FL 33173
maryan infield - San Luis Obispo, CA 93401
Randall Piazza - Plantation, FL 33322
Alicia Cuccia - Mokena, IL 60448
Roberta Overkamp - Minneapolis, MN 55449
Judy Erickson - Las Vegas, NV 89110
Angie Kosina - Scottsdale, AZ 85262
Sharon Ann Ridings - Lakeway, TX 78734
Stephen Ridings - Lakeway, TX 78734
Kimberly Seger - Kittanning, PA 16201
Mary Sue Staples - Charleston, SC 29403
Steve Groze - Youngsville, LA 70592
Charles A. Kush III - Middlesex, NJ 8846
Ellen Emerson - Bridgeport, CT 6605
Mary Wooldridge - Annapolis, MD 21403
Kristen Diaz - Surprise, AZ 85379
Jennifer Tozzi - Toms River, NJ 8753
Dameta Robinson - Wisconsin Rapids, WI 54494
Rosemary Goeller - Raleigh, NC 27603
Christi Heilbronner - San Antonio, TX 78252
david spaethe - Beech Grove, IN 46107
laura glenn - Overland Park, KS 66214
Sandra Kuschel - Coon Rapids, MN 55433
Karen Elger - Bronson, FL 32621
Kathy Mason - Sebewaing, MI 48759
Donna Leavitt - Toms River, NJ 8753
George Seuss - Chambersburg, PA 17201
Leah Wilson - Saint Charles, MO 63303
Marcia Godich - Trafford, PA 15085
Phoenix Giffen - Petaluma, CA 94952
andrew yuder - New York, NY 10023
William Lebich - Oxford, MI 48371
Margaret Vernon - Fonda, NY 12068
Evelyn Kocket - Carmel, NY 10512
Jonathan Gigear - Columbia, SC 29229
Terri Lynch - Pendleton, SC 29670
Michael Flaningam - Depoe Bay, OR 97341
Sherri Knapp - Shenandoah, PA 17976
Donna Drake - Driftwood, TX 78619
Mark Eller - Aransas Pass, TX 78336
Meecy Carmichael - Charlotte, NC 28226
Darlene Baker - Austin, TX 78732

Deborah Weber - Ashland, OH 44805
Steve Sketo - Bakersfield, CA 93312
Felena Puentes - Bakersfield, CA 93312
Nathalie dimm - San Diego, CA 92109
Deena Reed - Osseo, MN 55369
Shannan Johnson - Kissimmee, FL 34744
Catherine Nelson - Fort Myers, FL 33913
Katherine Richardson - Ayr, NE 68925
Katie Carroll - Athens, NY 12015
Jann Lee - Walnut Creek, CA 94595
Kathleen Mireault - Quincy, MA 2169
Elissa Mericle-Gray - Berwick, ME 3901
karen hooker - Thousand Oaks, CA 91360
Karyn Gold - Pembroke Pines, FL 33027
Diane Fields - Williamsburg, VA 23188
Sandra Levine MD - San Rafael, CA 94903
Dianne Ensign - Portland, OR 97219
Kimberly Carona - Sacramento, CA 95822
Dyan Osborne - Brentwood, CA 94513
George Bilyeu - Reston, VA 20190
Sarah Uharriet - St George, UT 84770
Jon Drago - Baton Rouge, LA 70815
William Bratten - Harrisburg, PA 17111
Gail Eatherly - Santa Barbara, CA 93111
MaryAnn Tittle - Phelan, CA 92371
Tracy Gilbert - Rialto, CA 92377
Beverly Hovsepian - Fresno, CA 93711
Jean Wiant - Glenolden, PA 19036
Kathryn Jacobs - Chelan, WA 98816
Stephen Mitchell - Newark, NY 14513
Kelly Caffrey - Parlin, NJ 8859
Janet Walls - Minden, NV 89423
Paulette Metzler - Lakewood, CO 80401
Glenn Hufnagel - Buffalo, NY 14215
Ashley Diaz - Miami, FL 33177
Michael Gan - Pueblo, CO 81007
Sylvia Mills - Fairfax, VA 22030
Tammy Luppino - Winchendon, MA 1475
Sharon Langworthy - Liverpool, NY 13088
Francine Clough - Williamsburg, VA 23188
Amy Kalblein - Port Jervis, NY 12771
Sandra Woodall - San Antonio, TX 78212
sharon Meagher - Berryville, VA 22611
Anthony Donnici - Liberty, MO 64068

Marie Maciel - Bridgewater, NJ 8807
KAREN BAUM - Palestine, TX 75801
Lora Lopes - Fredericksburg, VA 22408
Rosemarie Sawdon - Blacksburg, VA 24060
P McKenna - Oak Park, IL 60304
Jeannine Pinnt - Bothell, WA 98011
Roya Eliafan - Los Angeles, CA 90049
Andrew Umphries - Tucson, AZ 85749
Rochelle Lazio - Lakewood, OH 44107
Cynthia Unninayar - Columbia, MD 21044
Pascale Clerie - Princeton, FL 33032
Larry Fish - Moreno Valley, CA 92557
Candice Schellenger - Reno, NV 89523
Holli Sawyer - Newport News, VA 23601
Jarrett Cloud - Stanhope, NJ 7874
Krystal Fletcher-Burroughs - Palm Harbor, FL 34683
David Lowell - Roswell, GA 30075
Amanda Salvner - Ann Arbor, MI 48104
Judy Wang - Campbell, CA 95008
Joyce Lahna - Hastings, FL 32145
Everett Suchland - Darlington, SC 29532
Stephan Donovan - Oro Valley, AZ 85737
Cyndi Palmer - Overland Park, KS 66215
Constance Lalena - Sunrise, FL 33323
Barbara Blackwood - Spokane Valley, WA 99206
Margaret Beckman - Hayward, WI 54843
Cathy Medley - Cato, NY 13033
Victor Khayat - Reston, VA 20194
Carol Williamson - Aurora, CO 80012
Justin Froman - Indianapolis, IN 46236
Dona Ward - Eugene, OR 97402
Barbara Miller - Franklin, NJ 7416
Sandra Quasarano - Manchester, NJ 8759
Lorraine Austin - Braintree, MA 2184
Steven Fenster - Pemberton, NJ 8068
Adele Halbreich - Lunenburg, MA 1462
Lauren Eckert - Castleton, NY 12033
Desiree Rammon - Oreland, PA 19075
Lorenz Steininger - Stafford, VA 22554
Adriana Chalson - Wallingford, PA 19086
Carol Meade - Dennis, MA 2638
Kathy Worthington - Stonington, CT 6378
Deborah Spencer - Billerica, MA 1821
Anne Johnson - Somerville, MA 2145

Alexa Wall - Leicester, MA 1524
JOHN LEONARD - Pittsburgh, PA 15202
Jane Campeau - Dune Acres, IN 46304
Melanie Cohick - Boiling Springs, PA 17007
Janet MacBeth - Upton, MA 1568
Patti Blevins - Phillips, ME 4966
Paula Dailey - Rochester, NY 14606
Jacquelyn Digiovanni - Pittsford, NY 14534
lisa lendl-lander - Mcknight, PA 15237
MaryAnn Stanislowsky - Jonesborough, TN 37659
Carolyn Silvestro - Huntington, NY 11743
Samantha Daugherty - Frederick, MD 21702
Elaine Fontaine - Lake Worth Beach, FL 33460
Vitra García - Miami Shores, FL 33138
Scott Gibson - Saint Albans, WV 25177
Patricia Valadez Gonzalez - New York, NY 10024
Juliann Heilhecker - Canton, GA 30114
Deidre Koch - Round Rock, TX 78665
Muriel K Kruppa - South Portland, ME 4106
Diane Felci - Clearwater, FL 33756
Cornelia Teed - Bellingham, WA 98225
doug krause - Fargo, ND 58102
Nancy Hunter - Gold River, CA 95670
Joyce Grajczyk - Kent, WA 98031
Michele Banks - Redding, CA 96003
Yoko Hoffman - Seaside, CA 93955
Valerie Brown - Crownsville, MD 21032
Theresa Hebron - Fredericksburg, VA 22401
Beverly Ann Summers - Jacksonville, FL 32246
Veronica Quiris Raschko - Napa, CA 94558
Georgia Forbes - Clio, MI 48420
Denise Magee - Renton, WA 98057
Sandra Gray - Forked River, NJ 8731
tessa sucher - West Des Moines, IA 50266
Marlene Roddy - Philadelphia, PA 19115
Tanya Piker - La Junta, CO 81050
Janet Fincannon - Punta Gorda, FL 33950
Karen Jacques - Sacramento, CA 95811
Gregg Morris - Conifer, CO 80433
Jeanette Slichenmyer - Sherborn, MA 1770
Alan Bradley - Lombard, IL 60148
Kristen Bossert - Milton, DE 19968
Kara J Lau - East Peoria, IL 61611
Linda Headley - Cross City, FL 32628

Michelle Vicat - Stuart, FL 34994
Kevin Fitzgerald - Vernon Rockville, CT 6066
Colleen Wheeler - Atlanta, GA 30327
Mark Koritz - Atlanta, GA 30338
Carol Brinkman - Delphos, OH 45833
Tammy Bullock - Ramona, CA 92065
Sandra Weber - Toledo, OH 43615
Krista Taylor - Aurora, CO 80011
Claire Bush - Austin, TX 78722
Dave Frank - Ankeny, IA 50023
Anita Wright - Fort Collins, CO 80521
Estella Hernandez - San Antonio, TX 78223
John Boyer - Bronson, FL 32621
Nicole Tourgee - El Paso, TX 79936
Kimberly Shafer - Edgewood, WA 98372
Sandra Bergman - Puyallup, WA 98371
Michael Chapman - Atlanta, GA 30306
Elizabeth Cherubin - Camden, DE 19934
Elizabeth Cherubin - Camden, DE 19934
Linda Stein - New York, NY 10012
Catherine Harper - Port Angeles, WA 98362
Kathy Bradley - Lugoff, SC 29078
Elizabeth Ladiana - Ventura, CA 93003
Anne Tuddenham - El Cerrito, CA 94530
Misty Hay - Santa Rosa, CA 95407
Terrie Smith - Spring Valley, CA 91977
Patti Davis - Santa Monica, CA 90403
Donna Eveland - Camarillo, CA 93010
Julie Holly - Luling, TX 78648
Frederick Hamilton - Rancho Cucamonga, CA 91739
Raquel Cito - Moreno Valley, CA 92557
Judie Rae - Nevada City, CA 95959
Michaelene Galus - Lemont, IL 60439
Dennis Szczesniak - Lemont, IL 60439
Chris R - Dallas, TX 75231
G J - Becket, MA 1223
Cynthia Loucks - Prescott, AZ 86303
Mitchell Bogard - New York, NY 10025
Tracy Paskas - Rutherford, NJ 7070
Barbara Merrill - Union, NH 3887
Anne Golub - Jacksonville, NC 28540
kathy steinbrecher - Lafayette, CA 94549
Robert Honish - Denver, CO 80223
Dawn Jarusinsky - Austin, TX 78739

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Heidi Schmitz - Charlotte, NC 28203
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Marilyn Wendt - San Jose, CA 95125
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Jean Chagnon - New York, NY 10001
Steven Kuntzman - Kalamazoo, MI 49008
Britani German - Fresno, CA 93727
Missie Eshbaugh - Fort Myers, FL 33901
Mari Dominguez - Lodi, CA 95240
Eric Dougherty - Perkiomenville, PA 18074
John Finocchiaro - Melbourne Beach, FL 32951
Johnny Hall - Dana, KY 41615
SANDEE WILLIAMS - Union City, PA 16438
Andres Heljula - Freeport, IL 61032
Michelle Piazza - Spring Hill, FL 34608
Denise Henyard - Eastvale, CA 91752
David Ben Haim - Sun City West, AZ 85375
Greg Stawinoga - South Holland, IL 60473
Guadalupe Yanez - El Paso, TX 79938
John Desimone - Freehold, NJ 7728
Francine Lipka - Keansburg, NJ 7734
Nancy Sheerer - Wilmington, NC 28411
Dorothy Anderson - North Weymouth, MA 2191
Christine Lindsey - Casper, WY 82609
Kristen Lowry - Vacaville, CA 95688
Crystal Berg - Whiting, IN 46394
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Jerrilyn Miller - Valley Village, CA 91607
Penelope Adams - Broomfield, CO 80021
John Miller - Carol Stream, IL 60188
Laura Benge - Batavia, OH 45103
Yvette Tapp - Santa Fe, NM 87506
Laverne Penn - Cleveland, OH 44124
Michelle Macy - Houston, TX 77077
Mary Pianko - Greensburg, PA 15601
Emily Chambers - Ashland, VA 23005
Danelle Kinion - Panama City Beach, FL 32413
Stephen Powell - Central, SC 29630
LAWRENCE BROWN - Absecon, NJ 8201
al shayne - Los Angeles, CA 90036
Joyce L Britcher - Cape Coral, FL 33909

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Nasha Butterfield - O Fallon, MO 63366
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Barbara Hart - Jacksonville, FL 32225
Laurel Anderson - Phoenix, AZ 85032
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Deborah Jaworski - Charlotte, MI 48813
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Karen Runk - North Smithfield, RI 2896
Sunah Bhasin - South River, NJ 8882
Donna Rivett - Frankfort, NY 13340
Deborah Libby - Berrysburg, PA 17005
Luiza Grunebaum - Denville, NJ 7834
Michelle Eaton - Cedar Rapids, IA 52402
Judy Bash - Little Rock, AR 72211
Jim Hanson - Winter Park, FL 32789
Julia Knaz - Mountainside, NJ 7092
Nadine Blancato - Huntersville, NC 28078
Karen Eva - Pemberton, MN 56078
Jessica Dardarian - Folsom, CA 95630
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Tricia Gibson - Arp, TX 75750
lisa allarde - Kunkletown, PA 18058
allison Alberts - Kunkletown, PA 18058
Nancy Byron - Cypress, TX 77429
Heather Mann - Spotsylvania, VA 22553
Sonnta Simon - Littleton, CO 80126
Sarah Chotiner - San Diego, CA 92130
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Jo Jones - Clearwater, FL 33764
Kelly Rutherford - San Antonio, TX 78245
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Beverly Williamson-Pecori - Mc Kees Rocks, PA 15136
Lois nottingham - Prescott, AZ 86301
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Beverly Morin - Grayson, GA 30017
Leslie Spoon - Los Osos, CA 93402
Linda Rossin - Lake Hopatcong, NJ 7849
Jean Sim - Marlborough, MA 1752
Gary Gerell - New Fairfield, CT 6812
Kellie Smith - Deering, NH 3244
Charlotte A Clarke - Piscataway, NJ 8854
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Michelle Schmitt-DeBonis - Milltown, NJ 8850

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Deirdre Gately - Yonkers, NY 10704
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Patricia Williams - Jamestown, NY 14701
Dana Engell - Mount Vernon, OH 43050
Margaret Biase - Norwalk, CT 6855
Michelle Henderson - Auburn, MA 1501
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Lorilie Morey - Santa Rosa, CA 95401
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Lynn Diakogiannakis - Berkeley Heights, NJ 7922
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Elsie Rivera - Orlando, FL 32826
Kendra Knight - Burlingame, CA 94010
Edna Kemmitz - Brownwood, TX 76801
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Susan Walker - Winchester, VA 22601
Deborah Calabrese - Poughkeepsie, NY 12603
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Linda Pemberton - Modesto, CA 95350
Michelle Setaro - Modesto, CA 95350
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George Ruiz - San Carlos, CA 94070
Soozi MacLeod - Hopkins, MN 55343
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Gail King - Framingham, MA 1701
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Wanda Nelsen - Ashland, OR 97520
Martha Aubin - Santa Barbara, CA 93109
Marcia Wells - Fort Collins, CO 80524
Robert Janusko - Bethlehem, PA 18018
Anna Dahlberg - Raglan, AK 3296
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Linda Howell - Norfolk, VA 23507
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Peggy Schramm - Waukegan, IL 60085
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Ian Thomsen - Venice, FL 34293
Cindy Maldonado - Brandenburg, KY 40108
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WALTER EMERICH - Wisconsin Rapids, WI 54495
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Patricia Gregory - Farmington, NY 14425
Ellen Straw - Covina, CA 91722
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Kathryn Rogers - New Berlin, WI 53151

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Rebecca Muzychka - Fort Lauderdale, FL 33304
William Walker - Jacksonville, FL 32221
Sonja Finnie - Yucaipa, CA 92399
Hera Gerber - Saint Louis, MO 63131
Norman Sandel - Beacon Falls, CT 6403
Eleanora Kling - Brooklyn, NY 11238
Carrie Tanke - Monument, CO 80132
Doug Roaten - Matthews, NC 28105
Jackie Cole - Woodinville, WA 98072
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Patricia Bocanegra - San Antonio, TX 78231
Lourdes Lopez - Hialeah, FL 33012
Janeene Porcher - Golden, CO 80401
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Teri Johnson - Portland, CT 6480
Marcia Walker - Henderson, NV 89012
Janet Duran - New York, NY 10012
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Laurie Blanding - Midlothian, VA 23112
Nigel Sawyer - Jackson, GA 30233
Serene Roxanne Henry - Ashland, OH 44805
Steven Standard - Bellflower, CA 90706
Kathryn Dakis - New York, NY 10021
Donna Smith - Havertown, PA 19083
Doris Applebaum - Oak Park, MI 48237
Beal Families - Del Mar, CA 92014
Allister Layne - Conyers, GA 30094
Judith King - Vero Beach, FL 32968
Reann MacDonald - Jeannette, PA 15644
Louis Anipen - Tampa, FL 33606
Arlene Aughey - Saddle Brook, NJ 7663
Martin Reifinger - Woolwich, ME 4579
Sabrina Thompson - El Dorado Hills, CA 95762
Paula Tleimat - Concord, CA 94520
Freya Harris - Atlanta, GA 30310
Leonard Piersialla - Willow Springs, IL 60480
Kristen Tesch - Pine, CO 80470
Dan McAtee - Pine, CO 80470
Linda Conner - Miami, FL 33176
Leland Long - Denver, CO 80206

Linda Indyke - Cockeysville, MD 21030
Dana Petre-Miller - Keizer, OR 97303
Patricia Calascibett - Sun City, AZ 85351
Elisa Townshend - Denver, CO 80206
Justin Philipps - Newark, OH 43055
Margarita Gonzalez - Sylmar, CA 91342
Margarita Perez - Sylmar, CA 91342
Patricia Cetrone - Warren, OH 44484
Sandy Marschner - Worcester, MA 1606
Julie Richards - Clackamas, OR 97015
Kevin Bugman - Grand Island, NY 14072
Jeremy Trimm - Suisun City, CA 94585
Janelle Church - Yelm, WA 98597
Phyllis Turner - Winslow, AZ 86047
bethany witthuhn - North Royalton, OH 44133
Lyn du Mont - Golden, CO 80401
Jonathan McCann - Sag Harbor, NY 11963
Terry Yada - Kailua, HI 96734
Michelle Malaspino - Fairhaven, MA 2719
Alexander Mateo - Staten Island, NY 10305
Amy Cyr - Tolland, CT 6084
Hillary Derby - Roslindale, MA 2131
Ginny Johnson - Mountain Lakes, NJ 7046
Savannah Sherman - Saint Augustine, FL 32084
Antoinette Dusaid - Beverly Hills, CA 90211
Laura Cochrane - Asheville, NC 28806
Lisa Elderton - Bayville, NJ 8721
David G. Laramie - Shrewsbury, MA 1545
Kendra Daniel - Park Ridge, NJ 7656
Jane Warring - Versailles, KY 40383
Eric Newman - Bronx, NY 10475
Dawn Zelinski - Middletown, NJ 7748
Lesley Vainder - Fairfield, CT 6824
Sandra Sobanski - Brooklyn, NY 11218
Julia French - Lenox, MA 1240
Josette Le Beau - Neptune, NJ 7753
Jo Ann McGreevy - Hackensack, NJ 7601
Patricia Tholl - Needham, MA 2492
Kim Ramert - Okoboji, IA 51355
Debi Griepsma - Fontana, CA 92335
Victoria Urias - Seattle, WA 98125
Marcie Milam - Arlington, TX 76012
Michelle Sewald - Denver, CO 80202
Devon Benton - Naples, FL 34113

Ryan Sullivan - Naples, FL 34113
Terace Lasal - Albion, NY 14411
Trudy Sauvageau - North Myrtle Beach, SC 29582
Fran Ferdinand - Saint Louis, MO 63117
Terri Copps - Dayton, MN 55327
Shelley Vyas - Wake Forest, NC 27587
Beatrice Simmonds - Bronx, NY 10462
Thomeen Womack - Lincoln, CA 95648
Vanessa Barr - Bastrop, TX 78602
Debbie Devers - York, PA 17401
Bellanira Tiguila - Pasadena, CA 91104
Angela Rodden - Ardmore, OK 73401
Marie Hendon - Lake Villa, IL 60046
Donald Hendon - Lake Villa, IL 60046
Cheryl Maslin - Alameda, CA 94501
Andrew Jackson - Houston, TX 77047
Scott Grubb - Middlesboro, KY 40965
David. Mergen - Tucson, AZ 85715
Gerhard Weinberg - Efland, NC 27243
Nancy Young - Columbus, OH 43227
Suzy Berkowitz - Loxahatchee, FL 33470
Peggy Jewell - Madison, NC 27025
Robert Ricewasser - Monrovia, CA 91016
Daniel L Harris - Medford, NY 11763
Barbara Prato - New York, NY 10021
Andy Ersfeld - Hailey, ID 83333
Valerie Stein - Delray Beach, FL 33445
Ann Chavez - Chico, CA 95926
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Linda Farrell - Minneapolis, MN 55404
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Raquel Narvios - San Francisco, CA 94134
Mary Hirsch - Colorado Springs, CO 80921
Bernadette Andaloro - East Syracuse, NY 13057
Marcia Brier - Hillsborough, NH 3244
Lance Harrington - Miami, FL 33186
Barbara Mathes - Rio Rico, AZ 85648
Perry Gx - Tustin, CA 92780
Teresa Ohmit - Lakewood Ranch, FL 34202
Nancy Parlin - Charlotte, NC 28277
Jeffery Blanton - Cherryville, NC 28021
Lisa Wirth - Allentown, PA 18104
Paul West - Fort Collins, CO 80526
Mary Ragsdale - Ripon, CA 95366

Sherry Weiland - Hudson, MA 1749
Cathi Gilmore - Waban, MA 2468
Deborah Rawlinson - San Francisco, CA 94109
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Hannah King - Jackson, MS 39211
Karen Mizell - Orem, UT 84097
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Nancy Pope - Tarpon Springs, FL 34689
Alyssa Darlington - Fairfield, OH 45014
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lawrence gauci - Newport, KY 41071
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Lynn Pooley - Lakewood, OH 44107
Debra Smith - Milwaukie, OR 97267
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Simone Fonseca - Victorville, CA 92394
Julie Sanich - Dewey, AZ 86327
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Mark Dupps - Cincinnati, OH 45233
Claire Prevost - Granby, NY 0
Mark Garman - Cambria, CA 93428
Maria Cantwell - Naples, FL 34114
Susan Goldstein - Fort Myers, FL 33908
Erika Miller - Oronogo, MO 64855
mike dabrowski - Palm Harbor, FL 34683
Robert Lombardi - Brooklyn, NY 11234
Catherine Morris - Ashland, OR 97520
Colleen Auernig - Folsom, CA 95630
Thom Sherman - Butler, PA 16001
Donna Rose Sherman - Butler, PA 16001
Christine Elie - Littleton, MA 1460
Garth Wilson - Columbus, OH 43228
Sabine Bestier - Gig Harbor, WA 98332
Keri Knuthson - Paradise, CA 95969
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Connie Nothwang - Poway, CA 92064
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Christine Jeffson - Monument, CO 80132
patricia beasley - Winter Park, FL 32792
Tracie Finley - West Columbia, SC 29172
Gina Luizzi - Naples, FL 34119
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Susan McClure - Bozeman, MT 59715
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Carol Scherpenisse - Spring Lake, MI 49456
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Angela Wilkinson - Universal City, TX 78148
Bita Rezvani - Thousand Oaks, CA 91360
Kelli Ratliff - Irvine, CA 92604
Sue Cugini - Whittier, CA 90604
Anna Cruikshank - Springfield, OH 45506
Linda Jewell - Naples, FL 34117
Julia Hustad - Erdenheim, PA 19038
Suzanne Kirby - Sag Harbor, NY 11963
Jill Dione - Palm Coast, FL 32137
Victoria Wollam - Norwell, MA 2061
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Sally Warner - Califon, NJ 7830
Judy Greene - Waterbury, CT 6708
Cheryl Minieri - Byfield, MA 1922
Sandy Sanderson - Houston, TX 77046
Linda Nosser - Phoenixville, PA 19460
Alfred Mancini - Tewksbury, MA 1876
Susen Shapiro - Egg Harbor City, NJ 8215
Mary Goetz - East Haven, CT 6512
Jennifer Ivers - Forty Fort, PA 18704
Georgia Shankel - Chicago, IL 60624
Deborah Kenakin - Durham, NC 27713
Shelley Torres - Fort Pierce, FL 34947
Beth Schulz - Asheville, NC 28803
Jane Montonen - Palm Beach, FL 33480
Kathryn Johanessen - Stamford, CT 6906
Juan Gonzalez - Manchester, CT 6040
Christine Grossen - Walnut Creek, CA 94595
Barb Robertson - Middletown, OH 45044
Kira Labinger - New York, NY 10029
Amanda Lowe - Boise, ID 83702
Brenda Eckberg - Pekin, IL 61554
karen sanford - Umatilla, FL 32784

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Kristine Lacy - Tampa, FL 33625
Angie Spearman - San Diego, CA 92109
Becky Mcclain - Hudson, FL 34667
Misty Parrillo - Corpus Christi, TX 78412
Sandi Hefner - Cocoa Beach, FL 32931
Dennis Peternell - Webb City, MO 64870
Susan Loomis - Renton, WA 98058
Patricia Smetanka - Bonita Springs, FL 34135
Michael Smetanka - Bonita Springs, FL 34135
Diane LaMagdeleine - La Grange Highlands, IL 60525
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Lisa Steele - Roseville, CA 95661
Shana Van Meter - Irvine, CA 92614
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Robert Stark - Houston, TX 77062
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Pauline Parkin - Pittsburgh, PA 15227
Candy Bowman - Placerville, CA 95667
Lisa Haut - Bridgeport, CT 6610
Jan Lowrey - Hallsville, MO 65255
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Evelyn Kean - Pittsburgh, PA 15204
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Lisa Thorpe - Olathe, KS 66062
Elaine Arthur - Westborough, MA 1581
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Paul Ramos - Santa Ynez, CA 93460
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Jim Head - Oak Park, MI 48237
Susan MacDuff - Mineral, VA 23117
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Roxanne Dunn - Chicago, IL 60626
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Laurie Lears - New Freedom, PA 17349
Steve Harris - Saint Petersburg, FL 33704
Amy Wood - Grosse Pointe Park, MI 48230
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Caroline Van Haeften - Ventura, CA 93001
Karen Holman - Fruita, CO 81521
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Jackie Bomgardner - Goodyear, AZ 85338
Brenda Gamache - Seymour, TN 37865
Allison Robbins - Des Moines, IA 50316
Tracey Downing - Victorville, CA 92395
Angela Villafane - Miami Lakes, FL 33016
Rhonda Gaitan - Miami, FL 33193
Janie Allen - Martin, KY 41649
Nancy Hoort - Hull, MA 2045
Michelle Davis - Vacaville, CA 95688
Michele Lowery - San Antonio, TX 78242
Marcia Rogers - Fillmore, UT 84631
Melissa Duralia - Wellington, FL 33414
Wrenn Reed - Brookline, MA 2446
Peter Bromer - Miami, FL 33162
Kerry Hodges - Birmingham, MI 48009
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Kelly Deese - Honolulu, HI 96822
Patricia Kerstner - Phoenix, AZ 85048
Anne Olivares - Phoenix, AZ 85022
Katherine Silvey - Martinez, CA 94553
Miyuki Powell - Midway City, CA 92655
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Miranda Helly - Oakland, CA 94612

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Joelle Porter - Reno, NV 89506
Joanie Doas - Fort Worth, TX 76177
Linda Maines - Charleston, SC 29412
Kevin Quail - Placitas, NM 87043
Chad Kapusta - Vista, CA 92081
Angela Clayton - Vista, CA 92081
Tyler Fitzgerald - Vista, CA 92081
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Jean Schlachter - Loudon, TN 37774
AJ Cho - San Leandro, CA 94579
JOHN Lamb - Sierra Madre, CA 91024
Deborah Chronister - Ocala, FL 34473
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Paula Morgan - Winter Springs, FL 32708
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Kian Kad - Rancho Santa Margarita, CA 92688
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Michele Bacher - Minneapolis, MN 55432
Tammy Knoll - Sioux City, IA 51106
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heidi shuler - Vancouver, WA 98682
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Jane Love - Socorro, NM 87801
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Sara Carroll - Boulder City, NV 89005
Robert Akerley - Deland, FL 32720
Rose McBride - De Soto, MO 63020

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Emily Hurn - Belchertown, MA 1007
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Donna Wissinger - Matthews, NC 28105
Cheri Kunz - Woodinville, WA 98077
Cindy Horn - La Fayette, NY 13084
Janie Conroy - Cincinnati, OH 45223
Colleen Carroccia - Toms River, NJ 8755
joey delhoste - Denham Springs, LA 70726
sara stepnicka - Phoenix, AZ 85022
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Lorna Luther - Sioux Falls, SD 57103
Tina Lewis - Mission, TX 78572
Holly Luban - Atascadero, CA 93422
Marilyn Fisher - Waukesha, WI 53186
Barb Woods - Clovis, CA 93611
Ruth Boice - Shamong, NJ 8088
Katika Chuon - Jacksonville, FL 32233
Daniel Gan - Des Moines, IA 50310
Sandi Aden - Lincoln, NE 68521
Mary Sterling-Wiener - Sarasota, FL 34236
Michele Miklinski - Clearwater, FL 33756
Edward Crawford - Norfolk, VA 23509
MariLynn Herman - Mandan, ND 58554
Danielle Ifrah - Pembroke Pines, FL 33027
Lisa Moskal - Joliet, IL 60432
Glen Wetzel - Surprise, AZ 85374
Lesley Goodyk - Knoxville, IA 50138
Jane McConville - Chicago, IL 60640
Steven Sy - East Lansing, MI 48823
Bill Herman - Crown Point, IN 46307
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Trois Moore - Goffstown, NH 3045
Sue Filley - Elkhart, IN 46514
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Stephaney Lloyd - S Pasadena, CA 91030
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Justin Berg - New Berlin, WI 53151
Jason Scharnagel - Concord, CA 94520
Elaine Donovan - Cedar Rapids, IA 52405

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Ellen Long - Durham, NC 27713
Robyn Dibble - Raymond, NH 3077
Enid Breakstone - Manchester, CT 6040
Tara Cufaude - Sacramento, CA 95819
jaime campora - Palm Bay, FL 32908
Marie Fannin-Laird - Paradise, CA 95969
Marie Elaina Rago - Northampton, PA 18067
Avril Barron - San Anselmo, CA 94960
Roger Southward - Placitas, NM 87043
Karen Nease - Rockmart, GA 30153
Linda Guagliardo - Ridge, NY 11961
Suzanne Muir - San Marcos, CA 92078
John Roig - Santa Fe, NM 87506
Vicki Hightower - Bates City, MO 64011
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Marisa Erdmann - West Allis, WI 53214
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Margaret Fularczyk - Surprise, AZ 85374
Diane Kastel - Wheaton, IL 60189
Marguerite Juliusson - Chicago, IL 60614
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Vicki Davis - San Jose, CA 95125
Kaylynn Wilson - Rainier, WA 98576
Mele Liss - Pacific Palisades, CA 90272
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Sofia Dober - Elk Grove Vlg, IL 60007
Natalie Peterman - Fleming Island, FL 32003
Bonnie Hackett - South Berwick, ME 3908
Janis Ciaramello - Johnston, RI 2919
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Sandra Zaninovich - Los Angeles, CA 90024
Elizabeth Yuster - Spencerville, MD 20868
Valerie Huffman - Portland, OR 97217
Maryanne McNab - Eden Prairie, MN 55346
Patty OToole - King City, OR 97224
Shirley Hale - Lovell, ME 4051
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Randle Sink - Huntington Beach, CA 92649
Matthew Lasky - Woodbridge, NJ 7095

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Miki Stokes - Ladera Ranch, CA 92694
Sofia Montemayor-Thomas - Burlington, VT 5405
Tammy Banks - Simsbury, CT 6070
Tony Segura - Las Vegas, NV 89106
Linda Bolduan - Lake Oswego, OR 97034
Fran Mason - Port Angeles, WA 98362
Sharon Miles - Placentia, CA 92870
Elaine Byrne - Austin, TX 78717
Carol Taggart - Menlo Park, CA 94025
Gabrielle Swanberg - Petaluma, CA 94954
Michael Spafford - Lima, OH 45805
Peggy Crowl - Trinity, TX 75862
Gary Shull - Naples, FL 34109
Ronit Corry - Santa Barbara, CA 93101
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Patricia Burton - Gaithersburg, MD 20877
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Nancy Leiting - Lemont, IL 60439
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Lisa Ann Kelly and Family - Santa Barbara, CA 93101
Gail Garson - Madera, CA 93638
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Deborah Williams - Aurora, CO 80017
Gloria Navan - Lawrenceville, GA 30043
Lisa Watson - West Mifflin, PA 15122
Elsy Shallman - Loxahatchee, FL 33470
Maria Mariorenzi - Cranston, RI 2920

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Michael Bertrams - Oroville, CA 95966
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Vanessa Ipsen - San Carlos, CA 94070
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Leslie Siegel - Jupiter, FL 33478
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John Nickey - Hanover, PA 17331
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Kenneth Ruby - Salem, NH 3079
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Melissa Spengler - Pueblo, CO 81001
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Janet Bolasci - Rutherford, NJ 7070
Janice Cashell - Bethlehem, CT 6751
Gayla Gordon - Prescott, AZ 86301
Lori Williams - Appleton, WI 54914
Beverly Mitchell - Boise, ID 83709
Suzanne Billings - Puyallup, WA 98375
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Theresa Gallagher - Mesa, AZ 85210
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Chris Kotschi - Fort Worth, TX 76120
Willie Hinze - Winston Salem, NC 27106
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Frances Bell - Saint Paul, MN 55104
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E F - Fort Myers, FL 33967
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Sherri Young - Beaver, PA 15009
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Joseph McCullough - Woodlyn, PA 19094
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Erin Mitchell - Pflugerville, TX 78660
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Teresa Thompson - Ridgewood, NY 11385

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Grisel Rodriguez - Miami Gardens, FL 33169
Sarah Welte - Beaverton, OR 97007
rod hemmila - Saint Paul, MN 55110
Helen Process - Centerville, PA 16404
Robert Hoitela - Piscataway, NJ 8854
Erfin Hartojo - Walnut, CA 91789
Jackie Samallo - Walnut, CA 91789
Rita Thio - Walnut, CA 91789
Christine Resch - Whitehall, PA 18052
Cathy Martin - Smyrna, GA 30080
Alex Cifelli - Fairfield, NJ 7004
Dianne Peterson - Dana Point, CA 92629
Gerald Ryan - Flemington, NJ 8822
Jeanne Cambouris - Flemington, NJ 8822
Jeanne Bradbury - Flemington, NJ 8822
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Donna Hreha - Port Jefferson Station, NY 11776
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Anne Liguori - East Hampton, NY 11937
Brenda Agnew - Haverhill, MA 1832
Tracy Verardi - Marquette, MI 49855
June Curley - Weare, NH 3281
Cory Ferguson - Driftwood, TX 78619
CJ Williams - Waco, TX 76710
Giuliana Rinaldo - Burlingame, CA 94010
Natalie Chernett - Brookeville, MD 20833
Kimberly Carignan - Shaker Heights, OH 44122
Laurie Sauer - Cypress, TX 77429
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Sarah Garn - Lexington, KY 40511
Bernice Rowe - Milford, VA 22514
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Patricia Mitchell - Camden, SC 29020
Kim Atrosh - Bradenton, FL 34211
Susanne Maguire - Manchester, NH 3104
Debbie Dodge - Brighton, CO 80601
Connie Devine - Yerington, NV 89447

Deb Christensen - Manteno, IL 60950
Taffy Williams - Tuckahoe, NY 10707
Elizabeth Schlein - Houston, TX 77027
Rosa Palacios - Chicago, IL 60608
Guy Taylor - Livonia, MI 48152
Patricia Davis - Wichita Falls, TX 76309
Debra Snow - Gresham, OR 97080
Carrie Rosenblatt - Bronx, NY 10462
carla zandick - Bensalem, PA 19020
Karla Bouvette - Vancouver, WA 98660
Rita Benlolo - Spring Hill, FL 34606
Karen Drennen - South Park, PA 15129
Coleen Dove - Bonney Lake, WA 98391
Miranda O'shields - Fort Payne, AL 35967
Shereen Gillette - Waxhaw, NC 28173
Orva M Gullett - Marion, OH 43302
George Picchioni - Bronx, NY 10462
jan drew - Santa Rosa, CA 95403
Thomas Boswell - Saint Clair, MI 48079
Stacey Bradley - Hastings, PA 16646
Andrea Giolli - West Linn, OR 97068
Karen Giammarco - Cleveland, OH 44119
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Leslie Alsteens - Janesville, WI 53546
Norma Jean McGrath - Las Vegas, NV 89135
Susan Thomas - Phoenix, AZ 85027
Nancy Wittenborn - Clearwater, FL 33755
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Lorri Francis - Chicago, IL 60622
Bernadette Zayas - Williston Park, NY 11596
Dean Butts - Rosholt, WI 54473
Bonnie Butts - Rosholt, WI 54473
Tatyana Skatyr - Woodland, CA 95695
Debora Hojda - Miami, FL 33179
Lisa Stanfill - Lincoln, CA 95648
Elizabeth MacKelvie - Appleton, WI 54915
John Kashner - Trenton, NJ 8610
tim Gregory - Grayson, GA 30017
Linda Luzitano - South Jordan, UT 84095
Elena Knox - Volcano, CA 95689
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Malcolm Groome - Topanga, CA 90290

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Jimmie Oneal - Meadow Valley, CA 95956
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Aylia Colwell - Decatur, GA 30032
Linda Pipp - Rochester Hills, MI 48306
Linda Satter - Manchester Center, VT 5255
Carmie Hagar - Pownal, ME 4069
Janine Hicks - Porter Ranch, CA 91326
Constance Bylsma - New Lenox, IL 60451
Anne Mazzone - Easton, CT 6612
Laureen McKinney - Rollinsville, CO 80474
Mary Lawless - Bristol, WI 53104
Kate Bolinger - Bend, OR 97703
L Reeves - Mokena, IL 60448
Heather Davis - Aloha, OR 97003
Marybeth Mikalsen - Ronkonkoma, NY 11779
nina van duyne - Flemington, NJ 8822
Lisa Nardi - Great Neck, NY 11023
Michelle Metzler - Manchester, CT 6042
Michelle Kaufman - Rutland, VT 5701
katherine dander - Boston, MA 2114
michele olsen - Williston Park, NY 11596
Thomas Granholm - Stockholm, NY 11246
Marilyn Campolettano - Setauket, NY 11733
Kim Persse - Skaneateles, NY 13152
Judy Bosch - Cherry Hill, NJ 8002
Terry Derchia - Littleton, CO 80127
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Ainga Dobbelaere - Davis, OK 73030
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Jantien Bethlehem - Oudeschip, DC 11111
Becky Lechner - Binghamton, NY 13901
Kimberly McGorty - Spotswood, NJ 8884
Donna Parente - Milford, MA 1757
Doris Theodorou - Easton, PA 18045
Tracy Doherty - Malden, MA 2148

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Stacey Riccardi - Harrison, NY 10528
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Pamela Susslin - Hermosa Beach, CA 90254
Eva Danilak - Cupertino, CA 95014
Gerri Paniccia - Lombard, IL 60148
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Anne Elkins - Anacortes, WA 98221
Annmarie Parmenter - Belleville, NJ 7109
Tim Pokela - Marquette, MI 49855
Barbara Rosenkotter - Deer Harbor, WA 98243
Robin Kolwicz - Phoenix, AZ 85004
Michelle Granberg - Idaho Falls, ID 83401
Helen LeBrecht - Waccabuc, NY 10597
Nancy Rivet - Lyndonville, VT 5851
Linda Bridges - Athens, IL 62613
Gwen Carlson - Brockway, PA 15824
Deborah Vizvary - Kingston, NY 12401
Françoise May - Palm Springs, CA 92264
Cindy Bassham - Richardson, TX 75080
Jennifer Laval - Evansville, IN 47714
Jennifer Roth - Terre Haute, IN 47803
Jean Marie VanWinkle - Bedford, VA 24523
Henry Rhyne - Hampstead, NC 28443
Janet Romano - Egg Harbor Township, NJ 8234
Janet Ginepro - Monroe, MI 48162
Gina Obrien - Bastrop, TX 78602
Jack Block - Schaumburg, IL 60194
Sherry Frey - Douglassville, PA 19518
William Moore - New York, NY 10024
Cynthia Howell - Sterling, VA 20165
Lizzie Vierra - Costa Mesa, CA 92627
Greg Gazzana - Brooksville, FL 34602
Vicky Semones - Gig Harbor, WA 98335
Julie Stinchcomb - Roseville, CA 95678

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Lori Neuman - Manitowoc, WI 54220
Hunter Klapperich - Jim Falls, WI 54748
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Linda Smith - Easton, PA 18042
Michele Pacheco - Upland, CA 91784
Linda Bell - Santa Rosa, CA 95403
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Kathleen Meyer - Bayside, NY 11360
Barbara Tountas - Shoreline, WA 98155
Robert Banning - Carpentersville, IL 60110
Tina Durakov - Bethlehem, PA 18017
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Kathleen Mcwhorter - Palatine, IL 60074
Teresa Kwon - Saratoga, CA 95070
Cayla Coleman - San Rafael, CA 94901
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Bret murray - Columbus, OH 43214
Rosemary Agrista - Gillette, NJ 7933
Robin Covino - Milford, CT 6460
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Michael Renfrow - Portland, OR 97213
Kelley Griffin - Downingtown, PA 19335
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Saundra Petrella - Beaver, PA 15009
Evelyn Bach - Greenacres, FL 33463
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diane hestich - Colton, CA 92324
Ann Griffin - Saint Clair Shores, MI 48081
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Nancy Gowani - Woodland Hills, CA 91367
Sally Cadonau - Aloha, OR 97078
Michele Villeneuve - Kingsport, TN 37660
Charles Wieland - San Ramon, CA 94583
Constance Graham - Hingham, MA 2043
Mary Wallace - Berryville, VA 22611

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Julie Berry - Clearwater, FL 33764
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Debra Culwell - Gresham, OR 97030
Toni Adisano - Brooklyn, NY 11223
Tina Gregory - Glen Carbon, IL 62034
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Alec Thorp - Yorktown Heights, NY 10598
David Weiss - Brooklyn, NY 11214
SEDA YEGHIKIAN - Chatsworth, CA 91311
Eileen ONeill - Danville, CA 94526
Connie Williams - Duarte, CA 91010
Gida Naser - Vacaville, CA 95687
Joseph Werzinski - New Hope, PA 18938
Nance Nicholls - Davenport, WA 99122
Sandra K Minnesang - New Castle, DE 19720
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Debbie Spear - Monroe, WA 98272
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Melissa Warfield - Farmington, MN 55024
Sharada Jayagopal - East Williston, NY 11596
Dr. Scott Whitener - Somerset, NJ 8873
Clare Goslant - Cambridge, MA 2138
Carol Goslant - Cambridge, MA 2138
Kim Goslant - Cambridge, MA 2138
Keith Wilkins - Mount Laurel, NJ 8054
Boyce Sherwin - Malone, NY 12953
Sharon Longyear - Port Ewen, NY 12466
Gary Wolf Ardito - East Haven, CT 6512
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Meredith Teders - Tulsa, OK 74119
Eileen Salesi - Toms River, NJ 8753
Kathy Rubera - East Hartford, CT 6118
Jennifer Jones - Lake City, MI 49651
Rosalinda Turner - Canton, MI 48188
Steven Biggio - Bellingham, WA 98229
Doris Knapp - Star, ID 83669
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Jodi Shannon - Mineral Wells, TX 76067
Mark Crane - Los Angeles, CA 90068
Angela Hughes - Charleston, WV 25314
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Izumi Yoshida - San Jose, CA 95116
Christian Comstock - Arlington, VA 22207
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Earl Frounfelter - Santa Maria, CA 93454
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Michele Symington - Cornelius, NC 28031
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Dennis Tackett - Virginia Beach, VA 23451
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Suzanne Becket - Cupertino, CA 95014
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Elaine Chung - Fremont, CA 94539
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Gregory Schneider - Stewartsville, NJ 8886
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Stephanie Bell - Seatac, WA 98198
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Linda Alvarado - Bakersfield, CA 93301
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Celana Bingham - Lexington, NC 27292
Lisa Condino - North Tonawanda, NY 14120
Gaia Cole - Brookline, MA 2446
Cyndee Kruggel - Colorado Springs, CO 80916
Stephanie Witkoski - Davie, FL 33324
Jane Rodgers - Pensacola, FL 32534
Debbie Czujko - Garfield, NJ 7026
Diana S - Tucson, AZ 85745
Maureen Levier - Beachwood, NJ 8722
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Marco Pardi - Lawrenceville, GA 30043
Sandra and Keith Daenzer - Lapeer, MI 48446
russ ziegler - Downers Grove, IL 60516

Murray Kaufman - Irvine, CA 92612
Barbara Andrew - Princeton, NJ 8540
sharon campanella - Kenmore, NY 14217
Paulette Jaeger - Sutton, MA 1590
Melanie Verschueren - New York, NY 10001
Dave Barrett - Hudson Falls, NY 12839
Nancy Bohan - Branford, CT 6405
Lisa Koehl - Ormond Beach, FL 32174
Susanne Lewis - Mc Donald, PA 15057
Lisa Spencer - Newport, DE 19804
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Rena Renee Cantway - Ocala, FL 34470
Laura V Schaap - Davis, CA 95618
Jim Franzi - Fiddletown, CA 95629
Sharon Carlson - Woodland Hills, CA 91364
Patrick Conn - Kent, WA 98031
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Margaret Polino - Bayside, NY 11364
Carlos Acosta - Edwards, CO 81632
Darlene Klingenberg - Toledo, OH 43613
Lori Rumpf - Lansing, MI 48910
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Amy Wright - Woodhaven, MI 48183
Jessica Freeman - Hopewell, VA 23860
Andrew Canigiani - Woodbridge, VA 22191
Roz Connor - Pueblo, CO 81003
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Carolyn Saiia - Florence, OR 97439
Linda Stewart - Shelbyville, KY 40065
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Harold Watson - Springfield, MO 65803
Britton Saunders - Milwaukee, WI 53208
Mozelle Bashen - Reston, VA 20191
Beverly Beatham - Berlin, MI 48002

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Debbie Harrington - Kenner, LA 70062
Jodi Rodar - Pelham, MA 1002
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Madeline Tubb - Pigeon Forge, TN 37863
Linda Fielder - Carrollton, TX 75006
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Marya Bradley - Milwaukee, WI 53202
Debra Krauss - Crescent, PA 15046
Elizabeth Taylor - Ransom Township, PA 18411
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Catherine Williams - Tucson, AZ 85719
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Anne Kuzel - Woodland, CA 95695
Cindy Shoaf - Salisbury, NC 28146
Katherine Wright - Milford, MI 48381
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Martha Gorak - Katy, TX 77450
Katha Ricciardi - Cohasset, MN 55721
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George Parrish - Belen, NM 87002
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Diane Tabbott - Jacksonville, FL 32211
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Virginia Roberts - Flourtown, PA 19031
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Jim Wingate - Colorado Springs, CO 80919
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Kathy Donegan - Colton, OR 97017
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Valerie Emerson - Delran, NJ 8075
Andree Larsen - Philadelphia, PA 19148
Melissa Novak - Windsor Locks, CT 6096
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Diane Bastian - Liberty, PA 16930
Rachel Smith - Cape Coral, FL 33993
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Moira Landis - Ferndale, WA 98248
Julia Cranmer - Southampton, NJ 8088
Marie Gil - Bloomfield, NJ 7003
Christopher Carbone - Gibbsboro, NJ 8026
Urszula Lund - Billings, NY 12510

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Karen Wegner - Helena, MT 59602
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Veronica Renteria - Chicago, IL 60647
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Kathie Grignon - Moses Lake, WA 98837
Kirsten Wolner - Henderson, NV 89074
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Mia Moss - Temple, GA 30179
Marie Weis - Fox Island, WA 98333
Stephen Giger - San Clemente, CA 92672
Lisa Winters - Black Diamond, WA 98010
Paula Gullo - Bellmore, NY 11710
Frédéric Pulcini - Naples, FL 34110
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cave man - New York, NY 10107
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Catherine Seber - North Brunswick, NJ 8902
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Rosemary Knopff - Roseville, MN 55113
Laura Napoleon - Little Neck, NY 11362
Stacey Solum - Sarasota, FL 34232
Linda Sorrells - Texas City, TX 77590
Carol Schaffer - San Pablo, CA 94806
Judith Figlo - Springdale, UT 84767
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Marcia Faliti - Laguna Niguel, CA 92677
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Mary Troland - Oceanside, NY 11572
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Leigh Wales - Hilo, HI 96720
Elaine Schwartz - Homosassa, FL 34446
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Sylvia Sanchez - Loma Linda, CA 92354

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Suzanne Faris - Henderson, NV 89052
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Susan Wayne - Loma Linda, CA 92354
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Laurice Helmer - Monroe, CT 6468
Heather Wiggins - Levittown, PA 19055
Dawn Coppersmith - Chestertown, NY 12817
Alexander Vollmer - San Rafael, CA 94901
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Cynthia Skandis - Bronxville, NY 10708
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Sharon Morgan - Dedham, MA 2026
Lee McCann - O Fallon, MO 63366
Melissa Silva - Somerville, MA 2144
Barbara Solem - Shamong, NJ 8088
Dorothy Labi - Kingston, NY 12401
S Doetsch - Charlottesville, VA 22901
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Valerie Fannin - Chico, CA 95973
Elizabeth Parada - Tucson, AZ 85705
Chelsea Siegfried - Evans, CO 80620
Jill Holdal - Mount Vernon, WA 98274
Deb McGee - Macy, IN 46951
Yolanda Shaner - Las Vegas, NV 89128
Aleksey Gershgorin - Brooklyn, NY 11235
Zoe Kane - Toledo, OH 43606
Julie Bird - Riverton, WY 82501
Eugene Gorrin - Union, NJ 7083
Andrea Kitson - Rio Rancho, NM 87144
Dejah Bennett - Mckinney, TX 75071
Allison Bergeron - Bridgton, ME 4009
Catherine J Garneski - Dover, DE 19901
Christina Davis - Spanaway, WA 98387
Vilma McDonald - Kissimmee, FL 34758
Donna Jones - Herndon, VA 20171
Rebecca Harper - Los Angeles, CA 90049

Sylvia Smithwick - New Bern, NC 28560
april Doyle - Conway, SC 29526
Elaine Benjamin - Alpine, CA 91901
Georgia Carver - Rancho Cordova, CA 95670
Faith Franck - Las Vegas, NV 89134
Alice Miller - Bethpage, NY 11714
Lily Faber - Calabasas, CA 91302
Vicki Kopinski - Menifee, CA 92584
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Anna Eyring - Holladay, UT 84117
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Linda Campbell - Emmaus, PA 18049
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Lori Girshick - Mesa, AZ 85215
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Mona Spangler - Palm Harbor, FL 34683
Elizabeth Migliore - Dobbs Ferry, NY 10522
Linda Bellavia - San Francisco, CA 94115
Deborah Coviello - Clinton, MA 1510
Diana Noel-Labieniec - East Longmeadow, MA 1028
Kathleen Doctor - Kittanning, PA 16201
Mike Inganamort - Hauppauge, NY 11788
Juanita Garcia - Hauppauge, NY 11788
Carol Book - York, PA 17406
Corinne Marrone - Centereach, NY 11720
Lori Moog - Bridgewater, NJ 8807
Sabine Persenaire - Phoenixville, PA 19460
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Mark Gorres - Starbuck, MN 56381
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Laura Lambert - North St Paul, MN 55109
Mary Anderson - N Brookfield, MA 1535
Amy Kohlert - Spring, TX 77388
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Scott Korman - Floral Park, NY 11005
Judith Smith - Oakland, CA 94601
Doreen Perry - Pittsburgh, PA 15227
Lori Korell - Minneapolis, MN 55418
Lisa Pisano - Brooklyn, NY 11214
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Christy Anderson - San Antonio, TX 78261
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Dianne Douglas - Phoenix, AZ 85042
Rosalind O'Brien - Sacramento, CA 95818
Dondi Ali - Sanford, FL 32773
Vickie Morey - Saint Joseph, MO 64503
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Alexandria Luostari - Los Angeles, CA 90064
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Laura Vera - Dickinson, TX 77539
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Diana Donovan - Sarasota, FL 34235
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Kathy Murphy - Palm City, FL 34990
Rose Mary Spadaccini - Punta Gorda, FL 33983
Donna Kuroda - Herndon, VA 20171
Tyler Harrington - Schuyler Falls, NY 12985
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Dave Beck - San Juan Capistrano, CA 92675
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Toni Patterson - Hamilton, MT 59840
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Lisa Henry - Mission Viejo, CA 92692
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Lourdes Mannise - Pittsfield, MA 1201
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Catherine Thomas - Houston, TX 77042
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Audrey Hall - Nashville, TN 37207
Lori Spradlin - Friendswood, TX 77546
Sheree Courtney - Casselberry, FL 32707
Denise Insinga - Lindenhurst, NY 11757
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Michael Brown - Eugene, OR 97405
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Leslie Burpo - Eugene, OR 97405
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Martin Tripp - Santa Clarita, CA 91390
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Francis Porfilio - Staten Island, NY 10306
Marni Williams - Spring, TX 77386
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Sarah McGee - Killen, AL 35645
Tammy King - Gardner, MA 1440
James Gifford - Marshfield, MA 2050
paul Connolly - Braintree, MA 2184
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Juliane Hunka - Ruby, AK 99768
Kimberly Wyke - Camden, ME 4843
Brenda Flusche - Muenster, TX 76252
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Karen Shatz - Scarsdale, NY 10583
Dawn Infantes - Brick, NJ 8723
Charlie Burns - Norwalk, CT 6850
Joyce Crowley - Mullica Hill, NJ 8062
Tracy Foster - Egg Harbor Township, NJ 8234
Donna Dilla - Las Vegas, NV 89102
Rebecca Oberlin - Anoka, MN 55303
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Sandra Couch - Naperville, IL 60564
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Jane Bicquette - Sherwood, OR 97140

Rhonda Dern - Evergreen, CO 80439
Lynn Pfeifer - Newfield, NJ 8344
Rosemarie Pascone - Cranston, RI 2910
Linda Juilfs - Fairfield, CT 6825
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Debbie Rajcic - Riverside, CA 92503
Lisa Conway - Gallatin, TN 37066
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Kathe Garbrick - Manhattan, KS 66503
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Gena Strom - Eagle Point, OR 97524
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Lisa Warden - Salem, VA 24153
Laura Thurman - Maryland Heights, MO 63043
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Pat Stringfield - Longview, TX 75603
Deborah Santone - Pleasant Hill, CA 94523
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Kathy Clark - Medway, MA 2053
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Brooke Landau - New York, NY 10004
Thomas Cope - Medina, OH 44256
Silvana Borrelli - Englewood, CO 80113
Denise Arbonies - Phoenix, AZ 85004
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Mary Shaw - Cherry Hill, NJ 8002
Deborah Ogle - Powhatan, VA 23139
Tammy Beck - Hillsboro, IL 62049
Jane Leavitt - Seattle, WA 98144
Susan Leavitt - Seattle, WA 98144
Gina Read - Phoenix, AZ 85016
Mike Dee - Las Vegas, NV 89117
Irene Serrano - Columbia, MO 65203
Mark Osborn - Columbia, MO 65203
Irene Osborn - Columbia, MO 65203
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Lydia Good - Rancho Cordova, CA 95670
Brandie Deal - Bothell, WA 98021
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Debbie Schepis - Roselle Park, NJ 7204
Christopher Moyer - Urbana, IL 61802
Judy Frey - Tonawanda, NY 14150
Karen Milstein - Santa Fe, NM 87505

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Mary Guzman - Milwaukee, WI 53208
Renae Beeker - Salisbury, NC 28147
Lily Doris - Laguna Beach, CA 92651
Solomon Blecher - New York, NY 10009
Melinda Cetto - Raymore, MO 64083
Elaine Longo - Fort Lauderdale, FL 33308
Terry DeShaney - Francisco, IN 47649
Kelly Schwartz - Arlington, VA 22207
Anne Katz - Jupiter, FL 33477
Chris Rose - Petaluma, CA 94952
Cindy Hadlock - Anderson, SC 29624
Annette Benton - Pittsburg, CA 94565
Christina Chappell - Brookhaven, GA 30329
Suzanne Gilbert - Elon, NC 27244
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Deann Darling - Arlington, TX 76011
David Walker - Bowling Green, KY 42101
John White - Schenectady, NY 12345
Ryan O'Leary - Marshfield, WI 54449
Melanie Lavimoniere - Plainfield, CT 6374
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Tawny Robinson - Orange, CA 92868
Susannah Phillips - Severna Park, MD 21146
Leslie Spatola - Middletown, CT 6457
Christina Galvin - Spring Lake, NJ 7762
Karen Spradlin - Jacksonville, AL 36265
Kathy Tscheiner - Cincinnati, OH 45211
Deborah Hoffman - Titusville, FL 32796
Steve Thunberg - Northbrook, IL 60062
Susan Kimball - Fairfield Township, OH 45011
Cynthia Wright - Marietta, GA 30062
Toni Reeves - Simpsonville, SC 29681
Mary Saucedo - Austin, TX 78745
Derinda Nilsson - Utica, NY 13502
Karen Rome - Moore, SC 29369
Pauline Bonnen - Brooklyn, NY 11235
Mary Johnson - Edgewater, FL 32132
Margaret Meinert - Lexington, SC 29072
Karen J. Hutson - South Holland, IL 60473
Lorraine Nicotera - North Tonawanda, NY 14120

Kathy Winterburn - Littleton, CO 80123
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Siegrid Berman - Washington, NJ 7882
Eva Schocken - Springfield, MA 1108
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Bob Leppo - Shell Beach, CA 93449
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Ruth Rusch - Fayetteville, AR 72701
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Pat Jones - Deming, NM 88030
Barbara Puett - Austin, TX 78746
Lance Bergeron - Highland, IN 46322
Ryan Baka - Minneapolis, MN 55411
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Margaret Durham - Lubbock, TX 79410
Cheryl Detar - Louisville, KY 40216
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Nicole Sacco - Gibsonia, PA 15044
Frank Ayers - Altoona, PA 16602
Cori Ellison - New York, NY 10023
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Karen Baker - Crystal River, FL 34428
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Jan Payne - Jackson, MI 49203
Janet Rhodes - Temecula, CA 92592
Teresa Woods - Wesley Chapel, FL 33543
Tammy Rohatynski - Brighton, MI 48114
Jennifer Valentine - Massapequa Park, NY 11762
Mitzi Ocean - Glenside, PA 19038
Kathy Hatcher - Treynor, IA 51575
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Margaret Wells - Ventura, CA 93003

Joanne McBirney - La Crescenta, CA 91214
Doreen Gallien - Athol, MA 1331
Nancy Neumann - Clearwater, FL 33756
Sharon Tee - New Haven, CT 6513
Penny Amos - Esmont, VA 22937
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Holly Hall - Temecula, CA 92592
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Laura Long - Cedar Creek, TX 78612
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Betsy Wolf - Taos, NM 87571
Jessica Harvey - Nya, MN 55397
Susan Lewis - Evergreen, CO 80439
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Jennifer Scull - Chardon, OH 44024
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Deborah Dobson - Hendersonville, NC 28792
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Nancy Thompson - New York, NY 10025
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Lisa Banik - Torrington, CT 6790
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John Dunn - Morristown, NJ 7960
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Brad Nelson - Oxnard, CA 93035
Shirley Feldman - Silver Spring, MD 20906

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Kathy Giambelluca - Levittown, PA 19054
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Jeanne ODell - Caledonia, NY 14423
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Linda Faso - Las Vegas, NV 89113
Barbara Abraham - Leominster, MA 1453
Michelle Austin - Athens, AK 10433
Gerald Gushleff - Mitchell, IL 62040
Lilia Hanrahan - Centerville, MA 2632
Stephanie Kowalski - East Setauket, NY 11733
Wendy Seymour - Billerica, MA 1821
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Barbara Maddalena - Teaneck, NJ 7666
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28515
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Jill Mulato - Dana Point, CA 92629
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Maureen McCullough - Brooklyn Center, MN 55429
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Jill Rhiannon - Yuba City, CA 95991
Megan Maier - Bozeman, MT 59718
Carol Holm - Warminster, PA 18974
Taylor Benson - Menasha, WI 54952
Nanci Gabbard - Felicity, OH 45120
Rachel Bradley - Des Moines, IA 50321
Penelope Prochazka - Simi Valley, CA 93063
Lori Williams - Roanoke, VA 24018
Maureen Madigan - Bronx, NY 10463
Alan Gates - Phoenix, AZ 85041
Sara Azevedo - Long Beach, CA 90814
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Utkarsh Nath - Fremont, CA 94555
Michael Savage - New York, NY 10075
Carol Holland - Costa Mesa, CA 92627
Kathy Long - Hamburg, PA 19526
Kathleen Walsh - Stillwater, MN 55082
Nancy Lasley - Park City, UT 84098
Daphne Madron - Lenoir, NC 28645
Rose Shulman - Traphill, NC 28685
Donna Moatassem - Hubbard, OH 44425
Shannon Hunter - Anderson, CA 96007
Ewa Stein - Port Charlotte, FL 33948
Emily Davis - Martinsville, IN 46151
gail vento - Staten Island, NY 10314
Patricia Cummings - Clawson, MI 48017
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Eric Yurkanin - Atlanta, GA 30326
SUSAN MCCLUNG - Clayton, MI 49235
Nasrin Mazuji - Sierra Vista, AZ 85635
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Robin Bray - Edgartown, MA 2539
Nancy Stimac - Windsor, CT 6095
Wolfgang Burger - Haverhill, MA 1832
Tsar Fedorsky - Gloucester, MA 1930
Catherine Bedzyk - Rochester, NY 14622
Mark Hollinrake - New York, NY 10026
Lisa Kunsch - Attleboro, MA 2703
Helene Christina Weiss - Whitehouse Station, NJ 8889
Edythe Cox - Braintree, MA 2184
Lin Deats - Falmouth, MA 2540
Michelle Collar - North Attleboro, MA 2760

Sikt Grote - Nashua, NH 3063
Michelle Oroz - Auburn, CA 95603
David Gaier - Conshohocken, PA 19428
Allison Cowgill - Fort Collins, CO 80525
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Katarina Lang - Phoenix, AZ 85018
Kathy Snavely - Melbourne, FL 32934
Stephanie Honore - Kissimmee, FL 34746
Margaret Griffin - Stow, OH 44224
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James De Lara - Albuquerque, NM 87107
Kris Gata - Redondo Beach, CA 90277
Christine Schmidt - Schaumburg, IL 60193
Sami Marie - Bridgeville, PA 15017
Lynn Thomasberg - Minneapolis, MN 55408
BETH DOSHAY - Calabasas, CA 91302
Elizabeth Neumann - Molalla, OR 97038
Candice Barnett - Lancaster, CA 93536
Julie Kim - New York, NY 10003
Debra Kern - Cary, IL 60013
Brenda Michaels - Port Townsend, WA 98368
Karen Stacey - Chicago, IL 60657
Debbi Pratt - Seattle, WA 98199
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Beverly Harris - Beverly Hills, CA 90212
Jayne Moore - Largo, FL 33774
Amanda Clairmonte - Catharpin, VA 20143
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Claudia Drocea - Lakewood, NJ 8701
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Renny Bryden - Largo, FL 33771
Galen Hazelhofer - Sacramento, CA 95827
Kate Frangos - Honeoye, NY 14471
Jennifer Gorgo - Voorhees, NJ 8043
Karen Moore - Acton, MA 1720
Nicole Kennedy - Springfield, IL 62704
Daniel OBrien - Milton, NY 12547
Maria Heres - New York, NY 10024
Lisa Bass - Saint Johns, FL 32259
Mary Malfitano - Nutley, NJ 7110
Linda Crisp - Casper, WY 82604
Mike Chyba - Chicago, IL 60613
JEANNETTE ZISSIS - Rolling Meadows, IL 60008
Celia Antic - Northbrook, IL 60062
Ronda Bratton - Cleburne, TX 76031
Daniel Manobianco - Chicago, IL 60629
Diana Lewis - Summit, WI 53066
Judy Palmer - Tonasket, WA 98855
Tonya Ehret - Fort Worth, TX 76133
Angie Williams - Wishon, CA 93669
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Barbie Marquet - Key Largo, FL 33037
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Colene Flaherty - Steuben, ME 4680
Judi Oswald - Malabar, FL 32950
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Jo Chapman - Mims, FL 32754
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Donna Walker - Deering, NH 3244
Michelle Graves - Syracuse, NY 13209
Jean Thornsbury - Federal Way, WA 98023
Jessica Brennan - Selbyville, DE 19975
Cesarina Somogy - Naples, FL 34117
Barbara Bartell - Charlo, MT 59824
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Candi Ausman - Fremont, CA 94536
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Maryann Smale - Steuben, ME 4680
Maura Rahman - Brick, NJ 8723
Mark Mansfield - Geneva, NY 14456
Ruth Parkyn - Bethune, SC 29009
Blaise Brockman - Arcadia, CA 91007
Colonel Meyer - North Port, FL 34286
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Cheryl brooke - Cleveland, OH 44121
Nancy Gathing - Madison, WI 53714
Florin Sada - Riverbank, CA 95367
Bruce Ross - Katy, TX 77449
Diane-Michele Petrillo - Hamden, CT 6518
Pamela Saulter - Perris, CA 92571
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Lynne Jones - Salt Lake City, UT 84107
Shirley Waltz - Fort Lauderdale, FL 33334
Diana Zdenek - Orange, CA 92866
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Sharon Webb - Bartlett, TN 38133
Leilah Yanez - Tampa, FL 33629
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Judith Wisboro - Worcester, MA 1606
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Kimberly Coulter Searer - West Linn, OR 97068
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Morgane O'Connell - Princeton, NJ 8540
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Ross Mannino - Nutley, NJ 7110
theodora manolas - Glen Cove, NY 11542
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cathy crum - Agoura Hills, CA 91301
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Zoe Jewell - Durham, NC 27705
Ann Wiseman - Mansfield, IL 61854
Nancy Kurpaitis - Pittsfield, IL 62363
Charmaine Henriques - Madison, MS 39110
James Castaldi - Palmdale, CA 93550
Paulette Allison - Jefferson City, MO 65109
Tiffani LoBue - Palm Springs, CA 92264
Richard Waide - Billings, MT 59106
Kathi Ridgway - Gahanna, OH 43230
Sharon Nasholds - Wake Forest, NC 27587
Chris Brunner - Allen, TX 75002
Kathleen Grover - Johnson City, TN 37604
Robina Smith - Pomona, MO 65789
Angela Norse - Salem, OR 97302
Piper Burch - Slidell, LA 70458
Terri David - Venice, FL 34285
Kim Smith - Beverly, WV 26253
Beverly Thomas - Hot Springs National Park, AR 71901
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Balaji Sundaresan - Hackettstown, NJ 7840
Rebecca Jacobs-Pollez - Tishomingo, OK 73460
Diane Kuzma - Lexington, KY 40513
Debra Miller - Belvidere, NJ 7823
Marya Zanders - Centerville, IA 52544
Sheila Larkin - Jamaica Plain, MA 2130
Carm Tenhoff - Burnsville, MN 55337
Sharon Smith - Troy, NY 12180
Adam Mills - Asheville, NC 28801
Jennie Jensen - Ojai, CA 93023
Phyllis Gaiti - Oxford, MD 21654
Kim Johnson - Canton, MI 48188
Julie Skelton - Van Buren Twp, MI 48111
Jeanne Bastardi - Warwick, NY 10990
Paula Loftis - Beaufort, SC 29907
Robin Smith - New Milford, CT 6776
Deb Halliday - Sandy Creek, NY 13145
jacqueline tessman - Benton Harbor, MI 49022

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Traci Keller - Phoenix, AZ 85044
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Joanne Wein - Westerville, OH 43081
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Neenah Lancaster-Riemer - Ocala, FL 34470
L.L. Wilkinson - Taos, NM 87571
Suzanne Rugg - Russellville, AR 72801
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Ilene Choi - Flushing, NY 11358
Regina Case - Eureka, CA 95503
Marilee Murray - Anthem, AZ 85086
Kirk Elliott - Phoenix, AZ 85086
Denise Lantsberger - Livermore, CA 94551
Barbara Cornwell - Ryderwood, WA 98581
Jody Mahnken - Boise, ID 83713
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James Hickey - Springtown, TX 76082
karen winnubst - Cedar Hill, TX 75104
James Eller - Sun River, MT 59483
Thomas Nieland - Alamo, TX 78516
Carolyn Nieland - Alamo, TX 78516
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Leslye Barkdull - Springfield, OR 97478
Alisa Delguzzo - Bellaire, OH 43906
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Mildred Sanchez - Corrales, NM 87048
Margarita Flener - Sinton, TX 78387
Walter Ramsey - Oakley, CA 94561
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Suyin Phillips - Honolulu, HI 96816
Derek Binelli - Linden, NJ 7036
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WIlliam Denman - Winchester, MA 1890
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Dawn Strecker - Fort Lauderdale, FL 33315

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Deanna Smith - Scottsdale, AZ 85251
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Edmund Leahy - Spring Valley, IL 61362
Joyce Davis - Hoosick Falls, NY 12090
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Lonny LaChapelle - Westfield, MA 1085
Sherry Low - Montgomery, IL 60538
Brenda Morris - Marlton, NJ 8053
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Donna Garsee - Boyce, LA 71409

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Cindy Kasnicka - Brookfield, IL 60513
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Kathleen Lovan - Pensacola, FL 32504
Natalie Alexander - Kaneohe, HI 96744
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CW Cox - Bushnell, FL 33513
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Sandy Zumwalt - Springfield, MO 65810
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Mandy Tshibangu - Devon, PA 19333
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herbert Herschlag - Danbury, CT 6811
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Chris Stangl - Collegeville, PA 19426
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Judy Masbaum - North Bend, WA 98045
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Robin Peterson - Jacksonville, FL 32210
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Kami Anderson - Los Altos, CA 94022
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Cynthia Langendorf - Petaluma, CA 94952
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Christine Cotton - Ellsworth, ME 4605
Thalia Ventouris - Brunswick, OH 44212
Linda Hilf - Cheswick, PA 15024
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Jacqueline Diaz - Ormond Beach, FL 32174

Mike McCool - Millbury, MA 1527
Monica Henry - Elberta, MI 49628
Zelda Bush - Levittown, PA 19056
Julie Sacco - Hopatcong, NJ 7843
Maryellen Redish - Palm Springs, CA 92262
Raquel Buxton - Houston, TX 77092
Sue Hall - Castro Valley, CA 94546
Mandy Redder - Soldotna, AK 99669
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Debbie Naumann - Northport, AL 35473
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Eric Benson - St Louis Park, MN 55416
Erika Woods - Glen Allen, VA 23059
Karen Espanol - Culver City, CA 90230
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Hank Ramírez - San Diego, CA 92116
Gary Gill - Everett, WA 98208
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Darren Strain - Brookhaven, PA 19015
Carolyn Spencer - Las Vegas, NV 89147
Sharon Porter - Paradise, CA 95969
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Asilda Dube - Ballston Spa, NY 12020
Anne Davis - New York, NY 10036
Jean Maust - Tenino, WA 98589
Tina Zenko - Chicago, IL 60625
Kailey Leary - Berea, OH 44017
Meryl Alexander - Rockville Centre, NY 11570
Janice Schenfisch - Cypress, CA 90630
Michael Dorer - Fremont, CA 94538
Elizabeth Lacombe - Taunton, MA 2780
Chris Powell - Conover, NC 28613
Mark Weinberger - Daly City, CA 94015
George Bourlotos - Flanders, NJ 7836
Scott Kartinen - Brooklyn, NY 11249
Donna Blair - Phillipsburg, NJ 8865

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Bonnie Schweinler - Short Hills, NJ 7078
Phil Fischer - Glencoe, IL 60022
Michael Friedman - El Sobrante, CA 94803
Claire Watson - Kettering, OH 45429
Marsha Mirsky - Bethesda, MD 20814
khai hang - Baldwin Park, CA 91706
Heidi Dickson - Austin, TX 78751
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kristen englehart - Chicago, IL 60630
Judith Gurule - Dickinson, TX 77539
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Susanna Stone - Middle Island, NY 11953
Irene Salad - Decatur, IA 50067
Deborah Haws - Lincolnshire, IL 60069
Patti Johnson - Perkasie, PA 18944
Marilou Jung - Roth Hambach, PR 57910
Patricia Packer - Scotia, NY 12302
Catherine Watson - Flagler Beach, FL 32136
Leslie Billings - Wallingford, CT 6492
Marley McDermott - Floral Park, NY 11001
Michele Bouchard - Waterville, ME 4901
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Joe Tutt - Mesquite, TX 75149
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Sara Bishop - Sparta, TN 38583

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Margaret Mueller - Sharonville, OH 45241
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Christine Ciempola - Anderson, SC 29624
brandon dokes - Coloma, MI 49038
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Frank Force - Staten Island, NY 10304
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Kathy Turner - Clearfield, PA 16830
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Savannah Pulcini - Delray Beach, FL 33445
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Linda McMullin - Springfield, MO 65802
Sean Busch - Mesa, AZ 85204
Susan Donmoyer - Dillsburg, PA 17019
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Marlys Reid - Cocoa, FL 32927
Christine Norman - Cocoa, FL 32926
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Lynn Manheim - Factoryville, PA 18419
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Jennifer Love - Ashford, AL 36312
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Janice Higgins - Hadley, MA 1035
Sheila Slater - New York, NY 10025
Doris Soraci - Patterson, NY 12563
Christopher Lord - Brentwood, NY 11717
Sherry Berry - Ventura, CA 93003
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Becky Calhoun - Reno, NV 89502
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Claude McDonald - San Jose, CA 95120
lilith akasha - Los Angeles, CA 90028
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Elaine Ritchey - Columbia, MD 21046
Kevin Cook - Rhome, TX 76078
Eddie Milner - Huntingdon Valley, PA 19006
Lalie Burns - San Antonio, TX 78239
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Shawn Esher - Lititz, PA 17543
Rina Sunar - Lititz, PA 17543
Rina Sunar - Lititz, PA 17543
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Wayne Hair - Pella, IA 50219
John Van Haaften - Pella, IA 50219
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Maryetta Pinn - Bealeton, VA 22712
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Christa Neuber - W Hollywood, CA 90069
Christina Babst - W Hollywood, CA 90069
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Sharon Slocum - Kingman, AZ 86409
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Denise Tuttle - Schenectady, NY 12345
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Jean Hopkins - Charlotte, NC 28226
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Elizabeth Eagan - Martinsville, NJ 8836
Laura Nardozza - San Mateo, CA 94401
Heather Tachna - Colorado Springs, CO 80919
Rita Self - Fort Wayne, IN 46835
Martha Feldman - Takoma Park, MD 20912
Anthony Halterlein - Readyville, TN 37149
Oxana Postnaya - Windermere, FL 34786
Lisa Tichenor - Santa Rosa, CA 95404
Betty Covington - Saint Charles, MO 63304
Thomas Monforte - Indian Trail, NC 28079
Marjorie Laboy-Vagell - Tolland, CT 6084
April Bernys - Margate, FL 33063
Nancy Bear - Abilene, TX 79606
Sandy Rummell - Uniontown, PA 15401

Robin Swanson - Honolulu, HI 96826
Timothy Spong - Houston, DE 19954
Vanessa Simsick - Denver, CO 80220
Laura McGowan - Houston, TX 77041
Lisa Jefko - Roscoe, IL 61073
Marina Brooks - Boca Raton, FL 33433
John Kirchner - Fort Wayne, IN 46815
ROBERT KOCH - Bronxville, NY 10708
Sherry Matthews - Dittmer, MO 63023
Sharon Hawkinson - Citrus Heights, CA 95610
Sandra Costa - Mount Vernon, TX 75457
Nancy Gregory - Littleton, CO 80120
Beth Groneman - Mesa, AZ 85206
Alece Rutherford - Herriman, UT 84096
Elaine Hegh - Lansdale, PA 19446
Michelle Ippolito - Fernley, NV 89408
Megan Lankenau - Silver Spring, MD 20910
Susan Dorchin - Delray Beach, FL 33446
Jennifer Stedman - Little Valley, NY 14755
Elsa Knutson - Manhattan Beach, CA 90266
Chris Bouckaert - Thousand Oaks, CA 91360
Marge Galloway - Howell, MI 48855
Rachel Arnone - Bradenton, FL 34202
Rhonda Boyle - Tucson, AZ 85741
Kathleen Moraski - Saint Paul, MN 55125
Victoria Shih - Plano, TX 75025
David Ortiz - Franklin, WI 53132
Josephine Cristobal - Honolulu, HI 96826
Dina Dornseif - Milaca, MN 56353
Tatiana Medina - Miami, FL 33122
David Coleman - Cobb, CA 95426
Terry Tedesco - Tucson, AZ 85718
Carolyn Holmes - Chicago, IL 60631
Anita Coca - Parkland, FL 33076
Paula Stevens - Orlando, FL 32818
Jeanie Scott - San Francisco, CA 94132
Kathryn Osborn - La Mesa, CA 91942
Virginia Johnston - Keene, NH 3431
Linda Tarantino - New Bedford, MA 2740
Donna Rice - Elkton, MD 21921
Carlos Luna - New York, NY 10038
Alexandra Schulz - St Augustin, AK 53757
Deborah Goodman - Woodstock, VT 5091
alexandra moffat - Orford, NH 3777

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Lisa Tichenor - Sarasota, FL 34236
Ruth DuValle - Live Oak, TX 78233
Marylou Ogle - Knoxville, TN 37919
Rainbow Di Benedetto - Austin, TX 78750
Janet Karasinski - Glenn Dale, MD 20769
kathy grieves - Peoria, AZ 85383
Catherine Bourke - Burbank, IL 60459
Lauren Convery - Springfield, VA 22153
Carrie Kopacz - Gresham, OR 97030
Carolina Rozo - Miami Beach, FL 33141
John Gieser - Seattle, WA 98117
David Katz - Arvada, CO 80005
Christina DeRespiris - New Rochelle, NY 10805
Victoria Pawlick - Williamson, NY 14589
Wendy Fossa - Essex, MA 1929
Christine Piekarski - Canton, MA 2021
Suzanne Marienau - Ozark, MO 65721
Rochelle La Frinere - San Diego, CA 92114
Anthony Ricciardi - Atlanta, GA 30316
Mary OConnor - Anchorage, AK 99502
LuAnn Havers - Charlotte, NC 28273
Jacqueline Wazny - Hamburg, NY 14075
Joyce Patton - Lindon, UT 84042
Amanda Alcamo - New Hyde Park, NY 11040
Jennifer Waldo - Las Vegas, NV 89166
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David Hall - Davisburg, MI 48350
Eileen Fiorentino - Lakewood, NJ 8701
Debra Yovella - Las Vegas, NV 89129
Janice Everett - Knoxville, TN 37931
Jannett Heckert - Park City, UT 84098
Jodi Junkins - Fontana, CA 92336
Hannah Aiona-Baker - Vancouver, WA 98682
Margaret Gusdal - Everett, WA 98203
Red Elisa Mendoza - North Miami, FL 33161
Catrina Lessley - Pollock Pines, CA 95726
Ivette Varona - Miami, FL 33131
Tessa Bragg - Mount Clare, WV 26408
Kellen Dunn - New York, NY 10065
Peter Kahigian - Haverhill, MA 1832
William renninger - Eldred, PA 16731
Elizabeth Ashby - New York, NY 10128
Melissa Grondin - Malden, MA 2148

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Elene Gooze - Ballston Lake, NY 12019
Jo Anne Gorski - Purchase, NY 10577
Christine Verderber - Norwalk, CT 6850
Joanna Stuart - Columbia, SC 29204
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Paula Mahoney - Billerica, MA 1821
Sandra Bonetti - Milford, MA 1757
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Roslyn Pollinger - Edison, NJ 8817
lyn cap - Great Neck, NY 11021
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Gino Czaster - Tonawanda, NY 14150
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Rodney Love - Newbury Park, CA 91320
Megan Watson - Addison, TX 75001
Harry Pinand - Rockaway, NJ 7866
Linda Bescript - Langhorne, PA 19047
Marilyn Mick - San Antonio, TX 78239
Margaret Cobb - Archer, FL 32618
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Nancy Lambert - Boulder, CO 80302
Arlene Steinberg - Philadelphia, PA 19115
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Sandra Butler - Los Angeles, CA 90045
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Rebecca Kimsey - Sublimity, OR 97385
Mary Anne Tokar - Baldwinsville, NY 13027
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Cheryl Seiler - San Antonio, TX 78250
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Freda Ballas - Dallas, TX 75231
Melinda Morris - Newport, MI 48166
Cynthia Carr - Glendale, RI 2826
Briana Timmons - Bronx, NY 10473
Vanessa Bartley - Huntsville, AL 35802
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Lori Smith - San Rafael, CA 94901
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Ruth Steger - Saint Petersburg, FL 33702
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Krista Saunders - Burtchville, MI 48059
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Gary Thaler - Revere, MA 2151
Diane Pease - Littleton, NH 3561
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Mary Shepard - North Chili, NY 14514
Jean Prior - Arden, NC 28704
Mary Wood - Brookings, OR 97415
Lyda Eddington - Los Angeles, CA 90045
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John Pasqua - Escondido, CA 92025
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Paul Smith - Downingtown, PA 19335
Mitchell Mead - Spring, TX 77389
Lori King - Riverside, CA 92508
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Cathy Caswell - Foley, AL 36535
Sarah Stewart - Watertown, MA 2472
Sonja Wong - Brooklyn, NY 11201
Hilary McGregor - Ashland, MA 1721
Peter Townsend - Ashland, MA 1721
Maryanna Moskal - Buffalo, NY 14221
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Terri Decker - Redding, CA 96001
Tracie Micheff - Bartlett, IL 60103
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Ashley Kellett - Morristown, NJ 7960
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Laurie LaGoe - Alexandria, VA 22309
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Robert Uebel - Lindenhurst, NY 11757
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Cynthia Rosmus - Bayonne, NJ 7002
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Carol Bellavia - The Villages, FL 32162
Barbara Snyder - Lyons, NY 14489
Laurie Konwith - Lake Mary, FL 32746
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Juanita Puntasecca - Lilburn, GA 30047
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Suzanne Young - Roslindale, MA 2131
Michael Gresko - Highland Mills, NY 10930
KATE SPENCER - Saint George, UT 84770
martha king - Auburn, NY 13021
Cherie Martin - Dunedin, FL 34698
Shani Schulman - Ozone Park, NY 11417
Jane Salgado - Bellerose, NY 11426
Sharon Keller - Ocala, FL 34481
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Tammy Nogles - Bryn Mawr, PA 19010
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Audrey Mannolini - Huntington Beach, CA 92646
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Karen Dunn - Marietta, GA 30064
Linda Marsh - Old Lyme, CT 6371
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James Hutchison - Cambridge, MA 2138
Cynthia Karst - Charleston, SC 29412
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Katharine Warner - Sunland, CA 91040

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Rachael Lyon - Beaumont, CA 92223
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Lori Costa - New Bedford, MA 2746
Ronald huntley - Franklin, MA 2038
Amy Sophia Marashinsky - Amherst, MA 1002
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Barbara Lafaver - La Mesa, CA 91941
Marilyn Domke - Evanston, IL 60203
Katarzyna Gilpatrick - Billings, MO 65610
Eileen Shahzada - Elk Grove, CA 95624
Jordan McKenna - Redmond, WA 98053
Michelle Brown - Walnut Creek, CA 94596
June Heilman - Pocatello, ID 83201
Kerry Krueger - Warrenton, OR 97146
Cheryl Conley - Montgomery, TX 77316
Judy Oates - Great Barrington, MA 1230
Ann White - Santa Fe, NM 87508
charles stanley - Palm Coast, FL 32137
JM Shammas - Medway, MA 2053
Ruth Boniface - Toorak, HI 31425
Jennifer Cunningham - Bolingbrook, IL 60440
Daryl Denning - Corning, NY 14830
Pamela Lynn - Oak Ridge, NJ 7438
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Mary Urbanovich - Chester Sprgs, PA 19425
Jennifer Reinert - Marquette, MI 49855
Catherine DiGennaro - Saint James, NY 11780
Bianca Tenneriello - Jackson, NJ 8527
D. Dantuono - Huntington, NY 11743
Patty Traube - Centereach, NY 11720
May Ze - New York, NY 10028
Anita Goncalves - Ludlow, MA 1056
BrandyLyn McDonald - Wheaton, IL 60187
Terry Kayser - San Marcos, TX 78666
Lynn Patra - Redding, CA 96001
Llll D - Albany, CA 94706
Judy Basye - Mcminnville, OR 97128
Paula Bickelhaupt - Port Washington, WI 53074
Elke Blair - Vancouver, WA 98683
Barbara Whyman - Ventura, CA 93001

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Cynthia Liss - Brooklyn, NY 11228
Daniel Pruitt - Smyrna, GA 30080
Mary Harris - Cantonment, FL 32533
Deanna Pena - Houston, TX 77036
Sandy Nelson - Panama City, FL 32404
Kerry Michel - Vista, CA 92084
Randolph Severson - Ennis, TX 75119
Sandra Varvel - El Paso, TX 79907
Lisa Jones - Elk Grove, CA 95624
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Clinton Roche - Arlington Heights, IL 60004
Margret Cifaldi - Las Vegas, NV 89147
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Gloria Junkermann - Ashland, OR 97520
Marilyn Story - Halethorpe, MD 21227
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Sarah Hamilton - Canastota, NY 13032
Ted Hume - Los Angeles, CA 90011
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Gwendolyn Torres - Wyncote, PA 19095
Susan Cates - Durham, NC 27705
Alexandra Brenke - Reno, NV 89506
Patricia Peck - Niagara Falls, NY 14304
Jean Stidham - Las Vegas, NV 89145
Jacqueline Cuthbertson - Charlotte, NC 28227
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Marisa Morales - Denver, CO 80238
Teresa Phillips - Fort Collins, CO 80525
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Maria Barakos - Arleta, CA 91331
Julie Rubio - Estero, FL 33967
Anita Marshall - Stamford, CT 6907
Faith Quarto - Mahopac, NY 10541
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Lorna Wallach - Port Saint Lucie, FL 34987
Sherie Holomuzki - Homerville, OH 44235
Crystal Kent - Rio Linda, CA 95673
Diane Dillabough - New Hartford, NY 13413
Janet Maker - Los Angeles, CA 90024
Jennifer Reza - Los Angeles, CA 90046
Cindy Alba - Downey, CA 90240
Rob Roberto - Santee, CA 92071
John Funderlic - Schererville, IN 46375
Kevin Silvey - Seminole, FL 33777
Linda M Richards - Erie, CO 80516
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Barbara Rizzotti - Floral Park, NY 11001
Steven Devadanam - Houston, TX 77007
Brenda Seifert - Yakima, WA 98908
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Lorraine Brabham - Hoboken, NJ 7030
Carla Morin - Peoria, AZ 85382
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Carol Shelton - Bedford, TX 76022
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Barb Buhrman - Ballwin, MO 63021
Richard Compagni - Cortland, NY 13045
Yvonne Compagni - Cortland, NY 13045
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Cory Hall - Clifton Park, NY 12065
Kathleen Schatzmann - Colts Neck, NJ 7722
Ron Kovatis - Sea Isle City, NJ 8243
Rosalie Prieto - Bakersfield, CA 93311
John Howard - Brookings, OR 97415
Mariah Mitchell - Winston Salem, NC 27127
Pamela Flick - Whitmore Lake, MI 48189
Gabriela Raccah - Cutler Bay, FL 33157
Janice Prokop - Plymouth, MI 48170
J Anderson - Spanish Fork, UT 84660
Shawn Smith - Lincoln, NE 68521
David Del Sesto - Enfield, NH 3748
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Jacqueline Glyde - Portland, OR 97220
Mary Johnson - Loveland, OH 45140
Elizabeth Fahy - Deltona, FL 32725

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Valérie Raynaud - Gardiner, OR 97441
Dawn Boothe - Lebanon, CT 6249
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Dale Wood - Fairhope, AL 36532
Michael Bordenave - Fresno, CA 93728
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Tiffani Long - Lemoyne, PA 17043
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Jennifer Abernathy - Ventura, CA 93001
Dennis Landi - Bellflower, CA 90706
Alena Jorgensen - Temple City, CA 91780
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Irene Roos - Lakeside, CA 92040
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Pamela Maxfield - Danvers, MA 1923
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Deborah Dahlgren - East Hartford, CT 6118
Margaret Woodard - Calverton, NY 11933
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Tracie P - Portsmouth, NH 3801
Marisol Melgarejo - Hoorn, NH 16280
Claire Loridan - Papeete, AP 98713
Lynette Smith - Lecanto, FL 34461
Cassie Fletcher - Devon, NJ 55555
Callie Pillow - Mount Vernon, OH 43050
Carol Williams - Lititz, PA 17543
Laura De la Garza Blanca - Sant Cugat Del Vallés, AP 8195
Mona Khoury - Buckner, KY 40010
Beatrice Demoulins de Riols - Saint-Lon-Les-Mines, AP
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Poppy Bramley - Manchester, NH 3102
John Bramley - Manchester, NH 3102
S Bramley - Manchester, NH 3102
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Mike Evans - Berkeley, CA 94720
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Hilde Nagels - Machipongo, VA 23405
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Madison Mitchell - Simi Valley, CA 93063
Christine Josselin - Felda, FL 33930
Camille Serotini - Lake Geneva, WI 53147
Kristof Haavik - Menomonee Falls, WI 53051
Alley Perry - Tacoma, WA 98421
paula drumcea - Constan?A, CA 90131
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Dr. John Brooks - Tate, GA 30177
Lisa Annecone - Englewood, FL 34295
Azhand Shokohi - Maineville, OH 45039
Jamie Sawtell - Captain Cook, HI 96704
Kathie Boley - Three Rivers, CA 93271
Ken Gibb - Zephyr Cove, NV 89448
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Mary Callison - Bend, OR 97709
Carole Smudin - Bridgewater, MA 2324

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John Essman - Healdsburg, CA 95448
Phyllis Becker - Port Hadlock, WA 98339
Aubrey Johnson - Kotzebue, AK 99752
Christina Clement - Intercourse, PA 17534
Linda Coombs - Mashpee, MA 2649
Leslie Prouty - West Hyannisport, MA 2672
Charles Arnold - Manchester, NH 3105
Kurt Gross - San Diego, CA 92176
John Wozniak - Mendocino, CA 95460
Pamela Hall - Joliet, MT 59041
Dany Cockburn - Bearsville, NY 12409
Jackie Boone - Bailey, NC 27807
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Lisa Giovanni - Glen, NH 3838
Joann Sullivan - New York, NY 10013
Carolyn Long - Port Angeles, WA 98362
Nathan Scott - Whitewater, WI 53190
Gary Evans - Troutdale, OR 97060
robert smistik - Fairfield, IA 52556
Laurie Storm - Stinnett, TX 79083
Elizabeth Edwards - Cloverdale, OR 97112
Donna Hess - Butternut, WI 54514
Emily Dickinson-Adams - Suffield, CT 6078
Melissa K - South Heights, PA 15081
Janette St Pierre - Eugene, OR 97402
Jim Rogers - Woodstock, GA 30188
Cheryl Adams - Lucernemines, PA 15754
Mary callen - Swiftwater, PA 18370
Leticia Garcia - Scottsdale, AZ 85252
Carol Dearborn - Lakemont, GA 30552
Tara Hoffman - Wellsville, PA 17365
Karen Hughes - Pine Knot, KY 42635
Victoria Hilton - Guatay, CA 91931
Adriana Zuniga - Anaheim, CA 92803
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Sheila Gut - Lafox, IL 60147
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Donna Alleyne-Chin - Montara, CA 94037
Rita Carlson - Eureka, CA 95502
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April Woolley - Springer, NM 87747
Nancy Cooper - Botkins, OH 45306
Angela Tocci - Westtown, PA 19395
Jayne Winters - South China, ME 4358
Deborah Shinski - Kanab, UT 84741
Jeffrey Blackman - Tucson, AZ 85717
Jennifer Garcia - Corte Madera, CA 94976
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kare m - Beverly Hills, CA 90213
Nayda Valle - Tucson, AZ 85733
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Danielle Ferrusi - Germantown, NY 12526
M A - Henrietta, NY 14467
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V. Frick - York Harbor, ME 3911
Lisa Frost - Hornbrook, CA 96044
Carol Hall - Mathews, VA 23109
Christine Bohley - Philmont, NY 12565
Trina Bodine - Cloverdale, CA 95425
Kathleen Medina - Lenox, MA 1240
Etta Karth - Pepeekeo, HI 96783
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Carmine DiLeo - Middlesex, NJ 8846
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Susan Gilcreast - Derry, NH 3038
Connie Hart - Hulbert, MI 49748

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Sherry Guzzi - Tahoe City, CA 96145
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Sharon Mylott - Charlestown, NH 3603
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Helen Malinauskas - Montello, WI 53949
Sharon Wolfsohn - Hartland, WI 53029
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Paula Harris - Mukwonago, WI 53149
John Peterson - Oconomowoc, WI 53066
Carol Groenendal - Elkhorn, WI 53121
Claudia Michalski - Whitewater, WI 53190
Robert Kalovsky - Onalaska, WI 54650
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Lori Schabow - Shiocton, WI 54170
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Michael Zatto - Novato, CA 94949
Julie Clayman - Chagrin Falls, OH 44023
Tracy Kanno - Cranston, RI 2910
Dana Loy - Killeen, TX 76541
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Heather Quillen - Land O Lakes, FL 34639
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Richard Gilman - Vista, CA 92084
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Lillian Taylor - Lawrence, KS 66044
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Darlene Peters - Schofield, WI 54476
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Mary-Ellen Perry - Cambridge, MA 2138
Sharon McClennen - Collegeville, PA 19468
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Siobhan Fitzgerald - Avon, CT 6001
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Patricia Busk - San Francisco, CA 94131
Carol Zimring - Encino, CA 91316
Patricia Norton - Melbourne, FL 32935
Gail and Jim Breen - Garfield, NJ 7026
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Joelle Mauer - Merrill, WI 54452
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Barbara Danese - Placerville, CA 95667
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Denise M Brown - Rockaway Park, NY 11694
Candace Blankenship - Los Angeles, CA 90045
Lauren Alanis - Chicago, IL 60657
Marc Silverman - Los Angeles, CA 90068
Richard Hale - Schertz, TX 78154
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Jana Hennelly - Ramsey, NJ 7446
Brenda Kinley - Simpsonville, SC 29680
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JOSEPH KALEEL - Sebewaing, MI 48759
Carlos Espina - Webster, TX 77598
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Mary Parsons - Bellevue, NE 68005
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Nancy Petchel - Brookfield, WI 53005
Esther Cook - Pensacola, FL 32505
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Cristina Helms - Miami, FL 33150
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Debbie White - Seffner, FL 33584
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Patty Bethurem - Richmond, CA 94803
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S F - Midvale, UT 84047
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S Verma - Boynton Beach, FL 33734
Kathy Esch - Milwaukee, WI 53209
Sheila Beth - Pawleys Island, SC 29585
Sidney Mitchell - Dover Foxcroft, ME 4426
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Gary Sabin - Portland, TN 37148

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Darryl JOHNSON - castle hayne, NC 28429
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Susan Nulman - Cranston, RI 2920
T. Chandler - Dallas, TX 75243
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Ralph Collier - Hammond, IN 46324
Jonnie England - Dallas, TX 75233
Debbie Raif - Greenwood Lake, NY 10925
Allyson Short - Savannah, GA 31401
Leslie Owens - WINTHROP, MA 2152
Ellen Dryer - Loveland, OH 45140
Roxanna Evans - Apex, NC 27539
Melody Chadwick - Blackfoot, ID 83221
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Joan Mcdade - Lighthouse Point, FL 33064
Janice Poppenga - Boise, ID 83714
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Britt Lind - Thousand Oaks, CA 91360
Pamela Howe - Tucson, AZ 85743
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Dan Hopkins - Stevenson Ranch, CA 91381
Laura Morris - Fort Wayne, IN 46804
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Robin Hero - Jackson, MS 39211
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Marla Friedman - Saint Louis, MO 63117
Rebecca Turner - La Plata, MD 20646
Sandy Aversa - Ballwin, MO 63011
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Sharon Irwin - Talala, OK 74080
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Wayne Wilkinson - St Louis, MO 63116
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Jacqueline Flood - Boone, NC 28607
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Janett Randle - Ontario, CA 91762

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Debbie Swafford - Midland, TX 79707
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Nikki Jewell - Richmond, IN 47374
Cindy Witherell - Holt, MI 48842
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Maria Covino - San Antonio, TX 78238

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Michael Casey - Nakina, NC 28455
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Alicia Grossman - FL, 34987
Alicia Rohlfing - Colorado, 80921
Aline Corry - TX, 77598
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Alisa Curry - NV
Alisa Houpt - CO, 80234
Alisa Martinez - CO, 80933
Alisha Whaley - CO
Alison Osment - CA, 91411
Allen Alicia - NY
Allen Frank - WA
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allen weller - NJ, 7826
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Allison Agnello - FL
Allison Cooper - IA, 50801
Alora Beko - OH, 43081
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Alys Grant - NY, 11779
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Alyssa arrowood - KS
Alyssa Durbin - IL, 60913
Alyssa Kowalczyk - ME
Alyssa Rosenthal - NY
Amanda Adams - TX
Amanda Barletta - AZ
Amanda Coc - GA
Amanda Dean - OR
Amanda Floyd - FL, 32234
Amanda Henley - FL, 33616
Amanda Holmes - SC, 29340
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Amanda Mishoe - FL, 32656
Amanda Miyamoto - FL, 34108
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Amanda Ortiz - FL, 34746
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Amanda Skerski - AL, 90084
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Amber Bucy - CO
Amber Duperre - NY
Amber Garner - AL
Amber Martinelli - MI, 48141
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Amie Oliver - CA, 93614
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Amra Habibuddin - AL, 98121
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Amy Bernard - LA, 70471
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Amy Hall - AL
Amy Lerner - AL, 14224
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Amy Schmidt - PA, 16507
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Analicia Morales - TX, 78130
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Anderson Christina - NM, 87544-1745
Anderson Jennifer - FL, 32771

Anderson Kerensa - AL
Anderson Michelle - TX
Andi Klein - CA, 91390
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Andre Mittelmark - MN
Andre Munhoz - MA, 2189
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Andrea Detterline - PA
Andrea Engelbrecht - FL, 34109-8785
Andrea Fritz - WI, 53227-1358
Andrea Hall - NJ, 7438
Andrea Immoos - MI, 49022
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Andrea McCallister - AL
Andrea Muller - CT, 06114-3022
Andrea Smith - FL, 33351
Andrea Zemel - OH, 44023
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Andres Carrera - CA
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Andriette Redmann - AL
Anett Berindan - ny, 11204
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Angela Barbee - CA, 91910
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Angela Garabet - CA, 91741
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Angela Kuchenbecker - OH, 44260
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Angela Scotti - NH
Angela Shaw - FL
Angelia Angel - TX, 75052
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Annemarie Gallagher - PA, 19114
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Anthony Lowery - AL
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Antoinette Martinez - CA, 90023
Antonetta Ramos - RI
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Antrim Mark - WA
Applewhite Faye - KY
April Zorc - IL
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Ari Heyman - NJ
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Ariel Miller - TX, 78736
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Arielle Lindsey - AL
Arleen Papula - VA, 22039
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Art Croswell - AR
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Arthur L. Gilbert - AR, 72521
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Ashley Adrian - MI, 48842
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Ashley Melissa - AL

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ASHLYN TEED - UT
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Audrey Gregg - PA, 16686
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Avelina Donchenko - AL
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Bachman Sarah - AZ
Bacon Cathy - WI
Baeckelandt Marianne - FL
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Barb Carenen - WI
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Barbara Acker - AZ
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Barbara Cain - AR
Barbara' Castens - AL
Barbara Childers - MA, 2652
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Barbara Findlay - AL
Barbara Finley-Shea - MN, 55912
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Barbara Gibson - MD
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Barbara Greenleaf - CA, 92870
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Barbara Heitzner-Clarke - AL
Barbara Hicks - OK, 74464
Barbara J pitts - VA, 23150-3007
Barbara Jones - MN
Barbara Kayitmaz - NJ, 8534
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Barbara Lott - MO
Barbara Lukowski - NY
Barbara Magliocca - CA, 95945
Barbara Morrison - AL
Barbara Mueller Mueller - MD
Barbara Myers-Fontaine - NY, 10990
Barbara O'Steen - CA, 96044
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Barbara Ramirez - MI, 48722
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Barbara Sirk - MD, 21797-8521
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Barbara Spector - NJ, 8080
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Barri Spitzer - MD, 21117
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Barton Rose - FL
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Bazemore Christine - FL
Bea Gottschalk - AL
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Bear Linda - AL
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BeccaBoo Lawter - SC, 29334
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Becky Anderson - KS
becky bushong - IN, 46516-9753
Becky Hinson - SC, 29349
Becky Ilic - NJ, 7832
Becky j Keown - TX, 75683
Becky Meese - NC, 28315
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Becky Shaw - MI, 48433
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Bela D - MD, 21030
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Belinda Fitzgerald - IL
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Benjamin Wheatley - MA, 2453

Bennett Cheryl - OH, 43623
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Bernadette Masur - MA, 1701
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Bernice De Anda - CA
Bernice Dillman - FL, 33411
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Bertha Daley - TX, 77505
Best Megan - PA
Beth A Marshall - OR, 97502
Beth Foye - ME, 4535
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Bethel Cheryl - IL
Bethia Brehmer - MA
Betsy Berman - GA, 30306
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Bettina Bowers - TN, 37216
Betty Albright - NY, 12077
Betty Ausley - VA, 22025
Betty Brown - TX, 76310
Betty Dahlem - FL, 33637
Betty Jerome - KY, 42164
Betty Jordan - RI, 02809-0995
Betty Lomazzo - GA, 30507
Betty Lui - , 8360
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Betty Ostergard - IL
Betty Simpson - KS, 66067
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Betty Weber - MI
Betty Williams - NC
Betty Wilson - PA, 15044
Bettyjoe Parmer - PA, 17520
Bev Tinker - CO, 80821
Bev Verhulst - WI
Beverlee Patterson - NY, 12020
Beverly Barbosa - AL
Beverly Buckley - KS, 66061

Beverly Cook - TX, 76533
Beverly DeSanctis - NY
Beverly Fyfe - TX, 75081
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Beverly Johnston - WA, 98373
Beverly Leifer - AL, 90802
Beverly McCourt - AR, 72143
Beverly Nowling - FL, 32220
Beverly Peoples - PA
Beverly Steffens - MI, 48348-2861
Beverly Stumpf - CO, 80226
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Bialas Susan - GA, 30132
Bianca Jones - CO, 80234
Bianca McArrell - OH, 43017
Bickford Dot - ME, 4937
Bill Brobst - CA
Bill Donaldson - NJ, 7035
Birgit Witcher - IN
Birgitt Hicks - VA, 22403
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Birgitte Carlsen - NY, 11231-4906
Bishop Joy - NV
Blacklidge Scott - OR
BLACKMAN Karen - NY, 13411
Blair Whitaker - OR
Blanca Benitez - TX
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Blanche Lamboy - NY, 10459
Blasingim Jaime - OH, 43605-2936
Bloome Wendy - GA
Bob Bacho - OH, 44111
Bob Brucker - FL, 34208
Bob Furem - IL, 60640-4755
Bob Gunn - CA
BOB Menard - RI
Bob Sobecke - WI, 54521
Bob Vallas - IL, 61611
Bob Woodward - MA, 02766-3204
Bobbi Bobbi - AL
Bobbi George - CA, 95051-5161
Bobbie Davenport - FL, 34120
Bobbie Dowell - MO
Bobbie Forsgren - ID

Bobbye McGarry - FL, 34471
Bogue Karen - AL, 75630
Bonita Bonita - WV
Bonita Hall - WV, 26155
Bonner Wanda - FL
Bonnie Armontrout - NY, 14622
Bonnie Arnold - PA
Bonnie Beres - MI, 49102
Bonnie Bond - AL, 77360
Bonnie Braga-Chavez - NM
Bonnie Brooks - AL
Bonnie Calhoun - GA
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Bonnie Cavallo - Ct, 6460
Bonnie Garretson - VA, 23116
Bonnie Halterman Lockhart - MD
Bonnie Harrison - AL, 52411
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Bonnie Higley - CA, 92024
Bonnie Jackman - WA, 98604
Bonnie Jenkins Freel - OH
Bonnie LaRosa - NY, 11746
Bonnie Lovelady - CA, 95736
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Bonnie Sykes - , 16137
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Bonnie Whitson Jr - AZ, 85020
BONNNIE CARRUTH - CA
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Borbon Helen - AL, 7003
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Bowers Jack - CA
bowland Jane - OH
Boyer Tina - PA
Bozena Konefes - IL, 60107
Brad Blackburn - VT
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Brad Bowers - AL, 28358
Bradley Cohen - NC
Bradley Vega - CA
Braga Elaine - MA
Braley Launa - ME
Brandi Wolff - CO, 80215
Brandon Boe - CO, 80233-2661
Brandon Bowles - NY
Brandon Celli - FL
Brandon Perkins - OH, 44446
Brandy Farmer - NC
Brandy Garnett - FL, 34453
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Brandy Powers - WI, 53151
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Brenda Allen - SC
Brenda Billings - AL, 78744
Brenda Brock - GA, 30554
Brenda Czach - DE, 19703
Brenda Dwello - CA, 95462-0856
Brenda Gaudreau - NV, 89130
Brenda Goodman - MI
Brenda Heise - AL, 66614
Brenda Hummel - WA
Brenda Janssen - KS, 67480-8613
Brenda Jarman - IN
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Brenda Mudd - AL, 48730
Brenda Murchison - AL, 71104
Brenda Norris Warwick - OR, 97470
Brenda Nunemann - CO, 80504
Brenda Pagan - NJ
Brenda Psaras - NY, 11940
Brenda Sampson - OK
Brenda Shephard - FL, 33775
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Brenda Steinmetz - RI, 2839
Brenda Tischofer - CT
Brenda Walters - IA, 50223
Brenda Webb - FL
Brenda wise - AL
Brenna Kiewicz - MI
Brensinger Tammy - PA, 17929

Brent Walker - OH
Brett Busang - TN, 38117
Brett Caspary - CA, 95973
Brett St Germain - WA, 99403
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Brian Bisbee - OR
Brian Bodt - CA
Brian Canfield - MD
Brian Hail - TX, 78247
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Brian Mahoney - NY, 11703
brian mccullough - PA, 19154
Brian Messenger - CO
Briana Viele - NY
Brianna Brown - AR
Brianna Kohlenberg - TX, 75071-2426
Brianna Worsham - OR
Bridgar Hill - MT
Bridget Brewer - FL, 32129
Bridgett Dennis - AL
Bridie Aviles - MO
Brigid Fallon - OR, 97045
Brigitte Maria Evans - VA, 22630
Brigitte Piller - Ca, 90274
Brinton Lisa - ID, 83714
Brister Marilyn - VA
Brit Best - MN, 56308
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Britt Magadini - OR
Britta Hansen - ND
Brittany Griffin - TX
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Bruce Bennett - CO
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Brunie Rodriguez - GA, 30214
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Bryan Ersek - PA, 19014-2725
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Bryan Sabin - CT
Bryant Donna - AL, 48651
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Burke Lynn - CO, 80905
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C. McCrory - AL, 49085
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Calle Flynn - CT
Calley Lovett - AL
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Camile Getter - CA, 95819-3139
Camille Brighten - WA
camille I kocsis - MI, 49660
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Camille Peloso - MA, 1952
Camille Ward - MI
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Candace Colbert - OR, 97801-3073
Candace Shaffer - CT
Candace Slivinski - CA, 90250
Candace Walker - CO, 80538
Candice Cassato - WA, 98502-9690
Candice Engolia - FL, 33713
Candice McQueen - CO, 80705-4860
Candy Daugherty - KY
Candy Farrington - AZ
CANDY SINGLETON - AL, 35045
Cantrel Judy - MO
Cara Lovejoy - NC
Cara Tichy - CT, 6478
caren pencil - OH
Caren Sandford - IN, 47025

Carey Bryan - OR, 97703
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Carey Waterman - AL
Carissa Nichols - OH
CARL LUHRING - CA, 92083
Carla Engle - FL
Carla Johnson - AL
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Carla Perry - NE
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Carlene Nye - IN
Carlos Calvao - NY
CARLOS COHEN JR - NJ, 7104
Carlos Gusiner - AL
Carlos Martell - FL, 33511
Carman Taylor - AL
Carmela DeMorest - AL, 34431
Carmela Quinlan - GA, 30024
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Carmen Cortes - AL
carmen Prebel - FL, 32081
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Carmen Tiger - OK
Carmen Villaverde - AZ
Carney Melinda - PA, 15701-4002
Carol Accorsi - NY, 12020
Carol Bartels - AZ, 85286
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Carol Briggs - MA, 01522-1431
Carol Bryant - TX, 75056
Carol Carol - UT
Carol Carpenter - TX, 78250
Carol Chappell - NY, 12440
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Carol Grey - IA, 50436
Carol Groenendal - WI, 53121-3669
Carol Haas - OH
Carol Hill - AZ
Carol Hoadley - FL, 32320
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Carol Johnson - TN, 38485
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Carol Lagnese - NY, 11746
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Carol Lyons - TX, 78223
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Carol Marshall - NY, 14103
Carol McLaughlin - PA
Carol McWhirter - NE, 68932
Carol Meade - MA, 2638
Carol Meyer - MO, 65018
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carol miller - NE, 68507
Carol piazza - MA
Carol Reimer - TN, 37914
Carol Seeley - NY, 12117
Carol Shelfo - IL, 60108-1803
Carol Shipley - KY, 40006
Carol Solum-Kleinfeldt - WI, 53555
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Carol Sterley - WA, 98023
Carol Tafel - IL, 60056-1807
Carol Theodus - , 44028
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Carol Weissberg - CA, 91311
Carol Westall - FL
Carol White - SC
Carol Worcester - CO, 80401-4813
Carol Wright - UT, 84121
CarolBy Jones - KS, 66605
Carole Atilano - VA
Carole Barsis - PA, 17856
Carole Berry - OH
Carole Brady- Duport - CA, 94080
Carole De La Cruz - CA, 95492

Carole Farace - FL, 32837
Carole Feldman Koerper - OH, 43615-2758
Carole Friedman - ME, 4105
Carole Howey - PA
Carole Lange - WI
Carole Pitman - OH
Carole Ridley - FL, 32615
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Carole Strack - NM
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Carole Wilmoth - TX, 76059
Carolina Adler - CA, 91367
Carolina Cruz - AL, 80010
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Carolina Kelly - GA
Caroline Ashton - AZ
Caroline Barber - VA, 22202
Caroline Gautier - MN, 55318-1364
Caroline Palumbo - NC
Caroline Sellami - AL
Carollee Starr - MI
Carolno Bartley - OH
Carolyn Breedlove - LA, 71457
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Carolyn Burslem - MI, 48170-3238
Carolyn Chamberland - CA, 94550
Carolyn Clark - MS, 39553
Carolyn Crawford - IA
Carolyn Gilliam - TN, 37813
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Carolyn Henry - IL, 62298
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carolyn kull - NJ, 8080
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Carolyn Machado - MA, 1701
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Carolyn Reed - AL
Carolyn Slater - OH
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Carrie Elrod - TX, 78362
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Carroll McAndrews - NC
Caryn Kennedy - PA
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Cass Gilbert - IL, 60107
Cassandra Angulo - CA
Cassandra Garza - TX, 75165
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Castillo Delores - TX
Catalina Trevino - TX
Catharine Calloway - SC, 29334
CATHERINE BUCHANAN - CA, 95531
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Catherine Cregar - CA, 92584
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Catherine J Garneski - DE, 19901
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Catherine Scarborough - CA, 95621
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Cathleen Daniels - ID, 83333
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Cathryn Welch - PA, 17701
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Cathy Bourgeois - CA, 94565
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Cathy Nassimbene - CO, 80915
Cathy Norcross - GA, 30068
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Cathy Paxton-Haines - HI, 96768
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Cathy Sammartano - FL, 33458
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Cecil Woolley - CO, 80030
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Charlotte Kincaid - HI
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Cheryl Allen - CO, 80234
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Cheryl Anders - LA, 71292
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Cheryl Bradford - TX, 78412
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Chris Meyer - TX, 78233
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Chris Rodeghier - WI
Chris Silber - NY
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Christian Chambers-Nowitzke - MI, 48117
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Christina Lina - NY, 14139
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Christine Karuna-karan - WA, 98036
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Chuck Alvarez - CO, 80420
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Clark Lori - AL
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Colleen Camero - PA
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Constance Martucci - NY, 11415
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Coscia Susan - FL
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Covey Jennifer - FL
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Craig Carney - FL
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Crain Deborah - OH
Crash Whitman - NY
Crilly Laurie - AL
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Cristal Hernandez - GA, 30093
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cristina Lucero - CA
Crocker Carolyn - IN
Crompton Janet - NC
Cross Dorothy - TX
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Crystal brown - MN
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CW Cox - FL, 33513
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cynthia armour - DE, 19968-2911
Cynthia Barber - IL, 60102
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Cynthia Bringss - California, 91786
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Cynthia Jackson - FL
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Dan Hornaday - MI, 48906
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Dana Damiano - CO, 80210
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Dana Mark - AL

Dana McGlynn - NY
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Danelle Jo Koper - PA, 15089
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Dani A - AL, 80919
Daniel Bennett - OH, 45103-4007
Daniel Corral Jr - CA, 95024
Daniel DeBellis - NY
Daniel Hartwig Sr. - MA, 1256
Daniel Kelley - ID
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Daniel Kintz - WI
Daniel Winkler - WI, 54880
Daniela Puglia - FL, 33135
Daniela Wever - WA, 98360-1498
Danielle Alvord - WI, 53146
danielle Drain - NY, 11004-1345
Danielle Henderson - IL
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Danny Alderman - WV, 25143
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Daphne Madron - NC, 28645
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Darnell Mona - KY
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David Gregory - AL, 06051-3154
David Holmes - OR
David Kirshbaum - NY, 10027-3811
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David Wasserman - NY, 11367
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Davo Sarno - CT
Dawn Babcock - MI
Dawn Beckette - MD, 21224
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Dawn Daugherty - MO
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Deana John - MI, 48134
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Deb Bakowski - FL, 34241
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Debbi Meredith - CA
Debbi Ritz - TX, 66523-1604
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Debbie Carter - CO, 80921
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Debbie Henley - KY, 42069
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Debbie Holiday - OH, 44270
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Debi Cole - TX
Debo Rooth - TN
Debora Dunham - IL, 62702-2463
Debora Hojda - FL, 33179
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Deborah Greenberg - NJ, 07405-1202
Deborah Hager - NV, 89451
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Deborah L Redden - CA, 92111
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Debra Atkinson - SC, 29544
Debra Barger-Cook - CA
Debra Best - VA
Debra Bradford - AZ, 86301
Debra Carter - MA, 1830
Debra Christner - NC, 27376-9301
Debra Collins - SC, 29588
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Debra Gilliland - TN, 38138
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Debra Puckett - FL
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Debra Randall - NJ
Debra Spector - VA, 23061
Debra Staufenberger - AZ
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DEBRA VILLA - NY, 11754
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Dedra Ramones - IN
Dee Dean - IA
Dee Hammons - WA
Dee Manning - NV, 89103-3124
Dee Phillips - FL, 33556
Deirdre Cochran - CO, 80537
Delainie Hanson - TX, 77346
Delana Calzada - NM, 88001
Delette Elliott Corwel - CT, 6514
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Demetra Mihalopoulos - NY, 11105
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Dene Canon - NM
Deneen DuBois - CA, 92117
Denine Dunston - MD
Denise Ackerman - MI
Denise Alverson - VA, 24540
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Denise Carroll - IL
Denise Del Boccio - NJ, 07407-3233
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Denise Desjardin - RI, 2904
Denise Drzal - CT, 6890
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denise goreski - PA, 18042
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Denise Lombardi - PA, 19148
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Denise Rizzo - MA, 1083
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Derith Ross - MA
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Desiree Aldorando - NY, 10027
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Destani Duvaul - KS
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Diamanda Bifshas - MA
Diana Bourgeois - VT, 5468
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DIANA KEKULE - OR, 97341
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Diane Bell - MD
diane beylen - IL, 60020
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Diane Coleman - VA, 24435
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Diane DiBernardo - NY, 11732

Diane Ethridge - TX, 77304
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Diane Fahey - OH, 44094
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Diane Gangi - OR
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Diane Grentzer - CA
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Diane Hampton - MI, 48111
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Diane m Palcovic - FL
Diane Martin - CA, 92071-4547
Diane McCafferty - AZ, 85614
Diane Murray - OH, 45233
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Diane Ocepek - MN, 55741
Diane Roth - PA, 19134-3812
Diane Rulo - MO
Diane Shaughnessy - WA
Diane Shealy - FL, 32008
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Diane Tyree-Delara - CO, 80602
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Jacqueline Ghilino - NJ, 8757
Jacqueline Harper - WA
Jacqueline King - AL
Jacqueline Laverdure - WA
Jacqueline Mccann - OH
Jacqueline McDonald - NJ, 7734
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Jacquelyn Barnes - FL
Jacquelyn Brady - NY, 14001
Jacquelyn D Evans RN - CA
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Jada Musgrove - CA
Jaime Austen - OR, 97540
Jaime Harris - AL
Jaime Watkins-Gillham - DC, 20010
Jamar Francis-Tunkara - NY
James Addison - OH, 45102
James and Debi Starnes - TN, 37620
James Bigelow - AL
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James Bourne - NY
James Crosby - SC
James DeAngelo - AL, 7110

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James Maxwell - PA
James Milligan - UT
James Morris - NC, 27455
James p. White,sr - AR
James Pauline - TX, 79605
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James Wipp - KY
Jamie Bruehl - OK, 73012-0604
Jamie Carpenter - NC
Jamie Crockett - OK, 73099
Jamie Daniels - Florida, 33559
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Jamie Todorovitch - NV
Jamie Vasquez - CO, 80022-2113
Jamila Hadade - NY
Jan Brieger-Scranton - CO, 81635
Jan Ferry-Axman - NY
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Jan Kowalski Reseigh - MI, 48461
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Jan Strawbridge - CO, 80013
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Jana Davis - OH, 43031
Jane August - CA, 90290-0666

Jane Banks - IN
Jane Brown - PA, 18104
Jane Cherry - TX
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Jane Dunn - NJ
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Jane Lemison - ID
Jane Marney - AL
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janet warnke - IA
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Janetkhou Obrien - AL, 43566
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Janice Callihan - NM
Janice cipolla - NY, 14225
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Janice Kemmerer - PA, 18080
Janice Layton - NE, 68967
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Janice Misiura - NY, 11373
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Jannie Wilson - AL
Jaqueline Campos - CA
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Jason Barnes - NE
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Jauna Beeks - WA
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Jaye Campana - OH
Jayne Wright - CA, 93711-6626

Jayson Zachery - CA, 92103-5919
Jean Brock - NY, 12138
Jean Chagnon - NY, 10001
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Jean Gahan - OH, 45238
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Jeanette Conway - AL
Jeanette Limbert - Id, 83709
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Jeanine Greene - AZ, 85742
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Jeannie Bohley - MI, 48066
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Jeannie Holder - GA
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Jeannine Kennedy - OH, 43616
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Jebbie Browne - CO, 81236
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Jeinnie Rojas - CA, 92586-2363
Jen Gg - AL, 49622
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Jenay Schmidt - MO
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Jenifer Taylor - NY, 12065
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Jennifer Armstrong - AL, 98501
Jennifer Cassell - NC
jennifer Chappelka - FL, 34480
Jennifer Denney - OH
Jennifer Donkersloot - AL
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Jennifer East - CA, 93065
Jennifer Evans - PA, 15613
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Jennifer Mcneil - AZ
Jennifer Mekalonis - NY
Jennifer Miller - KY, 40324
Jennifer Moore - KY, 41048-8606
Jennifer Murray - MO, 63116
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Jennifer Printup - OH, 45424
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Jennifer Rondeau - MA, 01253-0835
Jennifer Rukovena - NC, 28465
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Jennifer Solverson - WA
Jennifer Stewart - CO, 80466
Jennifer Sumner - VA
jennifer swartzentruber - OH, 44654
Jennifer Tozzi - NJ
Jennifer Vreeland - AL, 55024
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Jenny Nottingham - OH, 44647
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Jensen Fiskin - CA, 92260
Jeremy Benjamin - CA, 90078
Jeremy Kuronya - UT, 84107
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jeri ichikawa - WA
Jeri White - FL, 32024
Jerilynn Hollist - AZ
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Jerri Bush - CO, 81321
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Jerry Shafer - NJ
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Jessica Denis - FL, 32714
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Jessica Frye-Goble - IL, 21229
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Jessica Hentig - MN, 55406
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Jessica Jessica - VA, 24148
jessica krigsman - NY
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Jessica Rollins - CO
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Jessica Villanueva - LA
Jessica Villegas - AL
Jessica Yoder - IN, 46774-2923
Jessica Zalaznick - TX, 78704-2523
Jesslyn Saylor - IN
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Jill Corsiglia - AL
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Jill Shearer - WI, 53142
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Jim Gonzales - AL, 16502-2301
jim Mitrano - NY
jimena bains - TX, 77066
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jj skiddy - NY, 11501
Jo A. Hackwortn - OR, 97302
Jo Ann Delcambre - LA, 70510
Jo Ann Zoodie - PA, 15501
Jo Cole - IL, 62785
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Jo Franco - CA, 90044
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Joan Askins-Vanderhoff - OH, 45205
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Joan Justus - CA, 92115
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Joan Peterson - TX, 78418-6115
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Joana Ruiz - CA, 91786
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Joann Butkus - IL, 60632
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Joann Fay - MI, 48180
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Joann McKendry - NJ, 8081
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JoAnn Williams - AR
Joanna Laney - CA, 94089
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JoAnne Bickley - AL
Joanne Burke - TN
Joanne Capprllo - VT
Joanne Doherty - CA, 93065
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Jocelyn Amalong - FL
Jodi Apitzsch - OH
Jodi Armstrong - CA, 92814
jodi fuller - CA
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Jody Prowant - IL
Jody Ware - UT
Joe Kissel - SC
Joe Ortelli - AL
Joe Santiago - FL
Joel Ayala - AZ, 85009
Joel Barkley - MN, 55404
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Joelle Turner - CA, 93257
Joellen Beranek - IL
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John Heiser - AL
John Hix - OR
John Holland - CT, 6450
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John Vondra - TX
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Johnson Belinda - NC
Johnson Francesca - CA, 94541
Johnson Linda - NC
Jolene Cardwell - AL
JON and Margaret Brown - FL
Jon Whitcomb - DC
Jonalyn Irvine - AZ
Jonelle Przybylski - WI, 54467
Jones Heather - ID
Joney Anderson - AL
Joni Andress - TX, 76022
Joni Portwood - KY

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Joretta Hanlon - OH
Jorge Avila - FL
Jose Franco - CA
Josee Bevington - VT, 5068
Joseph Abdulian - CA, 91601
Joseph Bail - FL
Joseph Bassett - OH
Joseph Fisher - RI, 02895-4374
Joseph Hayes - MA
Joseph Janos Jenei - MI
Joseph Johnson - ME, 4092
Joseph Kocses - FL
Joseph Medina - MO
Joseph Montagnino - NC, 28226
Joseph Phares - MO, 64111
Joseph Targac - TX, 77964
joseph vining - NV
Josephine Troy - NY
Josh Guy - MI, 48837
Josnn Whitlock - FL
Joy Conley - WA
Joy Dehut - OR, 97302
Joy Dugan - NE
joy edwards - MD, 20720
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Joy London - IL, 60661
Joy Sperry - OH, 45381
Joy Stengard - DE, 19947
Joy Waybright - WV
Joyce Allington - NJ, 08540-4719
Joyce Bannick - MI, 48706
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Joyce Coberly - FL, 32773
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Joyce Kircher - PA
Joyce Lindblad - KS
Joyce Martin - VT
Joyce McKinnell - WA
Joyce Nadine Dochenetz - MI

Joyce Olsen - UT, 84074
Joyce Pikal - OR
Joyce Renner - WV, 25420
Joyce Ritner - AZ, 85362
Joyce Twobirds - OR
Juan Diaz - AL
Juan Hernandez Garibay - TX, 79915
Juan Jose Aguilar - CA
Juan Ulloa - TX, 79924
Juanette Cremin - OR
Juanita Montano - WI
Juanita Ross - MT, 59101
Juanita Trevino - TX
Judi Bostic - CO, 80013
Judi Eckes - NJ
Judi Gooding - UT
Judi Keller - AL
Judi Pritchett - GA
Judith A Kraemer Coco - FL, 33015
Judith A. Koch - OH, 45247
Judith Alford - GA
Judith Brinkley - FL, 32539
Judith Buckner - WA, 98351-9546
Judith Carter - AZ
Judith Chambers - MI, 48723
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Judith Collins Rutkowski - MI, 48085
Judith Emerson - TX
Judith Harmon - OH, 45120
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Judith Johnson - GA
Judith Kimball - CA, 95446
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Judith McSwain - CA
Judith McWilliams - AL
Judith Morelle - VA, 23834-1842
Judith Nemeth - NH, 3079
Judith Parks - AL
Judith Perlstein - TX, 76182
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Judith Rucker - MI
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Judith Sterling - FL, 32960
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judy auza - CA, 94564
JUDY BAKER - NC
Judy Bradshaw - GA, 31705
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judy bristow - NV, 89015
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Judy Dove - NC
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Judy Guenette - WI, 53221
Judy Hall - OR
Judy Hart - NY, 12020
Judy Hileman - KS, 67468
Judy Holick - TX, 77479-6326
Judy Hooper - WI, 54220
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Judy Lubrano - NJ
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judy slyper - FL, 34771
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Juli Ballines - IL
Julia Damiano-Moore - MO, 64801
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Julia Slaughter - CT, 6762
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Julia Thompson - MO
Julia West - FL, 33705
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Julian Williams - GA, 30324-3803
Julianna Giovannini - MI, 49424
Julianne Toohey - MD, 20872
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Julie Guido - MA, 1747
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Kahn Shawna - IL
Kaija Lindskog - VA, 20169
Kandice Esser - PA, 19540
KARA BARNES - KS
Karan Kozlow - NY, 13790
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kare m - CA, 90211
Karen Alejandro - CO, 80906
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Karen Bennion - UT
Karen Boggs - AL
Karen Bratty - MA
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Karen Burns - TX, 78641
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Karen Correll - IN, 46545
Karen Coslett - CA, 95018
Karen Dennen - RI, 02865-1914
Karen Diamond - AL
Karen Dyer - PA, 18974
Karen Fagundes - CA, 95120
Karen Farley - PA, 19136
Karen Gentilman - ID, 83646-4667
Karen Gilbertson - NM, 87112
Karen Gleason - NH, 3060
Karen Hall - MI
Karen Hewelt - MI, 48001
Karen Hirschmiller - FL, 32780

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Karen J Hutson - IL, 60473
Karen Kagee - IA, 52761
Karen Keough - NJ
Karen Knous - SC, 33841
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karen lee - CA
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Karen Lutz - OH
Karen Markum - TN
Karen Mayerchak - GA
Karen Miller - IL, 60466
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Karen Patton - IL
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Karen Petty - VA, 23457
Karen Rasmussen - WI, 53118
Karen Reich - CT, 6105
Karen Reid - CA
Karen Reid - CA, 95403
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Karen Ritenour Noffsinger - CA, 92020
Karen Romano - CO, 80227
Karen Rusch - WI
Karen Ryckman - ME, 4473
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Karen Stammeyer - MI, 49264
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Karen Waltman - NC, 28792
Karen Warren Warren - AL, 36582
Karen Watson - IL, 60169-3772
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Karen Whaley - OH
KAREN WOLF - UT
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Kari Gundrum - WI, 53007-1209
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Kari-Ann Fulton - FL, 45714
Karin Kruse - WY, 82520
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Karin Porrini - WA
Karina Alexander - AL
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Karlene Donato - CA, 91801
Karmann Yusishen - PA
Karol Wolf - TX, 75713
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Karon Westmoreland - IN, 47905
Karst Desiree - AL
Karylee Feldman - CA, 92105
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Kashi Sinha - GA
Kasi Howarth - CA
Kaskus Steven - CO, 81520-7912
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Kate Coons - TN, 37691
Kate Fitz - OR
Kate Holland - CO, 80247
Kate Loftus - PA, 19050
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Katey Parson - VA
Katey Parson - VA, 23464-6753
Katharine Roberts - NM
Katherine Diehl - IL, 60050
Katherine Gipple - IA
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Katherine Leon - NY
Katherine Martin - VT
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Katherine Richardson - NE, 68925
Katherine Rickels - GA, 30132
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Kathie Eastman - GA, 30646
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Kathleen Ackley - WI, 53511
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KATHLEEN HALL - MD
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Kathleen Henderson - NJ, 7002
Kathleen Johnson - FL, 32127
Kathleen Kinsella - AL, 61065
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Kathleen Majdalani - WI, 53217
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Kathleen McEnery - KS, 66215
Kathleen Neely - FL, 33712
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Kathleen Poole - NM, 87120
Kathleen Price - FL
Kathleen Sweeney - NH, 3455
Kathleen Walters - NC
Kathleen Walters - NC, 27013
Kathleen White - CA, 94122-4247
Kathleen Wyatt - NH, 3060
Kathryn Fromelt - OR
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Kathryn Jimenez - AL
Kathryn Leonard - KS
Kathryn Lezenby - PA
Kathryn McCollum - MO
Kathryn Ridgway - CA, 93535
Kathryn Sellers - TX, 78155

Kathryn Soto - MA, 2673
Kathryn Whitacre - OH, 45502
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Kathy Balcom - CA
Kathy Bowden - OH, 44485
Kathy Cordell - OH, 43040
Kathy Crawford - IL, 61938
Kathy Dawson - KY
Kathy Donegan - OR, 97017
Kathy Dubak - MI
Kathy Ebsen - AL
Kathy Eisenbarth - WA
Kathy Fleming - WI, 53221
Kathy Forbes - CA, 95350-0209
Kathy Foster - ME, 4102
Kathy Gordon - CA, 92084
Kathy Gray - CA
Kathy Harris - CO, 80305
kathy head - GA
Kathy Howard - IL
Kathy Hunter - TN, 37187
Kathy Hynes McCoy - KS, 67002
Kathy Ireland - NH
Kathy Janfrancisco - AZ
Kathy Kane - IL, 60452-1631
Kathy Leslie - FL, 33040
Kathy Letheby - WI
Kathy Manning - OH
Kathy Marshall - MI
Kathy Marti - OK, 73116-3121
Kathy Maxwell - WI, 53066
KATHY MITCHELL - ID
Kathy Moore - OR, 97317
Kathy Moreau - MA, 2650
Kathy OBrien - CA, 95560
Kathy Parrish - MI, 48458
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Kathy Renner - CA, 95827
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Kathy Strozak - VA, 23430
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Katie Abbott - OR, 97703

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katrina odermatt - NC, 28081
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Katy Gadzichowski - AL
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Kay Goodan - NC
Kay Hewette - SC
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Kay Wright Kaiser - IN, 47464
Kaye Lewis - PA
Kaye Patrick - IN, 46816
Kayla Lugo - CO
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Kelley Fuller - CA, 95007
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Kelli Reynolds - NM, 88310
Kellie Miner - NE
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Kelly IlundÃ¡in - FL
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Kelly McGinty - FL, 33823
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Kelly Moe - WA
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Kendra Kostellic - IL
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Kenneth Allen - TX, 77803
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Kenneth Miller - ID, 83860
Kenneth Nowotny - TX, 75143
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Kerry Michel - CA, 92084
Kerry Palin - CO, 80210
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Kevin Aragon - NM
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Kidd Angela - KY
Kim Baket - AL
Kim Bohler - OH, 45331

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Kim Romero - CA
Kim Satter - IN, 46208-4655
Kim Silvers - MN, 56649
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Kim Taylor - OH, 45241
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Kim Vannatta - PA
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Kimberly Bofill - TN
Kimberly Fassett - CO, 80013
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Kimberly Kelley - CO
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Kimberly Lewis - WA, 98125
Kimberly Lucey - KY, 42066
Kimberly Matkin - FL, 33909
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Kimberly Platt-Ewing - AL
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Kirstian Semprevivo - GA, 31794
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Kittie McIntire - NH
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Knapp Bonita - AL
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Korana Stipetic - NY
Koubalo Nadine - AL
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Kreger Mary - AL
Kris Ducat - WI, 54241
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Krista Sanders - FL, 33770
Kristal Alcazar - TX, 78717
Kristen Allbritton - TX, 75071
Kristen Bossert - DE, 19968
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Kristi Willis Willis - KY, 40160
Kristianne Peake - CA, 95451
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Kristoffer Hamby - PA
Kristy Greene - RI
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Krystal Shoop-Hardin - WA
Krystyna Prochocki - AL
Ksenia Asatryan - CA, 95054
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Kym Kephart - CA, 93308
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Kymberlee Maki - MI, 49338
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kyra jackson - AL
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LaGrow Diana - KS, 67480-8803
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Lampe Elizabeth - VA
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Lana Zettl - SC, 29644
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Lancarte Elizabeth - TX
Landry Corkery - AL
Lani Hummel - MD, 21403
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Laura Buck - OK, 74035
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Laura O'BRIEN - FL
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Laura T - GA
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Lauren Bohannan - MO, 63123
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Lauren Devonshire - PA, 17013
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Lauren Fields - LA, 70815
Lauren Fischer - AL
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Lauren Weibert - TN, 37064
Laurence Kenneth - NJ
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Laurie Deaner - CT
Laurie Hernandez - CA, 90704
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Laurie Malone - IA, 50701
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Laurie Winogrand - NV
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Laurieno gotham - AL
Lavella Phillips - FL, 34222
LAVERNE DECKER - CA, 94510-0333
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Lawrence Johnson - TX
Lawrence Scrima - CO
Lawrence Simon - AL
Le June Perrin - NC
Lea Allen - OK
Lea Danielson - AR, 72631
Leah Bixenmann - TX, 75446
Leandra Jones - TN, 38450
Le-Ann Kropa - ME, 4240
Leanne Harmon - WA
Lee Ann Collens - WA, 98367
Lee Ann McMillan - MN, 56082
Lee Anne - AK
Lee Pace - AL, 45238
Lee Randall - MS
Lee Wessell - FL, 32164
Leea Grieve - OH, 43440
Leeann Derry - NE, 68102
Leeann Ivie - UT
LeeAnn McDonald - AK
Lee-anna Postnikoff - CA, 95823
Leela Dinunzio - NY, 12546
Lefler Kaitlin - FL, 33301
Legg Karen - AL
Leigh Curtis - IA, 52556
Leigh Howell - Tennessee, 38468
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Leila Livingston - CA, 90039
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LELAND BALDWIN - AZ
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Lennette De Forest - CO
leonard buntele - FL

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Leonardo Gomez - AL
Les BearClaw Stewart - NY
Lesley Speck - WA
Leslie Allen - KY
Leslie Anderson - CA, 94596-6403
Leslie Baker - FL, 32097-7504
Leslie Baker - TX
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Leslie Estep - OH
Leslie Goodman-Allen - AR, 72211
Leslie Hake - WA, 98520
Leslie Long - AL, 40601
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Lesta Teman - OH, 45833
Leticia Chavez - CA
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Letty Fuentes - CA, 92840
Lewis Duenas - AL, 79930
Lexie Boezeman Cataldo - CA, 91360
Li Smithers - RI, 2861
Liane Bennett - WA
Lidia Kolesnikova - AL
Liesen Tori - AL, 62347
Lil Anderson - NE, 68632
Lil Judd - CA
Lilian R. - TX
Lilian R. - Tx, 78759
Lilian Varga - FL, 32504
Lillian Blasso - NY, 11949
Lillian Douglas - IN
Lillian Prahl - NJ, 8724
Lillyam Barberi - NC, 28805
Lily Vandersteeg - AL, 46375
Lin Herz - FL, 32905-4836
Linda Arndt - MI
Linda Ashton - FL, 32211
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linda beck-yost - MO
LINDA Brumley - OH

Linda Bryant - OH, 43615
Linda Buchowicz - IL, 60053
Linda Burcham - IN
Linda Calbreath - CA, 95928-9433
Linda Cane - PA
Linda Carter - NY, 14450
linda caylor - TN, 37862
Linda Chaney - CO, 81212-2641
Linda Chase - CA
Linda Collier - AL
Linda Contreras - WI
Linda Cummings - CA, 93560
Linda Cutts - MA, 2472
Linda Dalton - California, 91739
Linda Davies - CO
Linda Davis - OH, 43793
Linda Delong - GA
Linda DiLello - FL, 33068
Linda Eschman - TX, 76890
Linda Eversole - OH, 45013-1224
Linda Farrar - TN, 37214
Linda Floyd - IN
Linda Fortier - ME
Linda Garhartt - NY
Linda Gillespie - WA, 98370
Linda Glover - VA, 23606
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Linda Haberle - FL, 33573
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Linda Hedden - FL
Linda Henningsen - NY, 11782
Linda Herrington - TX
Linda Hicks - AR, 72023
Linda Hill - NH
Linda Hittle - MI, 49442-4642
Linda Hopkins - MI, 49015
Linda Howard - CA
Linda Hull - MT, 59935
Linda Johnston - MA, 02766-1228
Linda Justice - NY
Linda Kalin - NV
Linda Karppinen - NY, 14036
Linda Kieler - AL, 53807

Linda LaBella - FL
Linda Lane - FL, 33884-2600
Linda Lanza - NY, 10956-1919
Linda Lanzetta - NJ, 08234-6984
Linda Lawson - OH, 45385
Linda Lee - IL, 60148
Linda Lewis - MI, 49415
Linda Linda - PA
Linda Linzer - FL, 33411
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Linda McGill - MI, 49707
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Linda Millemaci - NY, 14217-1503
Linda Morrison - TX, 75090-0216
Linda Mrsich - IN
Linda Nitz - OR
linda Olson - MT, 59860
Linda Ossman - PA, 17921
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Linda Richard - MA, 1550
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LINDA STARR - OH, 44212-1822
Linda Steininger - OH, 43718-9732
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Linda Stronza - WV, 25420
Linda Thornsley - AL
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Linville Deborah - OR
Linzi Gronning - WI
Lisa Achilli - NY
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Lisa Anderson - AL
Lisa Balmain - AL
Lisa Bates - WV
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Lisa Bettendorf - CA
Lisa Brown - NC
Lisa Brown - NJ
Lisa Celsky - PA
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Lisa Coburn - IN, 47201-9575
Lisa Cole - GA
Lisa Decenso - PA
Lisa DeOrnellas - PA, 17028
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Lisa Gomez - TX, 78704
Lisa Gruber - IL, 60014
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Lisa Marlow - TX
Lisa Marx - TX, 78418
Lisa McMahon - MA
Lisa Meier - CO, 80209
Lisa Merrill - CA, 92116
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Lisa Neil - NY
Lisa Phinney - VA
Lisa Piecora - FL
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Lisa Pisano - NY, 11214-6004
Lisa Pryzgoda - CT
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Lisa Reames - IN, 46219
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Lisa Simpson - , 75040
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Lisa Telomen - IL
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Lisa Winters - WA, 98010
LISA YANT - WA, 98125-4598
Lisa Zafar - FL, 32807
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Lisi Hernandez - AL, 96003
Liz Bode - AL, 49546
Liz Davis - AZ
Liz Kirby - NY, 12528
Liz Perkins - TX, 75068
Liz piercey - NY
Liz Tuck - CA
Lizbeth Mendoza - TX
Lizzie Vierra - CA, 92627
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LOBSANG DHONDUP - MN
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lollieÂ° ragana - CA, 90405-5523
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Long Nguyen - MD
Longtin Beth - AL
loni Jones - AL
Lonna Luth - WI, 53105
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Lora Child - MN
Lora Lutz - OH
Lora Purpero - OH, 45601
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Loretta Agosta - NY, 10520
Loretta Bolton - OH
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Loretta Johnston - MI
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Loretta Nelson - ME, 4048
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Lori Mahony - NY, 10950
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Lorraine Lorraine Gilbert - CA, 90755
Lorraine Vesce - FL

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Lozada Rory - CA
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LuAnne Larson - SD, 57759-7612
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Lucia M Annunziata - AZ, 11580
Lucie Baird - HI
Lucille Murphy - , 10707
Lucinda Seaton - CA
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Lucy Barkus - SD, 57006-5805
Lucy Ortiz - CA, 92345
Ludlow Veronica - AL, 37754
Luis Fajardo - OR, 97021
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lydia wilfong - AL, 35216
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Lynda Carlson - FL
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Lynn Bamford - AL
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Lynn Casper - TN, 38134
Lynn Chase - MA, 1247
Lynn Chipkin - VA
Lynn Ellis - CA, 95240
Lynn Gaeta - DE
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Lynn Garza - FL, 32159
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Lynn Learch - TN, 37777-3067
Lynn Lutz - FL
Lynn Morin - , 99507
Lynn Mountcastle - WI, 53058
Lynn Pihl - MN, 55316-3443
Lynn Pitts - GA
Lynn Ramage' - PA, 19020
Lynn Royce - OR
Lynn Sowinski - IL, 60188
Lynn Truchon - NH

Lynn wolf - MA, 01420-5207
Lynna Strom - MN, 55448-2411
Lynne Coleman - AL
Lynne Florio - CA, 92117
Lynne Loosemore - OH, 44511
Lynne McMahan - TX, 79118
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Lynneâ¸ Chiaro - AL, 12303
Lynnette Bower - IN
m susan buck - MD
Machel Hall - KY, 40065
Machiko Shimada - CA, 95485
Mack. Davis - AZ, 85339
Maclean Rebecca - AL
Macy Brock - OH
Madeliene Davidson - KY, 40370
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Madeline Ditta - NY, 11753
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Madelyn Farrar - RI
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Mae Dennis - KY, 42748
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Maggie Mayer - NY, 10022
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Maile Anthopoulos - OR, 97008
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Makensie Paulsen - MN
Maki Ben-Avari - Az, 86336
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Malena Spraker - VA, 24084
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Mandy Ruk - PA
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Mann Peggy - AL, 57401
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Manny Hwier - AL, 48324-1550
manuela reid - NM, 87015
Mara Crowe - FL
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Marapao Potenciano - AL
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Marceau Jouett - IL, 62704
Marcela Arias Gomez - FL
Marcey Crisan - MI
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Marcia LeVee - FL, 32195
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Maren Northway - CA, 92835
Margaret Anderson - TX
Margaret Cobb - FL, 32607-3166
Margaret Correa - OR
Margaret D'Aquila - CT, 6457
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Margaret Johnson - NM
Margaret Kamps - FL
Margaret Korshoj - AL
Margaret Kotoski - MD, 18966-1329
Margaret Mccoy - IL, 60625
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Margaret Peterson - IL, 60004
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Margaret Ribeiro - NJ, 08108-1521
Margaret Sanchez - CO
Margaret Thurlow - CT
Margaret Vincent Vincent - VA
Margaret Williams - CA
Margaret9th Stansill - AL
Margarita Bobko - AL, 44107
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Margi Null - WA, 98125
Margie Gutierrez - CA, 95835
Margo McIntire - VA, 22801
Marguerite Elia - CA, 95831
Marguerite Fitzpatrick Anderson - DE
Mari Lavin - WV
Maria Avila - CA, 92201
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Maria Teresa Fagan - IL
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Marianne Frauenknecht - MI
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Maridee Grammer - UT
Marie Calcagno - LA, 70001
Marie E U-Tortorelli - WA
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Marie Joseph - LA, 70001
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Mariela Astorga - NJ
Mariia Banketov - AL
Marilyn Altenbach - IN, 47025
Marilyn Auer - CO, 80206
Marilyn Barefoot - IN
Marilyn Britton - TN, 37743-0965
Marilyn DeRosa Wilkie - NY, 10801
Marilyn Fisher - WI, 53186-2670
Marilyn Flynn - NY, 11935
Marilyn Glover - SC
Marilyn Gutierrez - FL, 33177
marilyn koogler - AL, 65588
Marilyn L Polo Polo - CA, 92404
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Marilyn Polen - FL
marilyn redwine - OR, 97218-3669
Marilyn Wells - KY, 42217
Marilyn Whipple - NY, 12563
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Mario Melo - RI, 02915-5440

Mario Tobias - TX
Marion Kiefer - PA, 15203
Marion Ramsey - TX, 75135
Marisa Lockwood - TX, 76210-3066
Marisol labrador Pomaski - TX, 76063
Marissa Berns - Texas, 78213
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Marjorie Baker - AL, 34432
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mark avila - CA, 95827
Mark billington - NY
Mark Bohun - AL
Mark Carroll - CA, 92103
Mark Edwards - NY
Mark Francis - TX, 57049
Mark Haake - MO, 63044
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Mark Tauer - IL
Markey Karen - MA, 02719-1510
Marla Barlow - CA, 92065
Marla Erhart - AZ
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Marlen Garcia - NY, 12010
Marlene Campbell - TX, 77449
Marlene Goldsmith - PA, 15238
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Marlo Redmond - IL, 60433
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marni glovinsky - MI
Marsh Sandra - GA
Marsha Fundak - OH, 44001
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Marsha Young - IN, 46062
Marta Retzler - TN, 37862-8415
Marten Richard Borg - CA
Martha Ayers - GA
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Martha Cosper - ID
Martha Desrosiers - NM, 87124
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Martha Morningstar - NC, 27244-9397
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Marty Astrup - OH, 44077
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Marty Williams - PA, 18612-9158
Marvene Lynch - OK, 73020
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Mary Ann Lucas - PA, 15207
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Mary Beth Sanders - IL
Mary Blanchard kelleher - OR
Mary Brasher - MS, 38632
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Mary Harrigan - AL
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Mary Hollinger - MD, 20639
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Mary Israel - NM
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Mary Jo Gallo - OH, 44052
Mary Jo Provenzano - VA
Mary Jo Vincent - CA
Mary Johnson - WA, 98001
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Mary Jordan - Tennessee, 37075
Mary Kozak - NY
Mary L. Citkovich - WA
Mary Lanham - PA
Mary LeMoine - MA
Mary Lewis - WV
Mary Little - CA, 95688
Mary Long - FL, 32320
Mary Lou Presley - WI
Mary Louise Wagner - PA

Mary Marcelo - NC, 28303
Mary Mason - TX
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Mary McAlister - OK
Mary McKean - MD, 21001
Mary Meaney - NY, 10606
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Mary Morrow - TX
Mary OBERST - OH
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Mary Palenza - CT
Mary Pelley - OH
Mary Poster - FL, 33990
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MARY R. MARY R.COCCODRILLI - PA
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Mary Rodeman - MO, 65065
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Mary Vandenabeele - , 2139
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MaryAnn Gruden - TX
Maryann Lagana - AL
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Maryann Rivas - AL
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Maryann Therrien - NH
MaryAnn Wuttke - , 70065
Maryeileen Corcoran - AL
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MaryJean Karchefsky - OH
MaryLyn Kroner - IL, 60423
Mary-Margaret O'Connell - WA, 98506
maryrose lopez - CA, 95682
Marzzacco Cheryl - AL
Matney Cheryl - MO, 65706-9942
Matney Tammy - VA
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Matt Helm - IA, 52577-3352
Matthew Callaway - AL
Matthew Johnson - CA, 92081-7979
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Matthew Spaulding - VA, 20121
Maura Pichette - VT, 5758
Maureen Barr - MO, 63114
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Maureen Butler - KY, 42431
Maureen Hovestadt - NY, 11729
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Maureen Whalen - MD, 20715
Maurice Samuels - PA
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Max Morgan - TX, 77035
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Maye Elizabeth - NV
Mayelly Moreno - NY, 11207
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McCarthy Jeanne - IN
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McCracken Deborah McCracken - AL
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McGee Karen McGee - AL, 35031
Mcginnis Allison - AL
McGuire Cheryl - WA
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McNair Aisha - NV
McNamara Maureen - FL
Mcsorley Alicia - NJ
Meade Marilyn - WV, 25703
Meadows Timi - MO
megan bielinski - CO
Megan Button - WI
Megan Haferkamp - WA
Megan Lopez - CA
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Megan Wood - NY, 14620-2271
Meghan McMahon - MN
Mel Smith - NC
Mel Taylor - KS, 67201-1235
Melani Brown - OR, 97303-7505
Melanie Bellemore - OR
Melanie Correll - ND, 58078
Melanie Curtis - IN, 46237
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Melanie Izquier - CA
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Melinda Davis - OK
MELINDA MRDJA - IN, 46203
Melinda Robinson - NC, 28462
Melinda Shazer - PA, 15442
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Melissa Anderson - WA
Melissa Baines Keipper - OR, 97219
Melissa Billings - NC
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Melissa Laurent - LA
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Melissa Morelli - AZ, 85653
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Melissa Peace - MA, 02601-2128
Melissa Peretsky - CO, 80150
Melissa Rea - VA
Melissa Rodgers - TN, 37128
Melissa Rollins-soy - NC, 28792
Melissa Sharp - NC
Melissa Shields - IL
Melissa Snyder - IN, 46750
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Melissa White - IN, 46143
Melissa Williams - MI
Melodie Cleveland - TX, 77484
Melodie Padgett - KY, 41042
Melody GAVINA - TX, 76028
Melody Higgins - PA
Melody Reasoner - WA
Melody Thomas - GA, 30215
Meranda Harford - OH
Mercedes Acosta - FL
MEREDITH ANDERSON - CO, 80234
Mergen David - AL, 85715
Meridee Albrecht - TX, 78753
Merrie Shager - VA, 20191-4906
Merwarth Maureen - OH, 44839-2610
Meryl Spiewak - PA, 19067
Meyer Anita - WI, 53144
Meyer Gail - WI, 54901
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MH Reinarman - MO, 63090
Mia Casanova - NV, 89103-3118
mia Haines - PA
Mia Sciandra - AZ, 85209
Micah Livermore - AL
Mich8 Franco - CA, 93612
Michael Barboza - MA, 1930

Michael Bartek - OH, 44444
Michael Brown - MN
Michael Coffey - SC
Michael Crocker - FL
Michael Gardner - OH
Michael Green - TX
Michael Hayes - FL, 32926
Michael Henkel - MI, 48507
Michael Jarrett - AZ, 85705
Michael Kiehn - AK, 99502
Michael L - PA, 15636
Michael LaGuardia - FL, 33015
Michael Mager - NC
Michael mcelhiney - ID
michael mundt - AL
Michael Ostrosky - PA, 15068
Michael Philbrick - MN
Michael Prelozni - AZ
Michael Richards - NC
Michael Rosenfeld - CA, 91001
Michael Ryan - CA, 91367
Michael Savage - NY, 10075
Michael Smith - CO, 80020
Michael Spencer - OH
Michael Thill - CT, 6762
Michael Varani - MI
Michael Wood - AL
Michaela Davis - AL, 5853
Michaela Pilloni - CA
Michael-David Kerns - WV, 25425
Micheal Barry - ID
Michel Sevick - WI, 53126-9708
Michele Andretta - CA, 92121
michele b - NJ, 8210
Michele Cardone - AL, 7843
Michele Davis - IN, 46544
Michele DiCiccio - NY, 12047
michele Ezzo - pa, 18641
Michele Gulino - FL
Michele Harmon - AL
Michele Irwin - MI, 48044-6005
Michele Martin - MN, 55337
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Michele Naphen - NJ, 8525

Michele Neville - MA
Michele Osland - SC, 29455
MICHELE P - TX, 75075
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Michele Quealy - , 1915
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Michele Sikorski - MD, 20636
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Michele Tennis - MI, 48135
Michele Toney - TX, 76021
Michele Villeneuve - TN, 37660
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Michele Young - CA
Michelle Banhegyi - WA
Michelle Barowski - TX, 78108-3166
Michelle Blackley - IL, 62615
Michelle Brooks - AL, 79423
Michelle Cann - AL, 08068-1919
Michelle Chandler - AL, 36608
Michelle Connor - TX, 77074
Michelle Dankers - MN, 55945
Michelle DeRose - NJ
Michelle Dingman - MI, 48161
Michelle Foster - AR, 72118
Michelle Grenwalt - WI, 54414
Michelle Harrison - UT, 84041-1523
Michelle Hirsch - FL
Michelle Hix - MI, 48150
Michelle Holman - UT, 84129
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Michelle Johnson - AL
michelle kaehny - NC
Michelle Kaiser - IL
Michelle lucero - CA, 91745-2330
Michelle Michelle - WA, 98512
Michelle Mincy - IL
michelle muffet - OH
Michelle Novotny - SC, 29801
Michelle Scatchard - AL, 91006
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Michelle Soucy - MA
Michelle Storace - CA, 94506
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Michelle West - OR, 97034
Michelle Weyler - NV, 89133
Michelle Williams - MD
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midori furutate - NY, 10034
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Mike Feenaughty - SC, 29745-9127
Mike Gigliello - , 72903
Mike Giordano - PA
Mike Gonnerman - IA
Mike Kaufman - AL
Mike Kincheloe - AL
Mike Kostyzak - AL, 15132
Mike Lanka - AZ, 85138
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Mildred Powell - new york, 13850
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Miller Audie - AL
Miller Dianne - WA
Miller Linda - MI
Miller Susan - OH
millerno Sam - IL
Millwood Carol - TN
Mimi Davis - IL, 60560
Mina Gerny - FL
Mindy Moyer - PA
Mine Castillo - CA
Minerva HernÃ¡ndez - AL
Mirabai Nagle - CO, 80503
Miranda Miriam Lilith - AL
Miranda Simpson - OH
Miranda Sweat - AL
Miriam Alam - FL, 33126
Miriam Kellerhouse - NY
Miriam Khris - FL, 33076
Miriam May - IN
Miriam Oliveros - CA, 93612-6902
Miriam Thomas - NC, 28139
Miriam Wolff - NY, 11229
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Misty Bland - FL, 32909
Misty Bryant - FL
Mitch Stroes - CO, 80241
MITCHELL AMANDA - WY
Mitchell Mead - TX, 77389
Mitcheltree Jackie - PA, 16828-9322
Mitsch Ken - PA
Mitzi Mcguffin - AZ
MJ Mashburn - OK, 74011
MJ Solensky - PA
Molly Sanchez - TX
Momyer Helga - PA
Mona Riddiford - IA, 50025
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Monica Bagnasco - NY
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Monica Caldas - NY
Monica Henry - MI, 49628
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Monica Lanning - OK
Monica Maynor - AL
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Monika Androwich - IL
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Monique Fonseca - CA
Montgomery Mary - AL
Monti Clark - CA, 93619
Monzo Debbie - MI
Moon Tracey - GA, 30083-2227
Mooney Donna joy - TN
Mora Alarcon - CA, 92233
Morales Freddie - WA
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Morgan Calantoni - PA, 18040
Moriah Dupuis - MA, 1373
Morley F Shaw - DE
Mort Zukerman - MI
Ms Virginia Robertson - WA
Ms. Hill - VA, 24084
Ms. Stone-Mutti - MA, 01475-1926
Murphy Linda - IL
Murray Neill - WA

Murray Randy - NY
Musolf Mary - CA
Myers Melissa - IN, 46526
Myra Burns - WI
Myra Stenson - FL, 34691
Myriam Cardenas - OR
Myriam Pena - IL, 60047
Myrian Monnet - CA, 91101
Myrna Houle - CT, 6239
Myrna Lee - MD
Myrna Weller - IA, 52730
Myron Blahy - AL
N. Burnette - AK
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Nader Alomari - TX, 75013
Nadezhda Wall-Rossi - CA, 92129
Nadia Findley - FL, 32701
Nadig Debra - MN
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Nadine Maxwell - AL, 92399
Nadya Anderson - SD
najera Paola - CA
Nakisha VanderHoeven - CA, 86409
Nalan Williams - FL, 32937
Nance Berry - VA, 23235
Nanci D. - ME
Nancie Rodriguez - FL, 33186
Nancy 9th Johnson - NE
Nancy Anne Parker - NY, 12566
Nancy Beckus - CA, 94526
Nancy Boggs - AL
Nancy Bohan - CT, 6405
Nancy Bohanon - IL
Nancy Bowen - WI, 53226
Nancy Brown - CO, 80219
Nancy Burchett - UT
Nancy Campbell - VA, 22942
Nancy Clegg - OH, 44203
Nancy Cunningham - MA, 1085
Nancy Cyr - AL
Nancy DeCoursey - PA, 17408
Nancy Eisman - CA, 90045
Nancy Forgett - NY
Nancy Galavi - CA

Nancy Griffin - CA, 92806
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Nancy Guilliams - PA, 19518
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nancy polito - CA, 95662
Nancy Porcino - NY, 11725
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Nancy Seward - DE
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nancy smith - SC, 29464
Nancy Threadgill - NC
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Napier Joani - IA, 51012
Nastassia Hill - HI, 96738
Natalie Bullock - FL, 32064
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NATALIE MANGINI - NJ, 7470
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Nathalie WANGERMEZ - VA, 22031
Nathalie Zenteno - AZ
Nathan Hundemann - VT
Nathan Yaugo - CA, 92646
Natjan Sierra - FL, 33496
NCMB Christine - CT, 6441
Neff Adrienne - NH
Nellie Workman - WV, 26325
Nelson Cheryl - IL, 60120-8024
Net Torres - AL
Neumann Dee - VA
Neville Dunn - NY, 10021
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Nicholas Ashley - NC
Nicholas Kovalcik - WA
Nick Infield - CA, 91740
Nick Lamphier - WA, 98607
Nick Rabalais - LA, 70816
Nicolas Duonn - CA, 92705
Nicole Arcieri - NY, 10603
Nicole Cannon - OH, 44126
Nicole Clifton - UT, 84129
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NICOLE DIODATO - NY, 10308
Nicole Erickson - AL, 99208
Nicole Hendricks Smith - MI, 48081-3606
Nicole Mcgill - FL, 33604
Nicole Messier - MA, 2170
Nicole Ortiz - ME, 4084
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Nicole Poplin - OH, 45067-2015
Nicole Ratkovic - FL
Nicole Rosenberger - WA
Nicole Snyder - PA
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Nina Black Reid - DC, 20007-4201
Nina Graham - AR
Nina Jagtiani - CO, 80026
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Noah Goldthwait - MA
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Noemi Boros - TX, 78248
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Peg Malloy - MA, 1810
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Peggy Blake - MN, 56529-1610
Peggy Bouray - NC, 28021
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Peggy Courtney - MO
Peggy Davis - SC
Peggy De lapp De Lapp - CA, 95667-7916
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Penelope Majid - AL
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Penny Butts - FL, 32907
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Rachel Mahl - AL
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Rachel Reagor - TX, 77803
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Racquel Mensinger - PA
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Rebecca Horvath - MS
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Rebecca Kimmerle - AL
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Rebecca Lambert - FL, 34433
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Rebecca O'Donnell - PA, 19512
Rebecca payne - AR
Rebecca Probst - IN
Rebecca Reyes - TX, 79924
Rebecca Sadowsky - NV, 89031
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Rebecca Schwartz - MA, 1054
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Rebecca Taylor - IN, 47201
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Renae Leiker - CO

Rene Gelsomino - LA, 70070
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Robin Fischer - CA, 92507
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Ron Mark - CA, 91362
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Ronald Graham - KS
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Ronda Porter - VA
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RoseMarie Urban - CA, 95380-2701
Rosemary mease Rosemarymease - PA, 17038
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Ross Mannino - NJ, 7110
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Sally Long - AL, 43221
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Samantha Daugherty - MD, 21702-4055
Samboy Wendy - AL, 10473
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Sande Belanger - CA, 92315-0325
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sandra robinson - OK, 74016
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Sandy Fellin Schraer - MO, 63383
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Sandy Leos - CA, 91342
Sandy Mannon - MO, 65711
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Sandy Ross - IL
Sandy T - NC
Sandy Vandeman - CA, 93111
Sara Coffman - AZ

Sara Faulkner - OR, 97080
Sara Fry - AL
Sara Kane - NC, 27312
Sara Letterill - PA, 18331
Sara Russell - ME
Sarah Crabb - AL
Sarah Elizabeth Brannen - FL, 32607-5725
Sarah Haight - NY, 14837
Sarah Hauser - CO
Sarah Heritage - WI
Sarah Hubbard - AR, 72956
Sarah Kosse - IA
Sarah Miller - AL, 32086
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Sarah Olk - AL
Sarah Ortiz - GA, 30297
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Sarah Saldana - CA, 93257
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Sarah Taylor - FL
Sasha Hjerpe - OR, 97422
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Saundra Stephenson - CA, 95257
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Schwartz Linda - OR
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Scott Andrea - FL
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Scott Ellis - KY, 41073
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Scott Rondeau - WI, 53005

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Shanie Bartlett - VT
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Shanna Hanowell - AL
Shannon Bert - FL, 34484-3580
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Shannon Gunder - WV, 25958
Shannon Meredith - UT, 84532
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Shannon Smith - ID, 83709
Shannon Tesson - TX, 76234
Shannoni Marquardt - CA, 95127
Shari Froment - AL
shari gabree - TX, 77055
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Shari O'Hagan - MD, 21666
shari parker - CA, 92386
Shari Wright - MI
Sharlee Moore - CA, 90013
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Sharon Atkins - AL
Sharon Bradbury - CA, 94117
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Sharon Erreger - MI, 49318
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Sharon Lodico - NJ
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Sharon Marcelletti - MI, 49024
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Sharon Montague - DE
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Sharon Siegfried - MA
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Sharon Stabulis - OH, 44129
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Shaw Debi - CA
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Shawn Chadima - OH, 44312
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Shelley McDonald - MI, 49337-8312
Shelley Osullivan - MI, 48911
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Shelli Solis - AL
Shelly Bingham - IN, 46237
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Shelly Emerson - AZ, 85719-1077
Shelly Fie - FL
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Shepard Amy - MD, 21401-4524
Sheree Atkinson - NC, 28376
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Sheree Ginaldi - PA, 19154
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Sheri Davis - IA
Sheri Etter - IN, 47933-8064
Sheri Malinowski - NC, 27405
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Sherri Fryer - PA, 15728
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Sherri Rohr - AZ, 85234
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Sherrie Darce - LA, 70706
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Sherrie Randall - UT
Sherrie Stone - OR
Sherry Allen - GA, 31730-0588
Sherry Bryant - NC, 28146
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Sherry Goddard - IA
Sherry Hanbury - CA, 95991-4412
Sherry Harrison - TX
Sherry Hernandez - OH
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Sherry Malaver Parada - MT
Sherry McDowell - MO
Sherry Morris - NY, 13827
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Sherryl Merritt - AL
Sheryl Baum - FL

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Shine Schuck - OH, 44203
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Shirley Baker - MD, 21545
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Shirley Cotrotsos - NJ, 8093
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shirley hamilton - GA, 30442
Shirley Harris-Brown - MI, 48238
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Shirley Shirley - KS, 66609
Shirley Smithson - CO, 80631
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Shofner-Daniels Pam - KY, 40118
Shovah Joyce - NY, 12804
Sibyl Walski - CA, 96094-9484
Sidney Rudd - VA, 24541
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Signor Snook - PA, 17512-8825
Silva Drea - CA, 95688-2947
Silverwood Kami - AZ
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Simcha Aliyah - TX
Simodynes Jill - NE, 68157
Simone Wittmann - NJ, 07920-3200
Sims Nancy - AL
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Skelton Billie - TN
Sledge Rosaline - IL, 60473
Slicia Jaco - MO
Sloane Tribble - CA, 93023
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Snider Lori - CO
Snyder Lisa - PA, 18914
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sonia Ayala - NY, 11358
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Soothill Kristen - FL
Sophia Brown - TX, 78221
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Stacey Chartier-Grable - CA
Stacey Hoffrichter - IA, 51301
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Stacy Gonzales - TX
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Stafford Sherry - FL
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Star Herrera - FL
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Stephanie Carlin - NV, 89142
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Stephanie Hill Alexander - IN, 47374
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Stephanie Keller - CA
Stephanie Makala - NJ, 7825

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Stephanie May - AL, 43204
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Stephanie Thompson - FL, 32250
Stephanie Townsend - AL, 4462
Stephanie Wilson - WI
Stephanie Witt - AL, 24550
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Stephen Cook - IN, 46208
Stephen Geiger - MT
Stephen Kass - NY, 11566
Stephen Maxwell - HI, 96790
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Stephen Parente - IL, 61801
Stephen Scott - IA
Stephen Simmons - FL, 34667
Steve andI Marilyn - KY
Steve Crone - ME
Steve Harper - OH
Steve Martin - CO
Steve Schuetz - AL
Steve Wysocki - AL
Steven Berkowitz - AL
Steven DeGross Jr - MD
Steven Fakename - CA
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Still Deborah - AL
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suasn Cunningham - NY, 10016-9818
Sue Breen - NY, 12953
Sue Clairmont - WI
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Sue Ghilotti - CA
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suri singer - NY, 12779
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Susan Bishop - AL, 93283
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Susan Bortolussi - MA, 1085
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Susan Esposito - NY, 10312

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Susan Fielder - ME
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Susan Gleason - CA, 94952
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SUSAN Headley - AL, 64701
Susan Hines - TN, 37918
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Susan Hohman - PA
Susan Hominiuk - IN, 46613
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Susan Howard - NH, 3462
Susan Howard - SC, 29526
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Susan Hunter - FL, 32526
Susan Innamorato - MA, 1775
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Susan Joyce - AL
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SUSAN K MYERS - FL, 32205
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Susan Laws - TN
Susan Lehnertz - MN, 55906
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Susan Lummanick - CO, 80127
Susan Marsh - OR, 97035-1138
Susan Montgomery - SC, 29455
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Susan Mosley - AL
Susan Munshower - PA, 17015
Susan Needham - FL
Susan Norman-Jones - OR
Susan Ott - CA, 94928
Susan Parker - NH, 3857
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Susan Querze - MA, 1843

Susan Rapetti - OR
Susan Rhodes - IL, 61282
Susan Richardson - IN
Susan Ryan-Nelson - FL, 32780
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Susan Theobald - OH
Susan Thompson - OH
Susan Todd - MT, 59701
Susan Tokich - IL
Susan Vertrees - KY, 40162
Susan Volek - WI, 53039-1024
Susan Walker - VA, 22601
Susan Watts - NC, 27028
Susan Waxenberg - FL, 33437
Susan Wells - UT, 84015
Susan Williams - UT, 84720-4023
Susan Witte - AZ
Susan Wood - OH
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Susana tonelli - NJ, 8520
Susanne Bolin - AK
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susi holloway - OH, 45212
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Susie Hodge - TN, 37618
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Suzanne Carter - NC, 27597
Suzanne Ebert - OR
Suzanne Hendrickson - MS
Suzanne Kirby - NY, 11963
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Suzanne Meredith - CA
Suzanne Moran - TX
Suzanne Olvera - SC, 29412
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Svetlana zabavaky Zabavsky - AL
Swartz Ruby - MD, 21742
Swink S. - CA
Sydney Sammons - OH
Sylvia Bustamante - NM, 88012
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Sylwia Collins - IL
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Szabo Mark - NJ, 8859
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Szymon Surmacewicz - NY
T. West - MI
Tabitha Totten - NJ, 7010
Tamar Amirov - NY
Tamar Shaddeau - CA, 95901
Tamara Farra - CA, 90046
Tamara Geiselman Sammons-Geiselman - IN, 46970
Tamara Gossard - FL, 34116
Tamara Harris Harris - IL, 60030
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Tamara Lukachy - NV, 89074
Tamara Miller - VA, 23666-5024
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Tamarin Marc - CA, 91360
Tamei Woodruff - TX, 79133
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Tami Manning - TX
Tami Phelps - CA
Tammi Gilmore - OR, 97448
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Tammie Freerksen - MN
Tammie Hernandez - CA, 95020
Tammy Bullock - CA, 92065
Tammy Cortez - CO, 80549-8002

Tammy Gartner - OR
tammy grimes - IN
Tammy Hale - MO
Tammy Knettel - MN, 56373-3802
Tammy Knoll - IA, 51106-2536
Tammy Lettieri - FL, 33066
Tammy McDaniel - KY, 40004-8932
Tammy Thompson - FL
TAmmy Todd - KY
Tammy Welch - NH, 3743
Tana Washington - TX, 75460
Tandy cornett - KY, 40823
Tania Kerak - PA, 18969
Tanja Reilly - NC
Tanya Culligan - NY
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Tara Ross Turner - KY
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Taunja Brockway - TX
Taunna Davis - TX, 75418
Taylor Kathy - IL, 62526-1769
Taylor Latonya - TX, 76116
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Tenofsky Hillary - NY
Teresa Aguirre - TX
Teresa Boyer - IL
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Teresa Carter - IN
Teresa Delaney - TX, 77901
Teresa Doyle - IL, 61201
Teresa Ellis - OR, 97038
Teresa Findley - TX
Teresa Flaherty - FL, 33908
Teresa Gainey - SC, 29550
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Teresa Hall - CO
Teresa Kelly - AK, 99504
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TERESA LEUNG - AL
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Teresa Miller - MA, 2038
Teresa Mullady - AL, 12033
Teresa O'Connor - NE, 68845
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Teresa Spencer - SC, 29706
Teresa sutton - CA, 95467
Teresa Temple - TX, 78216
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Teresa Trude - OH
Teresa Underwood - NC, 27610
Teresa Vela - AL, 98632
Teri Smyth - FL, 32754
Terri Ann Olivadoti - NC, 28273-6995
Terri Barnett - AL, 60560
Terri Guild - CO, 80030
Terri Johnson - WA
Terri Lynn Daniel - ID
Terri Quick - NY, 14224
Terri Rood - CA, 93390
Terri Shaffer - WV
Terri Thompson - WI
Terri Van Fossen - CO
Terriess Krueger - WI
Terrill Godrich - FL
Terry Coakley - CA
Terry Coakley - CA, 92628
Terry Collins - CT
Terry Cox - MA, 1535
Terry English - FL, 32615
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Terry La Brecque - GA, 30189
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terry mcfadden - PA, 18103
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Terry Wormley - OR, 97006
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Tess Perry - AL, 36277
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Tesseo Kay - NV
Thelma Sumpter - TN
Theresa Behlman - NV
Theresa Childers - OH, 44515
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Theresa Dalton - AL
Theresa Everett - FL, 32566
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Theresa Heerey - PA
Theresa Kelly - NM
Theresa McNeely - IN, 47601
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Theresa Rohman - MO
Theresa Rollins - MT, 59873
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Theresa Sivori - KY, 40272
Theresa Sqnders - GA, 30725
Theresa Townley - MD
Theresa White - MO, 65548
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Therese Dunlap - NC, 28655
Therese Giffin - IL, 60706
Thomas Barbara - AL, 68516
Thomas Christenson - IL
Thomas Houghtaling - CA, 93101
Thomas L ane - AL
Thomas LP Ursula - AL
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Thomas Solis - California, 91340
Thomas Stevens - MI
Thomas Tom - OR, 97236
Thomas Wilson - TX
Thomasina Seah - IL, 60013-2324
Thomeen Womack - CA, 95648
Thompson Debra - NV
Thompson Sharon - NH
Threasa Hull - CA, 95370
Tiff Ers - Oregon, 97211
Tiffany Kellett - GA, 30747
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Tim Dahlberg - AL
Tim Payne - TX, 35739
Tim Smithpeters - AR
Tim Strickley - KY, 41076-1052
timi benton - FL
Timmie Smith - PA, 16512
Timothy Brown - IA, 50801
Timothy Sorensen - MI
Timothy Zierke - TX, 76504
Tina Allington - NY
Tina Baker - FL, 34771
Tina Boswell - UT
Tina Briscoe - MO, 64779
Tina Courtney - MS, 39209
Tina Dancing Dove Brewer - , 36701
Tina Elliott - MI
Tina Graham - VT
Tina Ihrke - MN, 55421
Tina Kenney - CO, 81125
Tina Marie Sague - NV, 89142
Tina Milligan clifton - AL
Tina Roberts - CA
Tina Seitzinger - MO
Tina Shurtleff - NC, 28906
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Tina Slivon - CO, 81507
Tina Szymanski - AL
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Tina Xanos - IL, 60455
Tina Yandell - OR
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Tiz Stellar - AL
Tobi Harrison - TX, 77055
Todd Ashbeck - , 54494
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Tom Antony - CA, 95050
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Tom Harper - CA, 95949
Tom Mullin - SC
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Tom Wood - UT, 84111
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Toni Rubin - OR
Tonjia Kyle - IL, 61104
Tony Martino - NY, 10310
Tony Trionfi - MI
Tonya Brantley - IN, 47711
Tonya Farler - KY, 41749
Tonya Jenkins - FL, 32225
Tonya littlewolf - CA
Tonya Roth - NY, 13601
Tori Campenni - WI
Totasdiys Hernandez - CA, 90003
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Townsend Cheryl - KY, 40014-9178
Tracey Waser - NC, 28786
Traci Fox - AL
Traci Phillips - AL, 60411
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Tracie Chandler - AL, 36460
Tracy Capanna - PA, 19061
Tracy Carneal - TX
Tracy Copper - IL
Tracy Cornthwait - AL
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Tracy Gallo - WI, 53703
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Tracy Malone - FL, 34613
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Travis Childers - VA, 22032

Treena Wagner - PA
Trevena Bert - OK
Tricia Kob - CO, 80526
Tricia Prinz - CA, 96022-7706
Tricia Reynolds - AZ
Triebel DJ - NM
Trina Gravert - KS
Trina Keafer - AZ, 85203
Trish Boyko - MI, 48310
Trish King - CA
Trish Martin - Ohio, 44401
Trissa Mosier - AL
Tristan Henderson - LA
Trowbridge Justine - MI
Troy Zengel - AL
Trudy Buffington - FL
Tudon Oralia - AL
Turner Anna - GA, 30141
Ty Hockin - PA
Typee Hadenfeldt - CO
Tyree Sylvia - KY
Uilani Mcmoore - HI, 96825
Una Zieger - PA
Uri Rafaeli - CA, 91042
Ursula Morales - TX, 78209
V. Burak - WI, 53066
Val Leair - WI, 54868
ValÃ©rie Raynaud - NY, 12209
Valerene Corbin - NV, 89123
Valerie Brown - MD, 21032
Valerie Johnsen - AL
Valerie Knotts - IN, 46060
Valerie Lane - CA, 93555
Valerie Larsen - MN, 55811
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Valerie Sanderson - IA, 50478
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Valorie Mahas - AL
Van Swoll Janet - AR, 72714
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Zagor Zachary - MI
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Zakeia Rodgers - MD, 20850
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Zaragoza Eliseo - TX
Zelaena Stalnecker - PA
Zenith Ironside - CA
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Zickella Linda - FL, 33980
Zina Craig - PA, 19035
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Zsuzsanna Sziraki - CT, 6478
Zuvich Laura - CA
Zuzanna Diaz - AL

Exhibit 1

Exhibit 2

PETITION FOR RULEMAKING
PURSUANT TO THE ADMINISTRATIVE PROCEDURE ACT, 5 U.S.C. § 553(e)

TO THE U.S. DEPARTMENT OF AGRICULTURE, ANIMAL AND PLANT HEALTH INSPECTION SERVICE

FOR PROMULGATION OF A REGULATORY FRAMEWORK TO GOVERN THE WILDLIFE SERVICES PROGRAM

FOR TRANSPARENCY, ACCOUNTABILITY, RELIABLILITY, THE HUMANE TREATMENT OF ANIMALS, AND THE PROTECTION OF ANIMALS AND SPECIES, AND PUBLIC HEALTH AND SAFETY

December 2, 2013

SUBMITTED BY:

CENTER FOR BIOLOGICAL DIVERSITY
PROJECT COYOTE
ANIMAL WELFARE INSTITUTE
ANIMAL LEGAL DEFENSE FUND

NOTICE OF PETITION FOR RULEMAKING

Via Electronic Mail and Certified Mail/Return Receipt Requested (with Literature Cited)

December 2, 2013

Tom Vilsack, Secretary
U.S. Department of Agriculture
1400 Independence Ave., S.W.
Washington, DC 20250
Email: agsec@usda.gov

Kevin Shea, Administrator
Animal Plant Health & Inspection Service
4700 River Road, Unit 84
Riverdale, MD 20737-1234
Email: kevin.a.shea@aphis.usda.gov

William H. Clay, Deputy Administrator for Wildlife Services
Animal Plant Health & Inspection Service, Wildlife Services
1400 Independence Avenue, SW
Room 1624 South Agriculture Building
Washington, DC 20250-3402
Email: bill.clay@aphis.usda.gov

Dear Secretary Vilsack, Administrator Shea, and Deputy Administrator Clay:

Pursuant to section 553(e) of the Administrative Procedure Act, 5 U.S.C. § 553(e) ("APA"), and 7 C.F.R. § 1.28, the Center for Biological Diversity, Project Coyote, Animal Welfare Institute, and Animal Legal Defense Fund (hereinafter "Petitioners") hereby petition for issuance and amendment of rules to govern the Wildlife Services program that is administered by the Animal and Plant Health Inspection Service ("APHIS"), an agency within the U.S. Department of Agriculture ("USDA").[1]

Petitioners are "interested persons" under APA section 553(e), and seek issuance and amendment of certain existing rules to provide a regulatory framework to govern the Wildlife Services program and to make it consistent with American values, science, and with all relevant legal authorities and policies.

[1] 5 U.S.C. § 553(e) provides that "[e]ach agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule." 7 C.F.R. § 1.28 states that "interested persons" may file petitions in accordance with 5 U.S.C. § 553(e) "for the issuance, amendment or repeal of a rule … with the official that issued or is authorized to issue the rule," and that "[a]ll such petitions shall be given prompt consideration and petitioners will be notified promptly of the disposition made of their petitions."

Specifically, Petitioners seek issuance or amendment of rules to ensure that the Wildlife Services program:

- is fully transparent and accountable to the public;
- maintains and makes routinely available to the public reliable data and information about its activities;
- minimizes and phases out the use of lethal control, particularly prophylactic lethal control;
- emphasizes selective, non-lethal, non-toxic, and non-capture methods;
- restores apex predators and ecosystems and mitigates the likely effects of climate change;
- is humane and in accordance with proscribed ethical standards;
- adheres strictly to all applicable procedural and substantive legal requirements; and
- sets procedural and substantive criteria for APHIS-Wildlife Services to identify and control invasive species.

A. LEAD PETITIONERS

The CENTER FOR BIOLOGICAL DIVERSITY ("Center") is a national, non-profit conservation organization with over 625,000 online activists and members whose mission is to work through science, law and creative media to secure a future for all species, great or small, hovering on the brink of extinction. The Center accomplishes its mission through scientific and legal advocacy, public education, and grassroots organizing.

PROJECT COYOTE works to promote coexistence between people and wildlife through education, science and advocacy. Project Coyote aims to create a shift in attitudes toward native carnivores by replacing ignorance and fear with understanding and appreciation. Project Coyote accomplishes its mission by championing progressive management policies that reduce human-coyote conflict, by supporting innovative scientific research, and by fostering respect for and understanding of America's apex predators.

Since 1951, the ANIMAL WELFARE INSTITUTE ("AWI") has sought to alleviate the suffering inflicted on animals by people. AWI works to end the torture inflicted on animals by Wildlife Services. It is particularly concerned about the routine use of lethal control techniques including, but not limited to, steel-jaw leghold traps, snares, poisoning, shooting, and denning. Instead, AWI favors non-lethal strategies to resolve human-wildlife conflicts and funds research to develop and test new strategies. AWI also works to minimize the impacts of all human actions that are detrimental to endangered species.

B. SUPPORTING PETITIONER

The ANIMAL LEGAL DEFENSE FUND ("ALDF") is a national, non-profit organization dedicated to protecting the lives and advancing the interests of animals through the legal system. ALDF works to halt the ecologically harmful and inhumane killing of wild and domestic animals resulting from the outdated and unscientific predator policies practiced by APHIS–Wildlife Services. To this end, ALDF is engaged with governmental entities at the federal, state, and county level to highlight the problems of indiscriminant lethal control methods, provide compiled statistical data, and inform them of their legal obligations to protect and preserve wild animals currently being destroyed through their association with Wildlife Services.

C. PETITIONERS' INTERESTS

Petitioners and their members are "interested persons" within the meaning of 7 C.F.R. § 1.28, with have aesthetic, moral, scientific, recreational, and procedural interests in the nation's wildlife and ecosystems that are adversely affected and injured by the activities that are routinely conducted by APHIS-Wildlife Services. Petitioners' members include individuals who have scientific or other interests in the species and ecosystems that are impacted by APHIS-Wildlife Services' activities, and members who have domestic pets that have been injured or killed as a result of APHIS-Wildlife Services' activities and/or who must curtail their activities out of concern for their own and their companion animals' well-being.

Thank you for your consideration. We look forward to your timely response.

Respectfully submitted,

Amy R. Atwood,
Senior Attorney
D. Noah Greenwald,
Endangered Species Director
Michael J. Robinson,
Conservation Advocate
CENTER FOR BIOLOGICAL DIVERSITY

Stephen Wells,
Executive Director
ANIMAL LEGAL DEFENSE FUND

Camilla Fox,
Founder & Executive Director
PROJECT COYOTE

Cathy Liss,
President
ANIMAL WELFARE INSTITUTE

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The large carnivores in particular are objects of fascination to most Americans,
and for every person whose sheep may be molested by a coyote
there are perhaps a thousand others
who would thrill to hear a coyote chorus in the night.

Advisory Board on Wildlife and Game Management
(1964)

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It is clear that the basic machinery of [APHIS-Wildlife Services]
contains a high degree of built-in resistance to change.
The substantial monetary contribution by the livestock industry
serves as a gyroscope to keep the bureaucratic machinery
pointed towards the familiar goal of general reduction of predator populations,
with little attention to the effects of this on the native wildlife fauna.

Cain Report
(1971)

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As long as private livestock producers can externalize the costs of predator losses
via government-subsidized predator control,
they will have little incentive for responsible animal husbandry techniques.

Bergstrom *et al*.
(2013)

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The greatness of a nation and its moral progress
can be judged by the way its animals are treated.
I hold that, the more helpless a creature,
the more entitled it is to protection
by man from the cruelty of man.

Mahatma Gandhi

I. EXECUTIVE SUMMARY

"Wildlife Services" is a federal program that was established more than a century ago and today is administered by the Animal and Plant Health Inspection Service ("APHIS"), an agency within the U.S. Department of Agriculture ("USDA"). The program kills millions of animals every year pursuant to the Animal Damage Control Act, 7 U.S.C. §§ 426-426d ("ADCA"), which provides statutory authority for – but does not require – establishment of a program within USDA for control of "injurious" wildlife.[2] In addition to the ADCA, Wildlife Services is bound by legal authorities that require transparency; the disclosure of reliable information; the humane treatment of animals; the protection of species, habitat and public health; and the control of invasive species. The program also operates pursuant to a series of "policy manuals" and "program directives" that apply such requirements to the program.

Despite the existing legal scheme, however, the Wildlife Services program has been marked by secrecy, controversy, public opposition, stale and deficient environmental reviews, and indiscriminate killings of large numbers of animals, with over 46.5 million animals reportedly killed since 1996, including more than 52,000 reported unintentional killings in the last 10 years.[3] It has removed species from landscapes and continues to suppress their recovery, in turn releasing cascading effects that ripple throughout and degrade ecosystems. It continues to carry out its activities despite decades of criticism, societal values, and substantial gains in humankind's understanding of animals, species, and the natural world that challenge the program's very foundational underpinnings, and despite vast and growing evidence that its practices are not only dangerous and inhumane, but tremendously ineffective and highly problematic as well.

A program such as Wildlife Services "necessarily requires the formulation of policy and the making of rules to fill any gap left, implicitly or explicitly, by Congress" – through the promulgation of rules and regulations – something that is typically conducted as a matter of course under the Administrative Procedure Act, 5 U.S.C. § 553 ("APA").[4] Nonetheless, USDA and APHIS have never afforded interested persons or the public the opportunity to provide comment and guide the program through a rulemaking under the APA. Consequently, the program lacks substantive rules and regulations to ensure its activities are: transparent; based on reliable information; appropriate; protective; safe, ethical, and humane; and consistent with all applicable laws, policies, and American values.

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[2] 7 U.S.C. § 426 provides:

> The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before October 28, 2000.

[3] *See* Center for Biological Diversity, *Data Compilation of Annual Animal Killings by APHIS-Wildlife Services* (2013) (hereinafter "Data Compilation") (Center for Biological Diversity compilation of agency program data reports documenting the number of native and invasive animals taken each Fiscal Year from 1996 through 2012).

[4] *Morton v. Ruiz*, 415 U.S. 199, 231 (1974).

Petitioners are four conservation and animal protection organizations that seek to correct these severe, long-standing defects, and to that end petition the USDA and APHIS pursuant to section 553(e) of the APA for promulgation of a comprehensive regulatory framework to govern Wildlife Services, which fills the gaps in the relevant statutory scheme and proscribes a regulatory framework for program activities that achieves necessary reform, thereby ensuring consistency with all relevant laws and policies and the shared values of the American people.

II. INTRODUCTION

APHIS-Wildlife Services is a century-old, highly-controversial and secretive animal "damage control" program that is administered by APHIS, an agency within USDA.[5] APHIS-Wildlife Services traps, snares, poisons, and shoots millions of animals every year in the United States, primarily on behalf of the livestock industry and other agribusiness as well as hunting interests.[6] As the editorial board of the *New York Times* recently observed, Wildlife Services is "misnamed" because its "lethal damage is broad and secretive" and its techniques are "old-fashioned."[7] And "the result … is a program that is wasteful, destructive to the balance of ecosystems, and ultimately ineffective."[8]

According to the program's reported data, Wildlife Services has killed more than 46.5 million animals since 1996, including federally- or state-protected animals like eagles, falcons, condors, foxes, wolves, grizzly bears, and many more.[9] Killing wildlife at this scale has contributed to the local extinction (the "extirpation") of many North American species, and has fundamentally altered ecosystems at a local, regional, and continental scale – as the *New York Times* Editorial Board put it, "undercut[ting] other programs intended to protect the balance of natural ecosystems" in the process.[10] Coyotes are the program's most frequently-targeted mammal, with over 1.4 million coyotes reportedly killed since 1996 and an average of 600 coyotes killed every

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[5] For an overview of the program, *see* USDA, APHIS, ANIMAL DAMAGE CONTROL PROGRAM: FINAL ENVIRONMENTAL IMPACT STATEMENT (1997) [hereinafter "1997 Programmatic FEIS"]. As set forth in the 1997 FEIS, the agency broadly defines "control" as "integrated pest management" actions to prevent or minimize wildlife conflict, including technical assistance, direct control, or both. *Id*. at 1-5. "Direct control" means actions that kill or relocate wildlife.

[6] *See* Data Compilation (note 3).

[7] Editorial, Agriculture's Misnamed Agency, *New York Times* (July 19, 2013) [hereinafter "*NY Times* Editorial"].

[8] *Id*.; *see also id*. (concluding that Wildlife Services needs to be brought "into accord with sound biological practices" as "[r]esolving wildlife conflicts need not involve indiscriminate killing").

[9] Bergstrom, J.B., Arias, L.C., Davidson, A.D., Ferguson, A.W., Randa, L.A. & Sheffield, S.R., 2013, License to kill: reforming federal wildlife control to restore biodiversity and ecosystem function, *Conservation Letters*, v. 6, p. 1-12 [hereinafter "Bergstrom *et al*. (2013)"]; *see also* Levine, N. and Knudson, T., Interactive graphic: Animals killed by Wildlife Services nationwide, *Sacramento Bee* (May 1, 2012) [*available at* http://www.sacbee.com/2012/04/28/4448951/interactive-graphic-animals-killed.html] [hereinafter "*Interactive Graphic*"].

[10] *NY Times* Editorial (note 7); Berger, K. M., 2006, Carnivore-livestock conflicts: Effects of subsidized predator control and economic correlates on the sheep industry, *Conservation Biology*, v. 20(3), p. 751 [hereinafter "Berger (2006)"]; Estes, J.A., Terborgh, J., Brashares, J.S., Power, M.E., Berger, J., Bond, W.J., Carpenter, S.R., Essington, T.E., Holt, R.D., Jackson, J.B.C., Marquis, R.J., Oksanen, L., Oksanen, T., Paine, R.T., Pikitch, E.K., Ripple, W.J., Sandin, S.A., Scheffer, M., Schoener, T.W., Shurin, J.B., Sinclair, A.R.E., Soulé, M.E., Virtanen, R. & Wardle, D.A., Trophic Downgrading of Planet Earth, 2011, *Science*, v. 333, p. 301-306 [hereinafter "Estes *et al*. (2011)"]; Bergstrom *et al*. (2013) (note 6).

week from aerial gunning alone.[11] Such extensive killing of coyotes is typically unwarranted and ineffective, especially across large geographic areas.[12] As high as they are, however, the actual figures are likely much greater; the program's reported data are not reliable and much of the take is never reported.[13]

Even worse, a significant portion of APHIS-Wildlife Service's killing and harm is unintentional. Based on program data (the actual numbers are likely much higher), since 2003 APHIS-Wildlife Services has killed more than 52,000 "non-target" animals using indiscriminate killing methods like snares, leg-hold traps, and poisons.[14] These methods have also killed and injured domestic

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[11] *See* Data Compilation (note 3); *infra* note 14 ("*Pandora's Box*"); Advisory Committee on Predator Control, Report to the Council on Environmental Quality and The Department of the Interior (Jan. 1972) [hereinafter "Cain Report (1971)"] at 1 ("After the wolves and grizzly bears had been largely exterminated and mountain lions eliminated or reduced except in a few local areas, the ubiquitous coyote inherited the role of chief target of predator-control programs.").

[12] *See, e.g.,* Bergstrom (2013) (note 9) ("We acknowledge that range-wide effects" from removing coyotes are "likely are negligible, because coyotes have greatly expanded their range east and west during the period of WS control"); Camilla H. Fox, Carnivore Management in the U.S: The Need for Reform, *AWI Quarterly* (Fall 2009) ("[n]ot all predators kill livestock" but Wildlife Services' approach is to kill a large number of coyotes in order to kill the "offending animal"); Conner, M.E. Jaeger, M.M., Weller, T.J. & McCullough, D.R., 1998, Effect of Coyote Removal on Sheep Depredation in Northern California*, Journal of Wildlife Management*, v. 62(2), p. 690 [hereinafter "Conner *et al*. (1998)") (finding low correlation between coyote control effort and reduction in sheep killing).

[13] *See* Knudson (2012) (note 14) at *Long Struggles* (reporting that "many non-target mortalities are not reported to avoid drawing attention to the agency") and *Neck Snares* ("'[t]he field guys do not report even a fraction of the non-target animals they catch,'" according to a former Wildlife Services trapper).

[14] *See Interactive Graphic* (note 6); *see also*:

- Knudson, T., The killing agency: Wildlife Services' brutal methods leave a trail of animal death, *Sacramento Bee* (Apr. 28, 2012) [hereinafter "*The Killing Agency*"];
- Knudson, T., Federal agency kills 7,800 animals by mistake in steel body-grip traps, *Sacramento Bee* (Apr. 28, 2012) [hereinafter "*7,800 Animals Killed by Mistake*"];
- Knudson, T., Long struggles in leg-hold device make for gruesome deaths, *Sacramento Bee* (Apr. 28, 2012) [hereinafter "*Long Struggles*"];
- Documents: Wildlife mysteries revealed, *Sacramento Bee* (Apr. 29, 2012);
- Knudson, T., Wildlife Services' deadly force opens Pandora's box of environmental problems, *Sacramento Bee* (Apr. 30, 2012) [hereinafter "*Pandora's Box*"];
- Knudson, T., Neck snare is a "non-forgiving and nonselective" killer, former trapper says, *Sacramento Bee* (Apr. 30, 2012) [hereinafter "*Neck Snares*"];
- Knudson, T., M-44s lure animal with smelly bait, kill with cyanide, *Sacramento Bee* (Apr. 30, 2012) [hereinafter "*M-44s*"];
- Knudson, T., Environmental group sues to halt killing practices of federal wildlife agency, *Sacramento Bee* (May 2, 2012);
- Knudson, T., Suggestions in changing Wildlife Services range from new practices to outright bans, *Sacramento Bee* (May 6, 2012) [hereinafter "*Suggested Changes*"];
- Knudson, T., Humane Society calls for reform of Wildlife Services after Bee series, *Sacramento Bee* (May 12, 2012) [hereinafter "*Calls for Reform*"];
- Knudson, T., Congressmen call for investigation of Wildlife Services agency, *Sacramento Bee* (May 20, 2012) [hereinafter "*Calls for Investigation*"];

animals, and in some cases have harmed people. Still, the program has not materially altered its methods or approach. As Congressman Peter DeFazio, D-Ore. has warned, "[s]ooner or later [the program is] going to kill a kid."[15]

Not only does APHIS-Wildlife Services use destructive and dangerous methods to decimate native wildlife populations and ecosystems and put the public at risk, but its killing of native wildlife has also been frequently ineffective at accomplishing its stated purpose: reducing predation such as livestock depredations or otherwise reducing or eliminating species that agricultural or other interests deem to be "pests."[16] The near extermination of wolves from the United States, for example, led to substantial increases in coyote populations through a process called "predator release." In response, APHIS-Wildlife Services has killed millions of coyotes – indeed, over 1.4 million reportedly killed since 1996 alone – but this has only resulted in

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- Knudson, T., Efforts to investigate Wildlife Services' methods continue, *Sacramento Bee* (June 25, 2012) [hereinafter "*Efforts to Investigate*"];
- Knudson, T., Wildlife Services meets with its critics, *Sacramento Bee* (June 30, 2012) ["*WS Meets its Critics*"]; Tom Knudson, Davis cuts ties with Wildlife Services over coyote killings, *Sacramento Bee* (July 19, 2012) [hereinafter "*Davis Cuts Ties*"];
- Knudson, T., U.S. wildlife worker's online photos of animal abuse stir outrage, *Sacramento Bee* (Nov. 2, 2012) [hereinafter "*Outrage*"];
- Knudson, T., Reform urged for Wildlife Services, *Sacramento Bee* (Nov. 18, 2012) [hereinafter "*Reform Urged*"];
- Knudson, T., Federal Wildlife Services makes a killing in animal-control business, *Sacramento Bee* (Nov. 18, 2012) [hereinafter "*Making a Killing*"];
- Knudson, T., Renewed call for probe of federal Wildlife Services, *Sacramento Bee* (Dec. 9, 2012) [hereinafter "*Renewed Calls for Probe*"];
- Knudson, T., Fish and Wildlife Department cancels Davis predator-hunting clinic, *Sacramento Bee* (Jan. 26, 2013) [hereinafter "*Clinic Canceled*"];
- Knudson, T., Wildlife Services tightens dog policy, *Sacramento Bee* (Apr. 16, 2012) [hereinafter "*Dog Policy*"];
- Knudson, T., Federal Wildlife Services changes rules on use of dogs, *Sacramento Bee* (Apr. 18, 2013) [hereinafter "*Dog Rules Changed*"]; and
- Knudson, T., Documents show questions about Wildlife Services probe in animal cruelty, *Sacramento Bee* (June 15, 2013) [hereinafter "*Animal Cruelty Probe Questions*"]

[collectively hereinafter "Knudson (2012)"].

15 *See* Cong. Rec. H4286 (June 16, 2011) (statement of Rep. DeFazio).

16 Berger (2006) (note 10); Bergstrom *et al*. (2013) (note 9); Conner *et al*. (1998) (note 9); Way, J.G., 2010, Double-litters in coywolf, *Canis latrans × lycaon*, packs following the death or disappearance of a resident territorial male, *Canadian Field-Naturalist*, v. 124(3), p. 256; Hurley, M.A., Unsworth, J.W., Zager, P., Hebblewhite, M., Garton, E.O., Montgomery, D.M., Skalski, J.R. & Maycock, C.L., 2011, Demographic response of mule deer to experimental reduction of coyotes and mountain lions in southeastern Idaho, *Wildlife Monographs*, v. 178, p. 1; Blejwas, K.M., Sacks, B.N., Jaeger, M.M. & McCullough, D.R., 2002, The effectiveness of selective removal of breeding coyotes in reducing sheep predation, *Journal of Wildlife Management*, v. 66(2), p. 451-462; Cypher, B.L. & Scrivner, J.H., 1992, Coyote control to protect endangered San Joaquin kit foxes at the Naval Petroleum Reserves, California, *Proceedings of the Fifteenth Vertebrate Pest Conference 1992*, Paper 21.

increased coyote populations due to compensatory reproduction.[17] APHIS-Wildlife Services' own research branch, the National Wildlife Research Center, has identified and tested non-lethal measures to reduce livestock depredations that are more effective, humane, and in line with American values, but Wildlife Services has failed to emphasize these methods.[18]

All of these and additional problems with Wildlife Services have been extensively documented for *decades*, with little discernible change in agency practice – instead, APHIS-Wildlife Services has actively worked to shield its activities from public scrutiny.[19]

Meanwhile, APHIS-Wildlife Services lacks any formal regulations to specify its mission and set regulatory standards for compliance with major federal statutes, including the Freedom of Information Act; National Environmental Policy Act; Data Quality Act; Endangered Species Act; Bald and Golden Eagle Protection Act; Migratory Bird Treaty Act; Federal Insecticide, Fungicide, and Rodenticide Act; and other authorities, as well as with its own policies and prevailing American values.

Therefore, Petitioners seek a formal rulemaking under the APA, including notice and an opportunity for public comment and final promulgation of substantive regulations, that will fill gaps in the existing statutory scheme, set a regulatory framework for program activities, and ensure the program's consistency with all applicable laws, policies, the best information, and American values.[20]

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[17] Robert L. Crabtree & Jennifer W. Sheldon, *Coyotes and Canid Coexistence in Yellowstone*, *in* CARNIVORES IN ECOSYSTEMS: THE YELLOWSTONE EXPERIENCE 127 (1999) [hereinafter "Crabtree and Sheldon (1999)"]; Eric M. Gese, *Demographics and Spatial Responses of Coyotes to Changes in Food and Exploitation*, *in* PROCEEDINGS OF THE 11TH WIDLIFE DAMAGE MANAGEMENT CONFERENCE 271 (2005) [hereinafter "Gese (2005)"].

[18] *See infra* at 29-30 (overview of non-lethal control methods); Bergstrom *et al*. (2013) (note 9) ("WS's National Wildlife Research Center (NWRC) conducts important research in nonlethal control, but those methods NWRC concludes are effective rarely are adopted by WS field operation.").

[19] *See infra* at 40-49 (discussing program's lack of transparency).

[20] "Legislative, or substantive, regulations are 'issued by an agency pursuant to statutory authority and which implement the statute" and "'have the force and effect of law.'" *Batterton v. Francis*, 432 U.S. 416, 437 (1977) (quoting U.S. Dept. of Justice, Attorney General's Manual on the Administrative Procedure Act (1947) and citing *U.S.* v. *Mersky,* 361 U.S. 431, 437-438 (1960); *Atchison, T. & S.F.R. Co.* v. *Scarlett***,** 300 U.S. 471, 474 (1937)); *see also Chrysler Corp. v. Brown*, 441 U.S. 281, 303 (1979) ("For agency discretion is limited not only by substantive, statutory grants of authority, but also by the procedural requirements which 'assure fairness and mature consideration of rules of general application.'") (quoting *NLRB* v. *Wyman-Gordon Co*., 394 U.S. 759, 764 (1969)).

Specifically, Petitioners seek rules that:

- Ensure that the Wildlife Services program is fully transparent and accountable to the public;
- Ensure that Wildlife Services maintains and routinely makes available reliable data and information about its activities;
- Set regulatory standards and procedures for the selection, use, and location of control methods, with the objective of minimizing and phasing out the use of lethal control and prophylactic lethal control, and with an emphasis on non-lethal, non-toxic, non-capture, and selective methods;
- Set narrow substantive and procedural criteria for those circumstances when the use of lethal control methods may be permitted, *e.g.*, only if selective and in response to local, verified injurious wildlife problems, after nonlethal methods have been documented to have been fully exhausted;
- Ensure that the Wildlife Services program does not jeopardize endangered or threatened species or undermine ecosystems, and works to restore apex predators to ecosystems;
- Set ethical standards for animal treatment, ensure that animals affected by the program are treated humanely, and ensure that agency personnel who commit acts of animal cruelty are subject to disciplinary action and/or employment termination;
- Specify regulatory standards and procedures by which the program will strictly adhere to all applicable procedural and substantive legal requirements; and
- Sets procedural and substantive criteria for APHIS-Wildlife Services to identify and control invasive species.

The ADCA – the primary legal authority which authorizes the program – provides that the program "may" be established, but does not mandate its existence or that it conduct any method(s) of control in particular.[21] Hence, in the absence of a substantive regulatory framework that successfully and consistently accomplishes objectives set forth above, there can be no viable rationale for the program's continued existence.

[21] 7 U.S.C. § 426 ("The Secretary of Agriculture *may* conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program.") (emphasis added).

III. BACKGROUND

Below is an historical overview of the program and long-standing pressure for reform from policy experts, advisory committees, scientific organizations, and non-governmental organizations, followed by an overview of the specific areas in which reforms are necessary in order to make the program consistent with all applicable legal authorities, policies, the best information, and American values.

A. ORIGINS OF THE WILDLIFE SERVICES PROGRAM

The animal control program that is now known as APHIS-Wildlife Services began in 1885, with the creation of the USDA Branch of Economic Ornithology.[22] Renamed the Division of Economic Ornithology and Mammalogy in 1886, the Division of Ornithology and Mammalogy in 1890, and the Division of Biological Survey in 1896, the agency became known as the Bureau of Biological Survey in 1905.[23] Through 1905, the Bureau focused on species identification, landowner education, and control of house sparrows.[24]

In 1906, the Bureau began to support U.S. Forest Service efforts to eradicate wolves from the newly-established forest reserve system.[25] By 1911, the agency was advocating for the use of strychnine to kill moles, squirrels, and prairie dogs – *i.e.*, species that agricultural interests consider to be undesirable.[26] In 1913, Congress appropriated funds for the Bureau to start killing ground squirrels in California.[27] In 1914, the first cooperative agreement was signed with the New Mexico College of Agriculture and Mechanical Arts.[28]

In 1915, Congress first appropriated funds to the Bureau of Biological Service for "destroying" wolves, coyotes, and other "injurious" animals (predators).[29] In 1931, Congress passed the ADCA, which "expanded the government role in predator control, authorizing the use of federal

[22] 1997 Programmatic FEIS (note 5) at 1-8.

[23] *Id*. at 1-8 – 1-9.

[24] *Id*.; *see also* MICHAEL J. ROBINSON, PREDATORY BUREAUCRACY: THE EXTERMINATION OF WOLVES AND THE TRANSFORMATION OF THE WEST (2005) [hereinafter "PREDATORY BUREAUCRACY"] at 61.

[25] PREDATORY BUREAUCRACY (note 24) at 62-63.

[26] *Id*. at 67.

[27] *Id*.; 1997 Programmatic FEIS (note 5) at 1-9.

[28] 1997 Programmatic FEIS (note 5) at 1-9.

[29] PREDATORY BUREAUCRACY (note 24) at 79; Cain Report (1971) (note 11) at 1, 8.

funds and personnel on private lands."[30] In 1939, the program was transferred to the Department of the Interior as the "Division of Predator and Rodent Control" ("PARC").[31]

In the first half of the 20th century, hunters employed by the program intentionally and unintentionally killed millions of wolves, coyotes, and other animals, especially in the West.[32] The program grew, facilitated in part by the "establishment of cooperative funding mechanisms – money from states, counties, and local ranching associations directly paid to [the program] for its services."[33]

The program was transferred to the Department of the Interior in 1939, and in 1940 was incorporated into the newly-created U.S. Fish and Wildlife Service's ("FWS"). In 1956, the program came to be directed by the Bureau of Sport Fisheries and Wildlife, within FWS.[34] In 1986, a congressional rider transferred the program, known then as "Animal Damage Control," back to USDA.[35]

B. PRESSURE FOR REFORMS AND FOR REGULATORY STANDARDS

The policies that initially underpinned the Wildlife Services program sought eradication or extermination of wildlife believed to threaten livestock grazing and agriculture. However, public opinion led to calls for reform – including regulatory reform – of APHIS's wildlife control program beginning in the late 1920s and early 1930s, and again during the 1960s and 1970s, and to passage of legal authorities and restrictions that bind APHIS in administering its Wildlife Services program today.

The program's primary response to criticism has been cosmetic, however, as it has tried to shape public opinion to be supportive of its activities and to avoid reform. Meanwhile, although many have recommended regulatory reform of Wildlife Services over the years, APHIS has never engaged in a substantive rulemaking under the APA to set regulatory standards and procedures for the program. And although APHIS-Wildlife Services has endeavored to improve its public image, critics have maintained that it still operates in the shadows, doing the bidding of private

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30 Feldman, J.W., 2007, Public Opinion, the Leopold Reports and the Reform of Federal Predator Control Policy, Human-Wildlife Conflicts, v. 1(1), p. 112 [hereinafter "Feldman (2007)"]. The ADCA has been amended since it was first enacted in 1931, but remains the statutory foundation for the Wildlife Services program.

31 PREDATORY BUREAUCRACY (note 24) at 79; Cain Report (1971) (note 11) at 1, 8.

32 PREDATORY BUREAUCRACY (note 24) at 111-113 (recounting non-target killings of wolverines, dogs, grouse, and sage hens); *see also* "WT Detail Page" (Sep. 14, 2010) (reporting killing of non-target wolverine in a foothold trap meant for wolves in Idaho) [hereinafter "WT Detail Page"]; 78 Fed. Reg. 7864 (Feb. 4, 2013) (recounting non-target killing of wolverine in Montana in 2010).

33 Feldman (2007) (note 30) at 14.

34 PREDATORY BUREAUCRACY (note 24) at 303.

35 1997 Programmatic FEIS (note 5) at 1-12.

agricultural interests, refusing to emphasize nonlethal methods and ethical standards, to the detriment of animals, species, and public accountability. Such deceptiveness has had consequences for Wildlife Services. For example, several counties in California are starting to take the lead in transitioning to local, cost-sharing programs, however, that focus on nonlethal methods in order to protect livestock from predators.

1. The Murie Report (1931)

In late 1930-early 1931, a survey employee named Olaus J. Murie authored one of the first highly-critical reports of the program.[36] Having studied the practices of program trappers and hunters in the field, Murie pronounced that "there is an incipient landslide in the direction of denouncing everything with fur or feathers that has the slightest adverse effect on any human interest and it makes me wonder where it will end."[37] Murie recommended a change in attitude, stating that "we should not discourage interest and enjoyment of any form of wild life, even if we are killing off such animals for economic reasons" and "consider sympathetically any plan which might be proposed … which shows leniency toward species that are in conflict with certain interests … ."[38] Murie's report was suppressed by the program's brass, however, who "execrated him" for writing it.[39]

2. The Leopold Report (1964)

Modern calls for reform of APHIS-Wildlife Services began in 1964 with publication of what has become known as the "Leopold Report," named for its lead author: Dr. A. Starker Leopold, a son of pioneering ecologist Aldo Leopold and a long-time advisor to the National Park Service.[40] Leopold spearheaded the Advisory Committee on Wildlife Management, a seven-member committee of wildlife biologists that had been created by U.S. Secretary of the Interior Stewart Udall.[41]

Secretary Udall established the committee in response to shifting public attitudes and growing protests against the program – protests which started to gain momentum as the program employed poisons like Compound 1080, an extremely-lethal poison with no antidote that can kill

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[36] PREDATORY BUREAUCRACY (note 24) at 234-235; Murie, O.J., Report on Investigations of Predatory Animal Poisoning, Wyoming and Colorado," *U.S. Fish and Wildlife Service, 1860-1961, Field Reports*, Record Unit 717b, Box 45, SIA, 20, 6 [hereinafter "Murie"].

[37] *Id*. at 234 (quoting Murie at 23-25).

[38] *Id*.

[39] *Id*. at 234-235.

[40] Leopold, A. S.; Cain, S. A.; Cottam, C. M.; Gabrielson, I. N.; and Kimball, T. L., 1964, Predator and Rodent Control in the United States, *US Fish & Wildlife Publications,* Paper 254 [hereinafter "Leopold Report"].

[41] Feldman (2007) (note 30) at 7.

100 people with a single teaspoon. Secretary Udall tasked the committee to review the program, answer growing public criticisms, and make recommendations for needed change.[42]
The Leopold Report observed that:

> In America we inherited a particularly prejudiced and unsympathetic view of animals that may at times be dangerous or troublesome. From the days of the mountain men through the period of conquest and settlement of the West, incessant war was waged against the wolf, grizzly, cougar, and the lowly coyote, and even today in the remaining backwoods the maxim persists that the only good varmint is a dead one.
>
> But times and social values change.[43]

The Leopold Report "lambasted" the program for failing to "differentiate those local situations where control is justified from the numerous cases where the same species of animals have societal values far in excess of the negligible damage they cause."[44] It found "abundant evidence that [some agency officials] willingly support almost any control proposal in which someone is enough interested to contribute matching funds."[45] The Board unanimously opined that "control as actually practiced today is considerably in excess of the amount that can be justified in terms of total public interest."[46] It concluded that "some review mechanism is required to protect animal life against unnecessary or excessive control and to assure that the interests of the public at large are duly considered, as well as the interests of agriculturalists and livestock operators."[47]

To that end, the Leopold Report recommended that the program work to achieve the following goals: (1) cease coyote control in areas that are occupied only by cattle, and not used by sheep; (2) undertake predator control for the protection of other forms of wildlife only after competent research has proven it to be desirable and locally needed; and (3) deem no predator control method acceptable if it results in the inadvertent death of a great number of animals during the process of killing a few that are causing damage.[48]

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[42] *Id*.

[43] Leopold Report (note 40) at 1. Although Leopold had supported extermination of mountain lions and wolves throughout the West in the 1920s, his ideas about wildlife management and predator control "altered drastically" later in the century. Feldman (2007) (note 30) at 3.

[44] Leopold Report (note 40) at 1-2; Feldman (2007) (note 30) at 7.

[45] Leopold Report (note 40) at 5; *see also id*. at 5-6 (characterizing the program's "firm entrenchment as a protective subsidy of livestock and agricultural interests" that has "invited criticism and distrust from many groups and individuals interested primarily in wildlife protection, including many ranchers").

[46] *Id*. at 2.

[47] *Id*. at 6.

[48] *Id*. at 8, 9, 24.

To meet these goals, the Leopold Report made the following specific recommendations:

1. The program should appoint an Advisory Board on Predator and Rodent Control;

2. The program should "reassess … its own goals";

3. The program should set forth "properly enforced regulations" and "explicit criteria to guide control decisions";

4. The program should cease rabies control programs where rabies are an "ephemeral disease in the wild";

5. The program should greatly amplify its research program;

6. The program should change its name (then known as the Branch of Predator and Rodent Control) in order to reflect a change in philosophy; and

7. The program should pursue regulation of the use of poisons.[49]

In the five years following issuance of the Leopold Report, the program went through a "spring cleaning," with "[p]olicies, names, terms, titles, and philosophies … replaced or changed" and a heavy emphasis on public perception.[50] In 1965, the program was renamed, from the U.S. Division of Predator and Rodent Control to the U.S. Division of Wildlife Services."[51] On its face, the program's guiding philosophy shifted as well, to be made consistent with the Leopold Report – *i.e.*, that "all animals have a right to exist, but control is necessary in certain situations."[52]

However, the Leopold Report's core substantive recommendations for reform – including the recommendation that the program set regulations and explicit criteria for control decisions – were not adopted. The "public clamor" over the program grew.[53]

In 1966, Congressman John Dingell held hearings on the program, and in 1970, the National Academy of Sciences published a USDA report which noted tremendous changes in public attitudes about wildlife and increasing recognition of the value of environmental conservation.[54]

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[49] *Id*. at 22-27.

[50] *See* Feldman (2007) (note 30) at 118 (noting that "[e]veryone involved in the predator control house cleaning recognized the importance of public perception" as "[a] public outcry had spurred the Leopold Report and its recommendations in the first place" and "federal policy needed to respect this public concern").

[51] *Id*. at 8. Other key terms were changed as well – thus, "'[p]oison' became 'toxicant' or chemical compound'" and "'kill' became 'reduction' or 'removal.'" *Id*.

[52] *Id*. at 9.

[53] Cain Report (1971) (note 11) at 2.

3. The Cain Report and President Nixon's Ban on the Use of Toxicants on Federal Lands (1970s)

Supporters of reform made substantial gains during the 1970s and early 1980s (until the agricultural lobby pushed back during the Reagan Administration).[55] Precipitating this period was an event in May 1970, when Boy Scouts near Casper, Wyoming came upon a grisly scene of dead bald and golden eagles which had been poisoned by agency personnel, who had heavily laced sheep carcasses with thallium sulfate.[56] A Senate hearing was held the next month to investigate the matter, shining more intense public scrutiny on the incident and bringing more negative publicity to the program.[57]

Popular magazines ran investigative articles about the program and environmental organizations filed lawsuits. In June 1970, the *New Yorker Magazine* ran a lengthy cover article about prairie dog control on the South Dakota prairie and the steep decline of the black-footed ferret, which preys on prairie dogs.[58] *Sports Illustrated* published another exposé by Jack Olsen in 1971 which chronicled out-of-control, poisoning by federal agents and cooperating sheep ranchers, and recounted poisoned dogs, eagles, bears, and humans.[59] In March 1971, Defenders of Wildlife, Sierra Club, National Wildlife Federation, and the Humane Society of the United States ("HSUS") filed suit, alleging a failure to comply with NEPA.[60]

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[54] Cain Report (1971) (note 11) at 2; COMMITTEE ON AGRICULTURAL LAND USE AND WILDLIFE RESOURCES, NATIONAL RESEARCH COUNCIL, LAND USE AND WILDLIFE RESOURCES 208 (1970).

[55] In line with the Leopold Report's recommendation that it do so, however, the program did change its name, *i.e.*, to the Division of Wildlife Services. *See* Cain Report (1971) (note 11) at 2.

[56] PREDATORY BUREAUCRACY (note 24) at 316.

[57] "Predator Control and Related Problems," Hearings before the Subcommittee on Agriculture, Environmental and Consumer Protection of the Committee on Appropriations. Senate. 92nd Congress, 1st Session. 1971; Feldman (2007) (note 30) at 122.

[58] McNulty, F., A Reporter at Large, "THE PRAIRIE DOG AND THE BLACK-FOOTED FERRET," *The New Yorker* (June 13, 1970) at 40.

[59] Jack Olsen, "THE POISONING OF THE WEST," *Sports Illustrated* (Mar. 8, 1971) at 72. Olsen "argued that no scientific studies had proven the wool growers' claims about the threat predators posed to sheep and lambs, suggesting instead that coyotes preferred rabbits, mice, and other forest rodents … ." Feldman (2007) (note 30) at 120.

[60] 42 U.S.C. §§ 4321-4347. In November 1971, these non-governmental organizations secured an order requiring the program to cease using toxic chemicals for predator damage control by February 15, 1972. Wade, D.A., 1980, Predator Damage Control, 1980: Recent History and Current Status, *Proceedings of the 9th Vertebrate Pest Conference* [hereinafter "Wade (1980)"] at 196.

The growing drumbeat for reform emanated from the Nixon Administration as well. In April 1971, three senior Nixon officials began to develop a plan to dismantle the program.[61] In July 1971, U.S. Department of Interior Secretary Rogers Morton appointed the Cain Committee, named for Stanley A. Cain (a former assistant secretary at U.S. Department of Interior and co-author of the Leopold Report), and made up of non-program scientists, to conduct another review.[62]

In January 1972, the "Cain Report" was released to the public.[63] Like the Leopold Report seven years before, the Cain Report criticized Wildlife Services for its "built-in resistance to change" and allegiance to livestock interests.[64] It went "one crucial step farther" than the Leopold Report, however, and abandoned hope that "[g]uidelines and good intentions" would result in needed changes.[65] Hence, the Cain Report recommended 15 specific reforms, including increased transparency and legislative and regulatory reforms:

1. Continued federal-state cooperation in predator control, but with all funds appropriated by Congress and the legislatures in order to allow for "citizen review and input in decision-making";

2. Immediate legislation to "remove all existing toxic chemicals from registration and use for operational predator control";

3. Professionalization of program personnel, to achieve a "balance of interests";

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[61] PREDATORY BUREAUCRACY (note 24) at 317; "Predatory Mammals and Endangered Species," Hearings before the Subcommittee on Fisheries and Wildlife Conservation of the Committee on Merchant Marine and Fisheries, House of Representatives, 92nd Congress, 2nd Session, March 21 and April 10, 1972.

[62] In convening the new panel on July 9, 1971, Secretary Morton personally pledged "that performance will follow program so that our imperiled predators will not perish in a sea of platitudes." PREDATORY BUREAUCRACY (note 24) at 317.

[63] Wade (1980) (note 60); Cain Report (1971) (note 11).

[64] Cain Report (1971) (note 11) at 2. The Cain Report observed that:

> Not only are many of the several hundred filed agents the same former 'trappers,' but the cooperative funding by federal, state, and county agencies, and by livestock associations and even individual ranchers, maintains a continuity of purpose in promoting the private interest of livestock growers, especially in western rangeland states. The substantial monetary contribution by the livestock industry serves as a gyroscope to keep the bureaucratic machinery pointed towards the familiar goal of general reduction of predator populations, with little attention to the effects of this on the native wildlife fauna.

Id.

[65] PREDATORY BUREAUCRACY (note 24) at 318; Cain Report (1971) (note 11) at 2 ("Guidelines and good intentions will no longer suffice.").

4. Establishment of “trapper-trainer extension programs” by states, to encourage the use of humane methods;

5. Congressional action to alleviate the economic burdens of livestock producers who experience heavy losses by predators;

6. Revisions to federal land grazing permits and leases to “provide for possible suspension or revocation” when “regulations governing predator control are violated”;

7. Prohibition of “all methods of predator control” in Wilderness Areas;

8. Congressional and state legislation to make aerial gunning of wildlife illegal, “except under exceptional circumstances and then only by authorized wildlife biologists of the appropriate federal and state agencies”;

9. Regulatory ability to suspend or revoke the license of any pilot who “knowingly carries a passenger whose acts lead to conviction of illegal predator control”;

10. Congressional action to “rule out the broadcast of toxicants for the control of rodents, rabbits, and other vertebrate pests on federal lands” and, if possible, “correlative action … for private lands as well”;

11. A long-term program to research “the actual livestock losses caused by each major predator,” to “validate the causes of economic damage and guide actions to alleviate excessive losses”;

12. A “detailed socio-economic study of cost-benefit ratios,” to “evaluat[e] the need for and efficacy of the program and its separate parts”;

13. A study of the “epidemiology of rabies in the field by a team of specialists provided with adequate funding,” to find out whether sending trappers to a rabies outbreak “does the slightest bit of good in terminating the disease”;

14. Congressional action to give necessary authority to the DOI Secretary to protect endangered predators;

15. State action to supplement federal protections of locally-rare wildlife populations.[66]

As the Cain Report was released in early 1972, President Nixon signed Executive Order 11643, which banned the use of several toxicants on federal public lands – including Compound 1080 (sodium fluoroacetate), strychnine, sodium cyanide (M-44s), and thallium sulfate – except for

[66] Cain Report (1971) (note 11) at 5-14.

emergency use by prior agreement of the Secretaries of the Departments of Interior, Agriculture, and Health, Education and Welfare, and the EPA Administrator.[67] On March 9, 1972, EPA cancelled the registration of these toxicants.[68] From 1972 to 1974, Congressional hearings were held to reassess the program and its use of toxic chemicals to control predators.[69] During that time, EPA denied several requests and applications by several western states for re-registration of the cancelled toxicants.[70]

Unfortunately, the cancellations of sodium cyanide and Compound 1080 did not last. In 1974, EPA granted experimental use of sodium cyanide (M-44s) to the State of Texas, and in 1975, EPA granted experimental or emergency use to Montana, California, South Dakota, Idaho, Nebraska, Kansas, and Texas A&M University, and to the program itself, which had by this time come to be known as the Office of Animal Damage Control.[71] In 1975, President Ford amended Executive Order 11643 to allow for the experimental use of M-44s for predator control on federal lands.[72] The following year, President Ford amended Executive Order 11643 again, to allow for the reregistration of sodium cyanide for this purpose.[73] And in 1977, EPA granted an experimental use permit to DOI for Compound 1080.[74]

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[67] Executive Order No. 11643, ENVIRONMENTAL SAFEGUARDS ON ACTIVITIES FOR ANIMAL DAMAGE CONTROL ON FEDERAL LANDS (Jan. 11, 1972); *see also* 37 Fed. Reg. 3000 (Feb. 20, 1972) (Department of Interior notice of closure of the use of chemicals toxic to predatory animals on public grazing lands). As described by James Feldman:

> [President] Nixon explained his order as a political decision – based on changing values – as much as a scientific one. "Americans today set high value on the preservation of wildlife," Nixon explained.

Feldman (2007) (note 30) at 122-123. On February 10, 1972, the Department of Interior announced that it had ceased the use of toxic chemicals in the animal damage control program. Wade (1980) (note 60).

[68] EPA Order PR 72-2, MANUFACTURERS, FORMULATORS, DISTRIBUTERS, AND REGISTRANTS OF ECONOMIC POISONS: SUSPENSION OF REGISTRATION FOR CERTAIN PRODUCTS CONTAINING SODICUM FLUOROACETATE (1080), STRYCHNINE AND SODIUM CYANIDE (Mar. 9, 1972). EPA's cancellation was based on its finding that strychnine, cyanide, and sodium fluoroacetate Compound 1080 "are among the most toxic chemicals known to man" and "are toxic not only to their targets but other animals and wildlife." *Id*. at 59-60.

[69] Wade (1980) (note 60).

[70] *Id*. Between 1972 and 1979, EPA did provide emergency use permission to several western states for the use of strychnine for rabies control, and granted such use to the State of Montana for the use of Compound 1080 on Columbian ground squirrels. *Id*.

[71] *Id*.; Government Accountability Office, WILDLIFE SERVICES PROGRAM INFORMATION ON ACTIVITIES TO MANAGE WILDLIFE DAMAGE, GAO-02-138 (2001) [hereinafter "GAO (2001)"].

[72] Executive Order No. 11870, ENVIRONMENTAL SAFEGUARDS ON ACTIVITIES FOR ANIMAL DAMAGE CONTROL ON FEDERAL LANDS (July 18, 1975).

[73] Executive Order No. 11917, AMENDING EXECUTIVE ORDER NO. 11643 OF FEBRUARY 8, 1972, RELATING TO ENVIRONMENTAL SAFEGUARDS ON ACTIVITIES FOR ANIMAL DAMAGE CONTROL ON FEDERAL LANDS (May 28, 1976).

Nevertheless, critics cheered when DOI Secretary Cecil Andrus formed an advisory committee in 1978 called the Animal Damage Control Study Advisory Committee.[75] The committee released draft reports in May and June of 1978, and released a final report in December 1978 that was, like the Leopold and Cain reports, highly critical of the program.[76] It found "insufficient documentation to justify the program's existence."[77] Its December 1978 report led to a November 1979 Department of Interior ("DOI") policy which declared that the program:

> [W]ill recognize the importance of predators to natural ecosystems, will strive to reduce conflicts between predators and livestock as far as possible, will direct lethal controls at offending animals, not the species as a whole, will prohibit the routine use of poisons on public lands except as provided in Executive Order 11643, as amended by Executive Orders 11870 and 11917, and will maintain public land use and wildlife resource values as a public trust.[78]

DOI Secretary Andrus set the specific goals for achieving these policy objectives, and directed FWS "to work toward their rapid implementation":

1. In the near term, prophylactic control should be limited to specific situations where unacceptably high levels of losses have been documented during the preceding 12 months. In the long term, through additional research, our goal should be to minimize and phase out the use of lethal prophylactic controls, including the creation of buffer zones;

2. Emphasize corrective control, utilizing non-lethal, non-capture methods and focusing on offending animals to the greatest degree possible;

3. Reduce conflicts through livestock husbandry techniques which decrease exposure of livestock to predators;

4. Expand the availability of extension services to ranchers;

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[74] Wade (1980) (note 60). Sodium cyanide and Compound 1080 continue to be two of the most controversial toxicants used by Wildlife Services; last year, Reps. DeFazio and Campbell introduced a bill to prohibit them. *See infra* at 19.

[75] The Leopold Report recommended establishment of an advisory committee for the program. *See supra* at 10; Leopold report (note 40) at 22

[76] FWS, PREDATOR DAMAGE IN THE WEST: A STUDY OF COYOTE MANAGEMENT ALTERNATIVES (1978).

[77] 1997 Programmatic FEIS (note 5) at 1-12; GAO (2001) (note 71) at 53.

[78] Memorandum from Secretary, U.S. Department of the Interior to Assistant Secretary, Fish and Wildlife and Parks, U.S. Department of the Interior (Nov. 8, 1979) [hereinafter "1979 DOI Policy"]; 1997 Programmatic FEIS (note 5) at 1-11.

5. Display resources to locations and in seasons of greatest need; and

6. Redirect and refocus research efforts to support the above goals and to achieve the long-term objective of preventing predator damage rather than controlling predators.

Secretary Andrus also set four immediate restrictions on certain activities, including the elimination of denning; tight restrictions on aerial gunning; selection of the most selective and humane traps and check frequency; and the immediate cessation of "further research or development of potential uses of Compound 1080."[79]

4. Critics Force Restrictions on Compound 1080 as Pressure for Reform Grows (1980s-2000s)

The agricultural lobby pushed back heavily against reforms including the 1979 DOI Policy beginning in the 1980s – in particular, against restrictions on toxicants use – but the public clamor for reform nevertheless led EPA to maintain restrictions on the program's use of one of its worst lethal poisons, Compound 1080.

In 1981 DOI Secretary James Watt rescinded the 1979 DOI policy that banned denning, and shortly thereafter, President Reagan signed Executive Order 12342, which revoked President Nixon's Executive Order 11643 in its entirety, making way for the resumed use of toxicants on federal lands.[80] Lobbyists for agricultural industries pushed for the program's transfer from DOI back to USDA as well, which occurred in 1986.[81] And in 1986, another advisory committee was established; its membership did not favor wildlife conservation interests.

In 1986, following years of administrative proceedings, EPA agreed to reauthorize above-ground use of strychnine for prairie dog control conditioned on pre-use surveys for black-footed ferrets living near targeted colonies.[82] Two years later, ruling on a lawsuit brought by Defenders of Wildlife and the Sierra Club, the Eighth Circuit Court of Appeals enjoined the registration of strychnine pending APHIS' compliance with the Endangered Species Act ("ESA") as to 14 protected species including migratory birds.[83] As a result, although APHIS-Wildlife Services

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[79] 1997 Programmatic FEIS (note 5) at 1-12.

[80] Executive Order No. 12342, ENVIRONMENTAL SAFEGUARDS FOR ANIMAL DAMAGE CONTROL ON FEDERAL LANDS (Jan. 27, 1982).

[81] 1997 Programmatic FEIS (note 5) at 1-12.

[82] PREDATORY BUREAUCRACY (note 24) at 330; Wade (1980) (note 60); 48 Fed. Reg. 48,522 (Oct. 19, 1983); *see also Defenders of Wildlife v. Administrator, EPA*, 882 F.2d 1294, 1297 (8th Cir. 1989), *aff'd in part, rev'd in part*, *Defenders of Wildlife v. Administrator, EPA*, 882 F.2d 1294 (8th Cir. 1989) (discussing history of administrative process).

[83] *Defenders of Wildlife v. EPA*, 688 F. Supp. at 1342-43.

employs strychnine to poison rodents in underground burrows today, EPA has maintained restrictions on the use of above-ground, non-arboreal field use of this toxicant.[84]

Although the bans on Compound 1080 were not permanent, they did lead to restricted use of the highly-toxic poison – *i.e.*, to "livestock protection collars," which are devices with two bladders containing the poison that are placed around the necks of potential prey animals (*e.g.*, sheep and goats) to target coyotes."[85] Since 1985, EPA has approved the use of Compound 1080 in LPCs.[86]

During the 1990s, APHIS prepared environmental analyses in order to meet requirements of NEPA and the ESA, culminating in programmatic environmental reviews that revealed more information about the program, then known as Animal Damage Control. A 1997 final "programmatic" environmental impact statement ("EIS") under NEPA confirmed the program's continued use of myriad lethal methods, including hunting, trapping, and the use of dozens of different poisons, including methods that it acknowledged kill or harm non-target wildlife (including endangered and threatened species) and affect ecosystems.[87] An accompanying biological opinion, required under the ESA, determined that program activities are likely to jeopardize the continued existence of seven endangered and threatened species, including the black-footed ferret, San Joaquin kit fox, Southwestern population of bald eagle, Attwater's prairie chicken, Mississippi sandhill crane, California condor, and Wyoming toad.[88] Yet, APHIS-Wildlife Services has elected to continue these activities, and has not since amended or prepared a new a programmatic review of the program.

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[84] PREDATORY BUREAUCRACY (note 24) at 330; EPA, REREGISTRATION ELIGIBILITY DECISION: STRYCHNINE (July 1996); Memorandum from Jane Smith, Health Effects Division, EPA to Jay Ellenberger, Special Review and Reregistration Division, STRYCHNINE, HED Chapter of the Reregistration Eligibility Decision Document (RED), Case #3133 (Jan. 22, 1996).

[85] PREDATORY BUREAUCRACY (note 24) at 330.

[86] Connolly, G., 1993, Livestock Protection Collars in the United States, 1988-1993, *Great Plains Wildlife Damage Control Workshop Proceedings*, Paper 327 [hereinafter "Connolly (1993)"]; USDA, APHIS-Wildlife Services Policy Directive 2.420, LIVESTOCK PROTECTION COLLARS (Feb. 17, 2004).

[87] 1997 Programmatic FEIS (note 5) at 3-48, 3-77 & Appendix H; USDA, APHIS, Animal Damage Control Program: DRAFT ENVIRONMENTAL IMPACT STATEMENT (1990); USDA, APHIS, Animal Damage Control Program: SUPPLEMENT TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (1993). FWS previously released a FEIS for the program in 1979. Department of Interior, U.S. Fish and Wildlife Service, FINAL ENVIRONMENTAL IMPACT STATEMENT ON MAMMALIAN PREDATOR DAMAGE MANAGEMENT FOR LIVESTOCK PROTECTION IN THE WESTERN UNITED STATES (1979).

[88] U.S. Department of the Interior, U.S. Fish and Wildlife Service, ANIMAL DAMAGE CONTROL "MAY AFFECT" DETERMINATIONS FOR FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES, USFWS BIOLOGICAL OPINION (1997) [hereinafter "1997 Programmatic BiOp"]. These programmatic environmental reviews remain in effect a quarter-century later, even though they do not assess all of the program's impacts to all affected endangered and threatened species, and despite greater understanding of such activities to wildlife, species, and ecosystems. *See infra* at 29-35.

Despite these decisionmaking processes, APHIS-Wildlife Services has not shed its poor reputation, as more information about its activities has continued to emerge. In 1990, the Government Accountability Office ("GAO") issued a report which acknowledged APHIS-Wildlife Services' "heavy emphasis on protecting sheep from coyotes" and public criticism for its killing of predators to minimize losses for livestock producers "who use public lands in an already heavily subsidized manner," as well as its failure to emphasize nonlethal, prophylactic techniques and the pain and suffering that it causes.[89] In a 1995 report, the GAO confirmed that, despite its rhetoric, the program primarily employs lethal control methods and that "field personnel rarely use nonlethal methods when controlling livestock predators."[90] The 1995 GAO Report also noted that "an operator's use of nonlethal control methods is not a prerequisite for receiving program assistance."[91]

The program and its allies have had to forestall legislative reforms. In 1998, Rep. DeFazio introduced an amendment to an appropriations bill to eliminate all federal funding for lethal predator control which passed the House of Representatives.[92] After Republican congressmen and powerful lobbyists for agricultural interests called for a revote the next day, the amendment failed.[93]

The American Society of Mammalogists – which has protested the program since shortly after it was founded in 1919[94] – maintains staunch opposition to the program. In 1999, the society passed a resolution that called on APHIS to: "critically review their methods for control of mammalian predators in light of the principles and practices of current wildlife management science and conservation biology"; "cease indiscriminant, preemptive, lethal control programs on federal, state, and private lands"; research alternative methods of predator control and "implement successful methods into field operations"; and "focus on … non-lethal control strategies, compensatory measures, and sound animal husbandry techniques, that could be supplemented by targeted, lethal control methods when necessary."[95]

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[89] USDA, APHIS, Animal Damage Control Program, DRAFT ENVIRONMENTAL IMPACT STATEMENT (1990); Government Accountability Office, WILDLIFE MANAGEMENT: EFFECTS OF ANIMAL DAMAGE CONTROL PROGRAM ON PREDATORS, GAO/RCED-90-149 (1990).

[90] Government Accountability Office, ANIMAL DAMAGE CONTROL, EFFORTS TO PROTECT LIVESTOCK FROM PREDATORS, GAO/RCED-96-3 (1995) [hereinafter "GAO (1995)"] at 3.

[91] *Id*.

[92] Watson, K. & Hanscom, G., Poison Traps Kill Unintended Victims, *High Country News* (Mar. 13, 2000) [*available at* http://www hcn.org/issues/174/5628] [hereinafter "*Poison Traps*"].

[93] *Id*.

[94] PREDATORY BUREAUCRACY (note 24) at 212-213.

[95] American Society of Mammalogists Resolution, *Mammalian Predator Control in the United States* (1999).

The program itself has admitted problems – *e.g.*, in 2005, APHIS identified many problems with the program's cooperative agreement process.[96] The final report of the agency's "Cooperative Agreements Process Improvement Team," known as the CAPIT Report, found that the cooperative agreement process had become decentralized "due to [an] increase in cooperative agreements," and that communication, guidance, and follow up have not kept pace … .[97] The CAPIT Report also found APHIS's processing of cooperative agreements to be internally inconsistent, with differences in planning, information sharing, communication, and paperwork as well as in how "working relationships are developed and how finances and results are monitored and reported."[98] The CAPIT Report concluded that cooperative agreements should be retained "as an approach to achieving program objectives and agency goals," but that the cooperative agreement process should be standardized, streamlined, and simplified, with a consistent message regarding expectations and practices and improved follow up.[99]

Chronic problems with the program were exposed again in a *Sacramento Bee* investigative series last year, and since then calls for reform have only amplified, including from members of Congress.[100] In March 2012, Rep. John Campbell, R-Calif. and Rep. DeFazio introduced a bill to ban the use of M-44s and Compound 1080.[101] In June 2012, along with Elton Gallegly, R-Calif., and Jackie Speier, D-Calif., Reps. Campbell and DeFazio requested a congressional investigation of the program.[102] In August 2012, Rep. Susan Davis, D-Calif., introduced legislation to require Wildlife Services to disclose details about the millions of animals that it kills; Rep. Davis reintroduced this legislation in 2013.[103] In November 2012, Reps. DeFazio and Campbell asked Agriculture Secretary Thomas Vilsack for a complete audit of the "culture"

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96 USDA, APHIS: Cooperative Agreements Process Improvement Team Final Report (Feb. 2005) [hereinafter "CAPIT Final Report"] at 1-2.

97 *Id*. at 1.

98 *Id*.

99 *Id*. at 2-3.

100 Knudson (2012) (note 14). In addition to Tom Knudson's award-winning investigative reporting on APHIS-Wildlife Services, Cristina Corbin of FoxNews.com has reported extensively on the program as well. *See* Corbin, C., Lawmaker accuses federal agency of 'stonewalling' attempts to investigate alleged coyote torture, *FoxNews.com* (Dec. 10, 2012) [hereinafter "*Federal Agency Accused of Stonewalling*"]; Corbin, C., Animal torture, abuse called a 'regular practice' within federal wildlife agency, *FoxNews.com* (Mar. 12, 2013) [hereinafter "*Torture, Abuse Regular Practice*"]; Corbin, C., Hundreds of family pets, protected species killed by little known federal agency, *FoxNews.com* (Mar. 17, 2013) [hereinafter "*Hundreds of Pets, Protected Species Killed*"]; Corbin, C., Federal agency gives few answers on months-long probe of alleged animal cruelty, *FoxNews.com* (June 12, 2013).

101 Compound 1080 and Sodium Cyanide Elimination Act, H.R. 2074, 112th Cong. (2d Sess. 2013).

102 Letter from Campbell, J., DeFazio, P., Gallegly, E. & Speier, J. to Issa, D. & Cummings, E. (June 8, 2012) at 1 ("We are concerned that Wildlife Services is failing to efficiently or effectively use the resources provided to it by the American taxpayers and that it is not adequately transparent or accountable to the public.").

103 Transparency for Lethal Control Act, H.R. 2074, 113th Cong. (1st Sess. 2013).

within Wildlife Services by the USDA Office of Inspector General.[104] In December 2012, Senator John Tester, D.-Mont. wrote the director of Wildlife Services to express "serious concerns" with the program.[105] In its annual plan for Fiscal Year 2013, the Office of Inspector General announced it would audit Wildlife Services' predator control activities and cooperator agreements.[106]

Along with several authors, Bradley Bergstrom, Ph.D., a professor of wildlife biology at Valdosta State University and chairman of the American Society of Mammalogists' conservation committee, published a review of APHIS-Wildlife Services in May of this year.[107] Calling it ineffective at reducing predation in the long term, Bergstrom *et al*. (2013) admonished the program for engaging in widespread lethal predator control and recommended its "sparing use of lethal control by methods that are species-specific" and the cessation of "all lethal control in federal wilderness areas and for the purpose of enhancing populations of common game species."[108]

In July, the *New York Times* editorial board declared that the program to be "wasteful, destructive to the balance of ecosystems and, ultimately, ineffective" and called for a "clear picture of what Wildlife Services is up to," stating that it is "time for the Department of Agriculture to bring the agency's work into accord with sound biological principles."[109]

Non-governmental organizations – including Petitioners – have maintained steadfast pressure and opposition to APHIS-Wildlife Services as well. Such organizations have repeatedly called for reforms and have consistently supported the efforts of members of Congress to investigate or cease federal funding for the program.[110] A broad, united coalition of environmental conservation and animal protection organizations – representing millions of Americans – met

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[104] Letter from DeFazio, P. & Campbell, J. to Vilsack, T. (Nov. 30, 2012) ("we are gravely concerned that photographs, published on Mr. Olson's Facebook in an album labeled 'work' and since removed, do not represent an isolated occurrence, but may reflect a deep-rooted problem within the Wildlife Services program that allows for, and encourages, inhumane lethal methods of predator control"); *see also Torture, Abuse Regular Practice* (note 100) ("Evidence showing animal cruelty has not been difficult to uncover.").

[105] Letter from Tester, J. (Sen.) to Green, J., Director of Wildlife Services (Dec. 5, 2012).

[106] Letter from Cathy Liss, AWI & Camilla Fox, Project Coyote to Phyllis K. Fong (the Hon.), USDA Office of Inspector General (May 29, 2013).

[107] Bergstrom *et al*. (2013) (note 9).

[108] *Id*.

[109] *NY Times* Editorial (note 7).

[110] *See*, *e.g.*, *Calls for Reform* (note 14); *infra* at note 178 (discussing Change.org petition).

with Assistant USDA Secretary Edward Avalos in July, expressing continued dissatisfaction with the program's refusal to be transparent and implement non-lethal methods in the field.[111]

5. Concerned with APHIS-Wildlife Services' Practices, California Cooperators are Taking Alternative Measures to Coexist with Carnivores

Before an overview of the areas in need of reform, it is worth noting that in the absence of meaningful reform by an intractable agency, California cooperators are beginning to reassess their agreements with APHIS-Wildlife Services and to pursue alternative livestock protection programs. For instance, Sonoma County, California is currently taking another look at the program and considering whether to renew its contract.[112] In July 2012, the Davis, California City Council voted unanimously to sever its contractual relationship with APHIS-Wildlife Services.[113]

Marin County, California has taken a strong lead in reform, severing its ties with APHIS-Wildlife Services in 2000 and replacing it with a new program that takes a fundamentally-different approach to livestock protection. The *Marin County Strategic Plan for Protection of Livestock and Wildlife* consists of a cost-share program to help ranchers install or upgrade fencing and other livestock-protective infrastructure, install strobe lights and other predator-deterrents and detectors, and purchase and sustain large-breed guard dogs and llamas.[114] Participants do not relinquish the ability to kill predators consistent with state and federal law, but rather than contract with APHIS-Wildlife Services, the county assigns personnel and allocates money to help stock-owners prevent depredations through non-lethal means.

The Marin County program has been resoundingly successful. According to the *San Francisco Chronicle*, coyote depredations on sheep in the county have fluctuated but have declined steadily from 236 in Fiscal Year 2002 to 90 in Fiscal year 2010 – a 62 percent reduction – with 14 ranchers recording no predation losses at all, and only three ranchers losing over 10 sheep during Fiscal Year 2010.[115] And contrary to an APHIS-Wildlife Services critique of the program,[116] annual direct program costs declined from $50,000 in 2001 to $20,000 in 2012, with the higher

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[111] *See* Letter from Camilla Fox, Project Coyote & Cathy Liss, AWI to Tom Vilsack, USDA (July 31 2013) (expressing gratitude for meeting with Assistant Secretary Avalos and requesting follow-up meeting with USDA Secretary Vilsack).

[112] Scully, S., Sonoma County Pulls Predator-Control Officer Off Job During Contract Review, *The Press Democrat* (Sep. 26, 2013).

[113] *Davis Cuts Ties* (note 14).

[114] *See* Fox, C.H., 2008, Analysis of the Marin County Strategic Plan for Protection of Livestock & Wildlife: An Alternative to Traditional Predator Control. M.A. thesis, Prescott College, AZ. 120 pp. Larkspur, CA.

[115] Fimrite, P., Ranchers shift from traps to dogs to fight coyotes, *San Francisco Chronicle* (Apr. 27, 2012) [hereinafter "Fimrite (2012)"].

[116] Shwiff, S.A., Sterner, R.T., Kirkpatrick, K.N., Engeman, R.M., and Collahan, C.C., 2005, Wildlife Services in California: Economic Assessments of Select Benefits and Costs, *USDA/APHIS/WS National Wildlife Research Center Publication*.

amounts likely reflecting start-up acquisition and installation expenses or upkeep of guard-animals.[117]

Yet, in the face of an intractable, highly-controversial federal program which lacks regulatory standards and refuses to reform despite decades of criticisms from experts, scientists, non-governmental organizations, government officials, and the program itself, Marin County is showing how cooperators can take matters into their own hands, sever their relationship with the program, and implement a new approach that can facilitate coexistence with wildlife, consistent with the values of the American public.

C. NEEDED REFORMS

Since the program's inception a century ago, humankind's understanding of wildlife and ecosystems has expanded and societal attitudes about our relationship with the natural world have shifted.[118] Livestock and agricultural industries, including those on whose behalf APHIS-Wildlife Services conducts its activities, produce a substantial percentage of humankind's greenhouse gas emissions, which are crossing perilous thresholds that will fundamentally change the Earth's life-sustaining systems.[119] As we cross over these thresholds, we have little choice but to examine the true consequences of our choices.[120] Among these are the consequences of our relationship with, and our policies regarding, animals and species.

Indeed, our knowledge and scientific understanding of animals – their ecology, physiology, behavior, cognition, sentience, and psychology – is much deeper than when the Wildlife Services program was initiated in the early part of the last century. We now recognize that animals have intrinsic value apart from their perceived value to humans.[121] This challenges old notions.[122]

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117 Fimrite (2012) (note 115).

118 *See* GAO (1990) (note 89) at 14 ("Although the ADC programs have continued to focus on killing predators, the thrust of the programs has changed over the years. Program emphasis in its early years was on conducting general eradication campaigns that might be directed at the entire statewide population of a particular species of predators. This operating philosophy contributed to decimating gray wolf populations in the continental United States. With changes in public attitudes, the program now emphasizes killing only problem animals.").

119 *See* Beschta, R.L., Donahue, D.L., DellaSala D.A., Rhodes, J.J., Karr, J.R., O'Brien, M.H., Fleischner, T.L., and Williams, C.D., 2012, Adapting to Climate Change on Western Public Lands: Addressing the Ecological Effects of Domestic, Wild, and Feral Ungulates, *Environmental Management*, v. 51, p. 474-91 ("the ongoing and impending effects of ungulates in a changing climate require new management strategies for limiting their threats to the long-term supply of ecosystem services on public lands" and "[r]eestablishing apex predators in large, contiguous areas of public land may help mitigate any adverse ecological effects of wild ungulates").

120 Fischlin, A., Midgley, G.F., Price,, J.T., Leemans, R., Gopal, B., Turley, C., Rounsevell, M.D.A., Dube, O.P., Tarazona, J., Velichko, A.A., 2007, *Ecosystems, their properties, goods, and services*, *in* CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 211 (Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. & Hanson, C.E., eds.).

121 Messmer, T.A., Reiter, D. & West, B.C., 2001, Enhancing Wildlife Sciences' Linkage to Public Policy: Lessons from the Predator-Control Pendulum, *Wildlife Society Bulletin*, v. 29, p. 1255 (advocating that wildlife managers

Indeed, Americans today value the welfare of all beings and believe that the human species has a moral obligation to be compassionate and humane toward the other animals and species, which have a right to live their lives on Earth, undisturbed and in their natural environments, without abuse or cruelty or the unraveling of their social relationships.[123] Old fairy tales and fables that demonize wolves and coyotes are being deconstructed. The ways in which we perceive and treat fellow beings and species has a direct connection to our own destiny.

Considering this, there are many specific areas where APHIS-Wildlife Services remains in dire need of reform – in particular with regard to: the program's indiscriminate killing and harming of wildlife; its targeting of predators and the consequences for wildlife populations and ecosystems; its ineffectiveness at reducing wildlife conflicts; its inhumane treatment of animals; the lack of nonlethal alternatives; and its lack of transparency and reliable information. Each of these areas is addressed below. As this overview demonstrates, reform of the APHIS-Wildlife Services program and its culture are long overdue.

1. APHIS-Wildlife Services Kills and Harms Vast Numbers of Animals

Since shortly after the first congressional appropriation to destroy wildlife in 1915, APHIS-Wildlife Services has contracted with "cooperators" – such as corporate agribusiness interests, livestock owners and associations, and local, state, and other federal government agencies – to kill animals on their behalf.[124] Cooperator funding currently comprises well over half of the program's funding for animal control.[125] This arrangement has created a substantial conflict of interest, as APHIS-Wildlife Services, which also receives Congressional funding, is beholden to narrow special interests and often takes actions in conflict with the interests of a majority of the American public.[126] As explained below, the consequences to the nation's wildlife are myriad.

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should "institutionalize new approaches to better address information lag time between scientific discovery and policy formation").

122 APHIS-Wildlife Services has stated that while the program initially "focused on predator control activities for the protection of livestock," "[o]ver the years, the program's philosophy …has evolved, along with societal values and perspectives" and the goal today is to "seek balance among a variety of priorities, including wildlife and environmental conservation, human health and safety, economic considerations, and social factors." *See* APHIS-Wildlife Services, PARTNERSHIPS AND PROGRESS (Aug. 2009) [hereinafter "PARTNERSHIPS AND PROGRESS"]; *see also* USDA, APHIS-Wildlife Services Policy Directive 1.301, CODE OF ETHICS (Aug. 31, 2010) [hereinafter APHIS-Wildlife Services Policy Directive 1.301"] ("Throughout the history of WS, the philosophy of wildlife damage management has evolved, along with societal values and perspectives.").

123 Duda, M.D. and Young, K.C., 1998, American Attitudes Toward Scientific Wildlife Management and Human Use of Fish and Wildlife: Implications for Public Relations and Communications Strategies, *Transaction of the North American Wildlife and Natural Resources Conference*, v. 63, p. 589 ("Attitudes toward consumptive, wildlife-related activities involve attitudes toward animal welfare and animal rights. Most Americans support animal welfare – that is, using animals but treating them humanely and with respect.").

124 USDA, APHIS-Wildlife Services, *Fiscal Year 2012 Federal and Cooperative Funding by Resource Category*.

125 *Id*.

126 *See* O'Toole, R., Audit of the USDA Animal Damage Control Program, *The Thoreau Institute* (1994) (finding that the program is unfairly distributed to selected Americans and creates perverse incentives for ranchers, and is

To begin with, the sheer number of animals killed on behalf of these interests is staggering.[127] APHIS-Wildlife Services reports that it kills millions of animals every year, with most of these being mammals and birds.[128] A tally of the number of animals that the program has reported that it has killed over the last 10 Fiscal Years (2003-2012) reveals nearly 14 million native animal deaths from 475 species over the past decade, an average of nearly 1,400,000 animals per year.[129]

Coyotes, beavers, and red-winged blackbirds were among those intentionally killed most frequently.[130] APHIS-Wildlife Services estimates that it has killed more than 1.4 million coyotes – the most frequently-targeted mammals – since 1996.[131] The toll on native carnivores, typically at the behest of corporate agribusiness interests, is very high, with about 120,000 native carnivores killed every year. Thousands of dens and burrows – *e.g.*, for coyotes and prairie dogs – are destroyed annually.[132] Accurate tallies are likely much greater; many animals killed in traps or by poison are simply discarded without reporting by agents in the field and are never found.[133] An unknown number of animals are injured or maimed, but are not necessarily killed, and are never reported.[134]

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ineffective, and highlighting the alternative approach of farmers in Kansas, who with no ADC assistance have significantly lower predation rates than those in neighboring states); Bergstrom *et al*. (2013) (note 9) ("A relatively few influential western ranchers and major agribusiness lobbying groups, such as the American Farm Bureau, have prevented Congress from reforming WS in the past.").

[127] *Pandora's Box* (note 14) (estimating the total number of predators killed daily by APHIS-Wildlife Services from 2006-11 totals about 560,000, an average of 256 killings each day). "Since 2001, more than 340,000 coyotes have been gunned down from planes and helicopters across 16 Western states, including California – an average 600 a week, agency records show." *Id*.

[128] Data Compilation (note 3); *see also* Bergstrom *et al*. (2013) (note 9) ("since 2000, WS has killed – intentionally and unintentionally – 2 million native mammals").

[129] Data Compilation (note 3).

[130] *Id*.

[131] *Id*.; *see also The Killing Agency* (note 14) (noting that over one million coyotes were reportedly killed during 2006-11); *Pandora's Box* (note 14) (estimating that APHIS-Wildlife kills 600 coyotes weekly with aerial gunning).

[132] Data Compilation (note 3).

[133] *Supra note* 13.

[134] The agency does not publicly disclose any data of animal injuries or maimings, only killings, removals, and/or "dispersals" of animals. *See* APHIS-Wildlife Services Program Data Reports [*available at* http://www.aphis.usda.gov/wildlife_damage/prog_data/2012_prog_data/index.shtml]. Former APHIS-Wildlife Services trappers have attested to frequent killings of "nontarget catch" that are not documented or reported by the program. *See, e.g., The Killing Agency* (former agency trapper stating recounting incident involving death of a federally-protected golden eagle, when supervisor advised "If you think nobody saw it, go get a shovel and bury it and don't say nothing to anybody.").

Much of the program's take of animals is unintentional or leads to unintended consequences that are not monitored. According to APHIS-Wildlife Services' figures, a substantial number – over 52,000 – of reported killings since 2003 were "unintentional" of non-target catch.[135] Protected species have been impacted as well; 15 species protected under the ESA and 328 birds species protected under the Migratory Bird Treaty Act ("MBTA") have been unintentionally killed as "non-targets" during the last decade.[136] These include grizzly bears, Louisiana black bears, bald eagles, golden eagles, swift foxes, San Joaquin kit foxes, and Mexican wolves, to name a few. Even this large tally is recognized as vastly under-representative of the number of non-target animals that are killed unintentionally.[137]

The program's reporting also fails to account for the secondary effects of its activities. Many animals are killed with poisons like Compound 1080 and M-44s, which are "spring-loaded metal cylinders that are baited with scent and fire sodium cyanide powder into the mouth of whatever tugs on them."[138] However:

> Only 10% of the bodies of poisoned animals are recovered, which leaves 90% to enter the ecosystem as food for exploring badgers, bobcats, crows, bears and pets. Scavenging leads to the secondary poisoning of thousands of innocent companion animals and unoffending wildlife, including threatened and endangered species, each year.[139]

2. APHIS-Wildlife Services Contributes to Species Decline and Impairment of Recovery by Decimating Wildlife Populations and Upending Ecosystems

Over the past century, APHIS-Wildlife Services played a leading role in the decimation of populations of a multitude of wildlife species, contributing to the endangerment of the bald eagle, California condor, Canada lynx, kit fox, swift fox, Utah prairie dog, Gunnison's prairie dog, grizzly bear, gray wolf, Mexican gray wolf, fisher, wolverine, and others.[140] The agency

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[135] *See* APHIS-Wildlife Services Program Data Reports (1996-2012) (complete set of all reported tallies of animals killed, trapped, relocated, and dispersed); *see also 7,800 Animals Killed by Mistake* (note 14) (reporting that more than 7,800 animals have been mistakenly killed by steel body-grip traps during Fiscal Years 2006-2011); *The Killing Agency* (M-44s are "[u]sed mainly to control coyotes" but have also "accidentally killed … black bears, raccoons, ravens, bobcats, kit foxes, wild pigs, opossums and federally protected bald eagles"); 1997 Programmatic FEIS (note 5) at Appendix P, page 271 ("use of M-44[s] … has resulted in the death of not only nontarget canids, including domestic dogs, but also other animals … such as the badger, bobcat, skunk, porcupine, raccoon, ring-tailed cat, black bear, raven crow and vulture").

[136] *Id*.

[137] Bergstrom *et al.* (2013) (note 6) (at 8) found that vast percentages of some species have been killed unintentionally.

[138] *M-44s* (note 14).

[139] Fox, C., The Case Against Poisoning Our Wildlife, *Huffington Post* (Aug. 6, 2010) [hereinafter "Fox, *Huff Post*"].

[140] 41 Fed. Reg. (July 12, 1976) (bald eagle); 1997 Programmatic BiOp (note 5) at 44 (California condor); 78 Fed. Reg. 7864 (Feb. 4, 2013) (proposed rule to list the wolverine as threatened species); FWS, SPECIES

contributed to the extermination of gray and red wolves, grizzly bears, prairie dogs, black-footed ferrets, and other animals from most or all of their historic ranges.[141] The killing of endangered species continues today, with one study reporting that more than a dozen state- and federally-protected species have been killed by APHIS Wildlife Services since 2000, including grizzly bears, gray wolves, Mexican wolves, bald and golden eagles, and others.[142]

In a number of cases, the federal government has had to expend considerable resources to reverse the impact of the program's species eradication, including expensive and difficult recovery programs for gray wolves, black-footed ferrets, and grizzly bears. For example, the federal government has spent tens of millions of dollars since 1974 restoring gray wolves, following their extirpation from most of the United States that was in large part carried out by APHIS-Wildlife Services.[143]

Monetary expense, however, is just the beginning of the damage caused by the program. Many of the species targeted by APHIS-Wildlife Services play critical roles in ecosystems, and their removals result in a cascade of unintended consequences. The loss of top predators in particular is well documented to cause a wide range of "unanticipated impacts" that are often profound, altering "processes as diverse as the dynamics of disease, wildfire, carbon sequestration, invasive species, and biogeochemical cycles."[144]

An overview of ecological principles illustrates this. "Predators" (or carnivores) are animals that prey on other animals.[145] "Apex" predators have few or no predators of their own and occupy

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ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM, GUNNISON'S PRAIRIE DOG (Apr. 2010); FWS, RECOVERY PLAN FOR UPLAND SPECIES OF THE SAN JOAQUIN VALLEY, CALIFORNIA (1998) (San Joaquin kit fox); FWS, UTAH PRAIRIE DOG (*CYNOMYS PARVIDENS*) REVISED RECOVERY PLAN (2012); FWS, GRIZZLY BEAR RECOVERY PLAN (1993); FWS, NORTHERN ROCKY MOUNTAIN WOLF RECOVERY PLAN (1987); FWS, SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM, WEST COAST POPULATION OF FISHER (Apr. 2012).

[141] Leopold report (note 40) at 15, 16 (discussing eradication of grizzly bears in Mexico, and poisoning of eagles, prairie dogs, and black-footed ferrets in the northern Great Plains); GAO (1990) (note 89) at 2 ("Killing offending animals, even to the extent of exterminating entire populations, became an accepted approach to control predator damage.").

[142] Bergstrom *et al*. (2013) (note 9).

[143] FWS, NORTHERN ROCKY MOUNTAINS WOLF RECOVERY PROGRAM UPDATE (2011) at 1; *see also* PREDATORY BUREAUCRACY (note 24) at 104-168, 285-86; Bergstrom *et al*. (2013) (note 9) (the WS $57 million annual budget is a livestock subsidy that "contravenes other federal expenditures" – like the $43 million that the U.S. Department of Interior has spent since 1974 reintroducing and conserving the gray wolf).

[144] Estes *et al*. (2011) (note 10); Bergstrom *et al*. (2013) (note 9).

[145] *See*, *e.g.*, Leopold report (note 40) at 9 ("The assertion that native birds and mammals are in general need of protection from native predators is supported weakly, if at all, by the enormous amount of wildlife research on the subject conducted in the past two or three decades.").

the top of the food chain.[146] Terrestrial apex predators include wolves, grizzly bears, and mountain lions.[147]

Apex predators create a "trophic cascade" of beneficial effects that flow through and sustain ecosystems and the web of life.[148] For example, wolves in Yellowstone and Grand Teton national parks have been found to benefit a host of species, including aspen, songbirds, beavers, bison, fish, pronghorn, foxes, and grizzly bears.[149] By reducing numbers and inducing elk to move, wolves have reduced browsing on aspen and other streamside vegetation, which has benefitted beavers, songbirds and fish populations.[150] Studies have also shown how wolves and coyotes interact, and how wolves can aid pronghorn populations as "wolves suppress[] coyotes and consequently fawn depredation."[151] Wolves also benefit scavengers by leaving carrion derived from predation; hence, wolf removal leads to reduced abundance of carrion for scavengers in specific areas.[152] For instance, the extirpation of wolves works to the detriment of grizzly bears, which are listed as a threatened species and which, in addition to acting as apex predators, can scavenge carrion left by wolves. A 2013 study shows that wolves benefit grizzly bears in Yellowstone through another trophic mechanism as well – specifically, wolf predation on elk has led to less elk browsing of berry-producing shrubs, providing grizzlies with access to larger quantities of fruit.[153]

The removal of apex predators may have other unexpected outcomes – for example, the "release" – of mid-sized or "mesopredators" like foxes, raccoons, and skunks that are not at the

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[146] Prugh, L.R., Stoner, C.J., Epps, C.W., Bean, W.T., Ripple, W.J., Laliberte, A.S. & Brashares, J.S., 2009, The Rise of the Mesopredator, *BioScience*, v. 59(9), p. 779 [hereinafter "Prugh *et al*. (2009)"].

[147] *Id.*

[148] Ripple, W.J. and Beschta, R.L., 2011, Trophic cascades in Yellowstone: The first 15 years after wolf reintroduction, *Biological Conservation*, v. 145, p. 205 [hereinafter "Ripple and Beschta (2011)"]; Estes *et al*. (2011) (note 10); Ripple, W.J., Beschta, R.L,, Fortin, J.K. & Robbins, C.T., 2013, Trophic cascades from wolves to grizzly bears in Yellowstone, *Journal of Animal Ecology*, doi: 10.1111/1365-2656.12123 [hereinafter "Ripple *et al*. 2013"].

[149] Ripple and Beschta (2011) (note 148); Bergstrom *et al*. (2013) (note 9); Estes *et al*. (2011) (note 10).

[150] *Id.*

[151] Berger, K.M. & Gese, E.M., 2007, Does interference competition with wolves limit the distribution and abundance of coyotes? *Journal of Animal Ecology*, v. 76, p. 1075; Smith, D.W., Peterson, R.O. & Houston, D.B., 2003, Yellowstone after Wolves, *BioScience*, v. 53(4), p. 330; Berger *et al*. (2008) (note 10); Prugh *et al*. (2009) (note 146); Bergstrom *et al*. (2013) (note 9).

[152] Ripple and Beschta (2011) (note 148); Wilmers C.C., Crabtree R.L., Smith D.W., Murphy K.M. & Getz, W.M., 2003, Trophic facilitation by introduced top predators: grey wolf subsidies to scavengers in Yellowstone National Park, *Journal of Animal Ecology*, v. 72, p. 909; Wilmers C.C., Stahler, D.R., Crabtree, R.L., Smith, D.W. & Getz, W.M., 2003, Resource dispersion and consumer dominance: scavenging at wolf- and hunter-killed carcasses in Greater Yellowstone, USA, *Ecology Letters*, v. 6(11), p. 996.

[153] Ripple *et al*. 2013 (note 148).

top of the food chain in the presence of coyotes.[154] Increased abundance of mesopredators in turn can negatively affect populations and diversity of other species, including ground-nesting birds, rodents, lagomorphs, and others. In some cases, declines in these species results in reduced prey for other predators and contribute to their decline and extirpation.

An example is the variation of the distribution and abundance of coyotes in coastal southern California – where wolves do not occur at all and, hence, coyotes have assumed the role of apex predator but have declined or disappeared due to urbanization and fragmented habitat.[155] As a study of this area observed, "[i]t appears that the decline and disappearance of the coyote, in conjunction with the effects of habitat fragmentation, affect the distribution and abundance of smaller carnivores and the persistence of their avian prey."[156] An estimated 75 local extinctions of native, scrub-breeding bird species may have occurred over the past century in these areas.[157]

Moreover, APHIS Wildlife Services has not limited its activities to lethal control of predators. Many other animals that serve important roles in their ecosystems have been targeted by the program as well. This is perhaps best exemplified by the elimination of prairie dogs from more than 90 percent of their range, which once spanned a large swath of North America.[158] This in turn has fundamentally altered the continent's grasslands – for example, causing an increase in

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[154] Crooks, K.R. and Soulé, M.E., 1999, Mesopredator release and avifaunal extinctions in a fragmented system, *Nature*, v. 400, p. 563 [hereinafter "Crooks & Soule (1999)"]; Prugh *et al*. (2009) (note 146). Although coyotes are mesopredators when wolves are present, they can act as apex predators where wolves have been extirpated. *See*, *e.g.*, Crooks & Soulé (1999).

[155] Crooks & Soulé (1999) (note 154). For additional examples *see*: Soulé, M.E., 1988, Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands, *Conservation Biology*, v. 2, p. 75; Sovada, M.A., Sargeant, A.B. & Grier, J.W., 1995, Differential effects of coyotes and red foxes on duck nest success, *Journal of Wildlife Management*, v. 59, p. 1; Palomares, F., Gaona, P., Ferreras, P. & Delibes, M, 1995, Positive effects on game species of top predators by controlling smaller predator populations: an example with lynx, mongooses, and rabbits, *Conservation Biology*, v. 9, p. 295; Rogers, C.M. & Caro, M.J., 1998, Song sparrows, top carnivores, and nest predation: a test of the mesopredator release hypothesis, *Oecologia*, v. 116, p. 227; CONTINENTAL CONSERVATION: SCIENTIFIC FOUNDATIONS FOR REGIONAL RESERVE NETWORKS (1999).

[156] *Id*. It is also noteworthy that coyotes are a primary target of killing by APHIS-Wildlife Services, yet the program's activities have contributed to growth of coyote populations. *See infra* at 29-30 (discussing ineffectiveness of coyote control).

[157] Crooks & Soulé (1999) (note 154) at 565.

[158] Kilgore D.L, 1969, An ecological study of the swift fox (*Vulpes velox*) in the Oklahoma Panhandle, *American Midland Naturalist*, v. 81, p. 512 [hereinafter "Kilgore (1969)"]; Miller, B.J., Reading, R.P., Biggins, D.E., Detling, J.K., Forrest, S.C., Hoogland, J.L., Javersak,, J., Miller, S.D., Proctor, J., Truettand, J. & Uresk, D.W., 2007, Prairie Dogs: An Ecological Review and Current Biopolitics, *The Journal of Wildlife Management*, v. 71, p. 2801; Haug, E.A., Millsap, B.A. & Martell, M.S., 1993, Burrowing Owl (*Athene cunicularia*), Species Account Number 061, The Birds of North America Online (A. Poole, Ed.), Ithaca, NY: Cornell Laboratory of Ornithology; from The Birds of North America Online database: http://bna.birds.cornell.edu/bna; Bergstrom *et al*. (2013) (note 9).

shrubs – and has led to the decline of many animals that use prairie dog burrows or are dependent on them for prey, such as black-footed ferrets, swift foxes, and burrowing owls.[159]

In short, the widespread killing of animals by APHIS Wildlife Services has caused, and continues to create, widespread impacts on North American wildlife populations and ecosystems.

3. APHIS-Wildlife Services is Frequently Ineffective at Reducing Wildlife Conflicts

Not only are APHIS-Wildlife Services' killing campaigns destructive, but they are also frequently ineffective at their stated purpose of protecting livestock or crops from native wildlife or boosting game species.

One study, for example, looked at whether killing wolves in response to depredation in Minnesota reduced the likelihood of depredations in the following year and found no reduction.[160] The extirpation of wolves from the landscape has removed one of the key limitations on coyote populations, further increasing the abundance of coyote populations and possibly negating reductions in depredations that had been achieved through wolf removal.[161] Predator control programs have proven to be ineffective at increasing game populations as well, because other factors, such as climate, habitat and forage are often more important than predation in determining population trajectory.[162]

A number of studies have found that removing coyotes – the most frequently-persecuted mammal, with more than 76,000 reportedly killed by APHIS-Wildlife Services in Fiscal Year 2012 alone[163] – is ineffective at reducing coyote populations in the long-term, or of targeting and killing individual animals responsible for the depredations.[164] Likewise, APHIS-Wildlife

159 Miller, B.J., Reading, R.P., Biggins, D.E., Detling, J.K., Forrest, S.C., Hoogland, J.L., Javersak,, J., Miller, S.D., Proctor, J., Truettand, J. & Uresk, D.W., 2007, Prairie Dogs: An Ecological Review and Current Biopolitics, *The Journal of Wildlife Management*, v. 71, p. 2801; Delibes-Mateos, M., Smith, A.T., Slobodchikoff, C.N. & Swenson, J.E., 2011, The paradox of keystone species persecuted as pests; the call for conservation of abundant small mammals in their native range, *Biological Conservation*, v. 144, p. 1335.

160 Harper, E.K., Paul, W.J., Mech, L.D., and Weisberg, S., 2007, Effectiveness of Lethal, Directed Wolf-Depredation Control in Minnesota, *Journal of Wildlife Management*, v. 72(3), p. 778-784.

161 Crabtree & Sheldon (1999) (note 17); Prugh *et al*. (2009) (note 146).

162 Hurley, M.A., Unsworth, J.W., Zager, P., Hebblewhite, M., Garton, E.O., Montgomery, D.M., Skalski, J.R. & Maycock, C.L., 2009, Demographic response of mule deer to experimental reduction of coyotes and mountain lions in southeastern Idaho, *Wildlife Monographs*, v. 178, p. 1.

163 Data Compilation (note 3).

164 Gese (2005); Linnell, J.D., Odden, J., Smith, M.E., Aanes, R. & Swenson, J.E., 1999, Large Carnivores That Kill Livestock: Do "Problem Individuals" Really Exist? *Wildlife Society Bulletin*, v. 27(3), p. 698; Mitchell, B.R., Jaeger, M.M. & Barrett, R.H., 2004, Coyote Depredation Management: Current Methods and Research Needs, *Wildlife Society Bulletin*, v. 32(4), p. 1209. One reason for this is that as coyote populations are aggressively targeted, more yearling females breed and more pups survive, allowing for populations to rebound and even increase to compensate

Services has dramatically increased its killing of prairie dogs in recent years – on behalf of livestock interests – yet "it is questionable whether livestock directly benefit from extermination of prairie dogs," whose colonies increase both the "nutritional content and digestibility of forage plants" and the "live-plant to dead-plant ratio," benefiting for both bison and cattle."[165] Indeed, the "decline of the sheep industry in both eastern and western United States" could be just as attributable to "market trends and production costs" as to predators or any other reason.[166]

4. APHIS-Wildlife Services Has Failed to Prioritize Non-lethal Methods, Which Are More Effective in Preventing Livestock Depredations

In contrast to the largely ineffective killing of predators, many non-lethal methods have been developed, tested, and shown to be effective at reducing livestock depredations, including by confining sheep at night or calving livestock in fenced enclosures/paddocks, which is sometimes surrounded by fladry (electrified or not electrified), as well as: by using range riders, rag boxes, livestock guard animals like dogs, llamas or donkeys, and others' bonding young sheep to cattle and goats to sheep and cattle; and by adjusting the timing of calving and turn out.[167] Much of this research was conducted by APHIS-Wildlife Services itself, yet the agency has failed to emphasize use of these methods – to the contrary, as the GAO made clear in 1995, "field personnel rarely use nonlethal methods when controlling livestock predators.[168]

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for the individuals killed. Crabtree & Sheldon (1999) (note 17). Even in cases where the population is reduced, studies show it will return to pre-control levels in less than a year. *See* Gese, E.M., *Demographics and Spatial Responses of Coyotes to Changes in Food and Exploitation*, *in* PROCEEDINGS OF THE 11TH WILDLIFE DAMAGE MANAGEMENT CONFERENCE 271 (2005).

[165] Bergstrom *et al*. (2013) (note 9).

[166] *Id*. (citing Berger (2006) (note 10)). Berger (2006) assessed whether coyote removal was effective at reducing widespread declines in sheep grazing, comparing sheep numbers between areas of the United States with extensive coyote control and areas with no coyote control, and found that declines in sheep grazing were largely comparable.

[167] Green, J.S. & Woodruff, R.A., 1988, Breed Comparisons and Characteristics of Use of Livestock Guarding Dogs, *Journal of Range Management*, v. 41(3), p. 249; Andelt, W.F., Phillips, R.L., Gruver, K.S. & Guthrie, J.W., 1999, Coyote predation on domestic sheep deterred with electronic dogtraining collar, *Wildlife Society Bulletin*, v. 27, p. 12; Shivik, J.A., Treves, A. & Callahan, P., 2003, Nonlethal techniques for managing predation: primary and secondary repellents, *Conservation Biology*, v. 17, p. 1531; Espuno, N., Lequette, B., Poulle, M., Migot, P. & Lebreton, J., 2004, Heterogeneous response to preventive sheep husbandry during wolf recolonization of the French Alps, *Wildlife Society Bulletin*, v. 32(4), p. 1195; Hawley, J.E., Gehring, T.M., Schultz, R.N., Rossler, S.T., & Wydeven, A.P., 2007, Assessment of Shock Collars as Nonlethal Management for Wolves in Wisconsin, *Journal of Wildlife Management*, v. 73(4), p. 518; Lance, N.J., Breck, S.W., Sime, C., Callahan, P., & Shivik, J.A., 2010, Biological, technical, and social aspects of applying electrified fladry for livestock protection from wolves (*Canis lupus*), *Wildlife Research*, v. 37, p. 708; Breck, S.W., Kluever, B.M., Panasci, M., Oakleaf, J., Johnson, T., Ballard, W., Howery, L., Bergman, D.L., 2011, Domestic calf mortality and producer detection rates in the Mexican wolf recovery area: Implications for livestock management and carnivore compensation schemes, *Biological Conservation*, v. 144, p. 930. As Bergstrom *et al*. (2013) (note 9) notes, "there is no downward trend in lethal control, despite GAO (1995) admonishments" (citing GAO (1995) (note 90)).

[168] GAO (1995) (note 90) at 3. "WS's National Wildlife Research Center (NWRC) conducts important research in nonlethal control, but those methods NWRC concludes are effective rarely are adopted by WS field operations, particularly on livestock grazing allotments in the West, which are heavily biased toward lethal control." Bergstrom *et al*. (2013) (note 9).

This is highly problematic because lethal control can be an excuse for not employing effective non-lethal methods, particularly for the most anti-predator livestock operators, who would rather see wolves or other predators killed than take action to prevent depredations from occurring.

5. APHIS-Wildlife Services Utilizes Dangerous and Inhumane Methods to Kill Wildlife

To accomplish its objectives, APHIS-Wildlife Services employs many lethal-control methods, including: strangling-neck, foot, and catch-pole snares; leghold, cage, Conibear, snap, gopher, and mole traps; shooting and aerial gunning; egg, nest, and hatchling removal and destruction; and use of a long list of highly-toxic chemicals like strychnine, sodium cyanide (M-44s), sodium fluoroacetate (Compound 1080), and fumigants.[169] APHIS-Wildlife Services "removes" coyote and fox dens by removing and shooting pups, or "destroys" them and other dens by placing poisonous fumigants inside that cause animals inside to asphyxiate and die.[170]

Animals caught in Wildlife Services traps die slow, excruciating deaths.[171] Traps are left for weeks and months, and even longer, with animals left to die of starvation, thirst, heat, stress, and exposure.[172] While the agency recommends that its traps be checked "as frequently as possible" and its "policy [is] to provide the quickest, most painless death possible to the animal," "[t]here are traps that are not checked for literally months at a time."[173] Ineffective aerial gunners miss

[169] 1997 Programmatic FEIS (note 5) (at Appendix J, p. 9-14).

[170] *Id*. (at Appendix J, p. 11) ("Denning").

[171] *Mistake* (note 14); *see also Long Struggles* (note 14) (quoting Dick Randall) ("The leg-hold trap … is probably the most cruel device ever invented by man and is a direct cause of inexcusable destruction and waste of our wildlife."); *M-44s* (note 14) (former Wildlife Services trapper describing death from M-44s: "It's not a painless death. They start whining. They start hemorrhaging from their ears and nose and mouth. They get paralysis and fall over. Then they start convulsing and they're gone. They are suffering endlessly until they die. It'll make you literally want to puke."); *Neck Snares* (note 14) (dog owner describing day in 2010 when his dog became ensnared in a Wildlife Services trap on an Idaho national forest: "This was a shocking thing … . Sometimes I try not to think about it because it hurts too much.").

[172] *Long Struggles* (note 14); *id*. (quoting former agency trapper) ("Remember, these animals have fur coats on. They exert themselves trying to get out. They over-stress with the heat and keel over and die. Most coyotes die this way, and when the trapper gets there, all that is left is a bunch of hair, bones and maggots. I've seen it hundreds of times and it always bothered me. It has to be a horrendous and torturous way to die.").

[173] USDA, APHIS-Wildlife Services Policy Directive 4.450, TRAPS AND TRAPPING DEVICES (Mar. 10, 2004) ("All traps and trapping devices are to be checked as frequently as possible and no less frequently than required by law, unless specific exemptions that may be provided for in applicable wildlife regulations are obtained"); 1997 Programmatic BiOp (note 88) at 5 ("it is ADC policy to provide the quickest, most painless death possible to the animal"); *Long Struggles* (note 14) (quoting former agency trapper as stating that "[t]here are traps that are not checked for literally months at a time"); *see also Pandora's Box* (note 14) (noting that animals often rot away before they are found by agency hunters).

their target and leave animals wounded or crippled.[174] Poisons (especially Compound 1080) can cause prolonged pain and suffering.[175]

Not only are companion dogs killed or harmed by traps and poisons, but dogs used by agency trappers attack trapped animals. Last year, Jamie Olson, an APHIS-Wildlife Services employee, posted seven photographs on his Facebook page – in a folder entitled "work" – of his dogs "ripping into live coyotes trapped in steel foot-holds" and of coyote carcasses.[176] Mr. Olson's work photographs also showed his dogs attacking bobcats and raccoons.[177] Mr. Olson evidently felt comfortable sharing these photographs with his Facebook friends without consequence to his position at APHIS-Wildlife Services.[178] One of the photographs posted by Mr. Olson is depicted below:

[174] *Pandora's Box* (note 14) (quoting former agency trapper) ("Who wants to see an animal get crippled and run around with its leg blown off? I saw that a lot."); 1997 Programmatic BiOp (note 5) at 5 ("it is ADC policy to provide the quickest, most painless death possible to the animal").

[175] *See* Letter from Danielle Clair to Rep. DeFazio (Feb. 18, 2002) (recounting death of family dog from M-44 in Oregon in 2002: "Oberon did not die immediately but after eight hours, during which the local emergency veterinarian clinic worked to turn this nightmare around" but "[u]nfortunately, Oberon received a lethal dose.").

[176] *Federal Agency Gives Few Answers* (note 100). The seven photographs from Mr. Olson's Facebook page are included as sources in support of this Petition.

[177] *Id*.

[178] *Id*. Project Coyote has collected almost 98,000 signatures to date on a petition seeking termination of Mr. Olson as a program employee. *See* Petition by Project Coyote, Fire USDA Wildlife Services Federal Trapper Jamie Olson for Animal Cruelty [*available at* http://www.change.org/petitions/fire-usda-wildlife-services-federal-trapper-jamie-olson-for-animal-cruelty].

Following a public outcry, APHIS-Wildlife Services was forced to conduct an investigation.[179] The APHIS Report of Olson Incident concluded that there was no "evidence" to support "allegations of animal cruelty" and that Mr. Olson did not violate "any part" of the agency's official standards of ethical conduct.[180] To date, Mr. Olson has not been disciplined as a result of the incident.

Russell Files – another APHIS-Wildlife Services trapper – was federally charged with criminal animal cruelty charges last year for deliberately setting traps in order to capture a neighbor's dog in suburban Phoenix, reportedly using APHIS-Wildlife Services equipment and while on agency time.[181] The following photograph shows the severely-injured dog:

179 USDA, APHIS, Marketing and Regulatory Programs – Business Service (MRP-BS), Human Resources Division (HRd), Administrative Investigations and Compliance Branch (AICB), REPORT OF INVESTIGATION: CASE NUMBER – AR-13-06-WS (Dec. 6, 2012) [hereinafter "REPORT OF OLSON INVESTIGATION"] at 2.

180 REPORT OF OLSON INVESTIGATION (note 179). The agency has claimed that the photographs were "taken out of context." Email from P. Sanchez, APHIS (Nov. 15, 2012). However, the formal investigation found that the photographs were posted on Facebook by Mr. Olson and were taken at several locations while Mr. Olson was "performing his official duties" with APHIS-Wildlife Services on behalf of ranchers. *See id*. at 2-4; *id*. at 2 ("The pictures … found in OLSON's Facebook accounted were located in a file entitled 'work.'"). During the investigation, Deputy Administrator William Clay told colleagues that he had "created a rule … to send all emails with 'Jamie Olson' in the Subject line directly to my junk folder." Email from William H. Clay, APHIS-Wildlife Services to G. Littauer and J. Green, APHIS-Wildlife Services (Nov. 8, 2012). Deputy Administrator Clay was made aware of several instances when Mr. Olson had not checked his traps in "accordance with our reporting directive" – including "some instances where Jamie Olson's M-44's had not been checked for up to 69 days." Email from William H. Clay, APHIS-Wildlife Services to G. Littauer, APHIS-Wildlife Services (Dec. 20, 2012). Despite this, the formal investigation concluded that Mr. Olson violated no trap-check frequency directives. *Id*.

181 RUSSELL FILES POLICE REPORT (Jan. 18, 2012); *see also Hundreds of Pets, Protected Species Killed* (note 100). A family dog named Maggie was killed by a "body-grip" trap set by Wildlife Services in suburban Oregon in 2011. *The Killing Agency* (note 14).

Like Mr. Olson, Mr. Files was not fired or even disciplined; rather, he finished his career at APHIS-Wildlife Services by resigning voluntarily, citing "personal reasons."[182] Mr. Olson, Mr. Files, and other examples plainly illustrate why many have identified a "culture of animal cruelty" – indeed, a culture of outright lawlessness – at Wildlife Services.[183]

In addition to traps, the use of toxicants – in particular, M-44s and Compound 1080 – cause tremendous pain and suffering. M-44s are devices that release sodium cyanide into the mouth of an animal when triggered, causing the animal to go into convulsions and die.[184] Compound 1080 is placed in a "livestock protection collar" (LPC), a bladder that attaches to the neck of a sheep or a goat, and which is designed to dispense the highly-toxic contents when it is punctured by an attacking coyote.[185] Compound 1080 is extremely toxic in very small amounts – a teaspoonful could kill 100 people – and LPCs do not always work as intended.[186] Death from a M-44 usually takes minutes (although it can take longer), whereas death from a Compound 1080 device typically occurs after many hours of suffering.[187]

APHIS-Wildlife Services' lethal toxicants pose a danger to the public. The agency has poisoned tens of thousands of animals to death in recent years, and its chemicals are present wherever the

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[182] RUSSELL FILES POLICE REPORT (note 181); *see also Hundreds of Pets, Protected Species Killed* (note 100). The dog, which lost "more than a dozen teeth in the ordeal," was captured in two leg-hold traps that had been set in Mr. Files' yard; she was "'covered in blood from trying to chew her way out" and '[t]he traps … were covered in blood.'" *Id*.

[183] *See Torture, Abuse Regular Practice* (note100) (former APHIS-Wildlife Services trapper recounting incident when he and a supervisor found nine coyotes caught in leghold snares in Nevada, and as was routine agency practice, signaled his dogs to attack, as his supervisor watched and laughed and as the dogs circled the coyotes and ripped into them); *id*. (quoting Rep. John Campbell, R-Calif.) ("This agency has become an outlet for people to abuse animals for no particular reason. It is completely out of control. They need to be brought into the 21st century."); Letter from Reps. DeFazio and Campbell to Tom Vilsack, USDA (Nov. 30, 2012) ("[W]e are gravely concerned that [Olson] photographs … do not represent an isolated occurrence, but may reflect a deep-rooted problem within the Wildlife Services program, that allows for, and encourages, inhumane lethal methods of predator control."); *see also* Letter from Cathy Liss, AWI & Camilla Fox, Project Coyote to William H. Clay, APHIS-Wildlife Services (Mar. 15, 2013) ("We have a broader concern that illegal behavior and shocking acts of animal abuse have emerged as patterns within WS."); *id*. (citing Olson, Traweek, and Files examples); Email from David M. Root, APHIS-Wildlife Services to William H. Clay, APHIS-Wildlife Services (May 17, 2013) (noting involvement of Jamie Olson's boss, David Bergman, who also has yet to be disciplined).

[184] 1997 Programmatic FEIS (note 5) at 1-11.

[185] *Id*. at Appendix P, p. 272.

[186] Turkington, R., CHEMICALS USED FOR ILLEGAL PURPOSES: A GUIDE FOR FIRST RESPONDERS TO IDENTIFY EXPLOSIVES, RECREATIONAL DRUGS, AND POISONS (2010) [hereinafter "Turkington (2010)"] at 361; Fox, *Huff Post* (note 139) (although LPCs are designed to be punctured by attacking predators, "pouches are just as easily punctured by vegetation and barbed wire, leaking Compound 1080 into the environment where grazing animals can be poisoned from eating the contaminated forage").

[187] Turkington (2010) (note 186).; *see also* Affidavit of Paul Wright (Sep. 19, 2001) [hereinafter "Wright Affidavit"] (describing how family dog who triggered APHIS-Wildlife Services M-44 device suffered for hours before dying from the cyanide exposure).

program is active – including, in some cases, near roads and places that are frequented by people and their pets. Indeed, examples of APHIS-Wildlife Services' personnel placing poisons in such areas are abundant, and even doing so with the intention of poisoning family dogs.[188] Moreover, since 1987 18 agency staff and members of the public have been exposed to M-44s that cause nausea, blurred vision, and other problems.[189] Ten people have died in aircraft crashes from aerial gunning operations since 1979.[190] Disruption of ecosystems risks exposing species and humans to dangerous diseases.[191] Remarking about sodium cyanide, Rep. Peter DeFazio, D-Ore., has warned that "[s]ooner or later it's going to kill a kid."[192]

6. APHIS-Wildlife Services Lacks Transparency and Accountability

Not surprisingly given its activities, APHIS is not transparent about the program – to the contrary, it "operates in the shadows."[193] It does not routinely make available specific, reliable

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[188] In 1996, two APHIS-Wildlife Services were cited for violations in connection with the unlawful placement of several M-44s in prohibited areas on the Gila National Forest, including within 200 feet of water and closer than 50 feet or within sight of a public road or pathway. *See* New Mexico Department of Agriculture, INVESTIGATIVE REPORT, Case No. 96-24 (Apr. 29, 1996). A similar incident was investigated in Texas last year. *See* Texas Department of Agriculture, NOTICE OF VIOLATION, TDA Incident No. 02414-00006891 (June 6, 2012) (citing APHIS-Wildlife Services employee Kyle Traweek for unlawfully placing M-44s in an area "frequented by humans or domestic dogs and where exposure to the public and family pets is probable," intentionally causing the fatal poisoning neighbor's dog). As Knudson (2012) reported, the agency has killed over 1,100 dogs including family pets since 2000; many of these were animals who died from agency poisons. *See The Killing Agency* (note 14). Examples of such incidents are abundant; for instance, a family dog was killed by an M-44 in Philomath, Oregon in 2002. Letter from Clair to Rep. DeFazio (note 175). Another family dog was killed by an M-44 in southern Colorado in 2001. A dog was killed in Oregon in 2000 from an M-44 placed on a tree farm where children frequently played. Cole, M. & Lednicer, L.G., Neighbor Dog's Death Halts Attempt to Trap Coyotes on Estacada Tree Farm, *The Oregonian* (Jan. 11, 2000). In 1999, APHIS-Wildlife Services placed an M-44 on land frequented by David Wright, killing his dog and exposing him and his daughter to cyanide. Wright Affidavit (note 187). In 1996, APHIS-Wildlife Services placed an M-44 on property belonging to Amanda Wood in Oregon, killing her dog and exposing her to cyanide poisoning. Watson, K. & Hanscom, G., Poison Traps Kill Unintended Victims, *High Country News* (Mar. 13, 2000) [*available at* http://www.hcn.org/issues/174/5628].

[189] *The Killing Agency* (note 14); *M-44s* (note 14); *see also* Predator Poison Under Review, *Associated Press* (Jan. 21, 2008) (Utah man exposed to APHIS-Wildlife Services' M-44 in 2003 "suffers from long-term health effects," "has difficulty breathing, vomits almost daily and can no longer work").

[190] *The Killing Agency* (note 14).

[191] For instance, in 2011 mule deer tested positive for the plague in an area in Nevada where APHIS-Wildlife Services had been targeting coyotes. *Pandora's Box* (note 14) (description of the emergence of the plague in mule deer in an area where APHIS-Wildlife Services was killing predators). The plague is a disease that is sparked by rodents and transmittable to humans. Killing coyotes typically results in an increase of coyote prey species including rodents that carry plague, at least until coyotes respond to the increase in prey with larger litter sizes. *See supra* note 16

[192] *See* Cong. Rec. H4286 (June 16, 2011) (statement of Rep. DeFazio); *see also id*. ("Some kid is going to be pulling on that little string saying, gee, I wonder what this does – BAM, cyanide shot shell. Now, that's really discriminate. That's really effective.").

[193] *The Killing Agency* (note 14); *id*. (quoting acting state director in California as stating: "We pride ourselves on our ability to go in and get the job done quietly without many people knowing about it."); *see also* Email from Carol

information about its activities, including the specific wildlife "problems" that it purports to solve, on whose behalf it conducts its activities, and where.[194]

The agency's website provides only broad summaries of program activities and categories of funding sources.[195] The program self-reports the number of animals that it kills, but these figures are not reliable; former agency personnel have revealed that the program kills far more animals than it reports. The program has no accurate sense of whether it is effective, as it "conducts little or no population monitoring of lethally controlled mammals nor of their alternate natural prey, no studies of whether WS is additive with other causes of mortality, and no studies of how control affects populations of nontarget species that are unintentionally killed."[196] The agency has policies that "prohibit agency employees from identifying themselves on social media websites."[197]

An investigation into Jamie Olson has concluded without any disciplinary action being taken against him, and the agency refuses even to disclose the results of the investigation.[198] In another high profile incident, an investigation into the January, 2013 killing of a Mexican wolf – a critically-endangered animal – was initiated only after the killing was leaked to the media and after the federal government suppressed information showing that the killing had occurred.[199]

Indeed, because the program is so secretive, the fact that anything is known about its darker aspects at all is due to agency whistleblowers, dogged investigative journalism, longtime

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A. Bannerman, Publication Affairs Specialist, Wildlife Services & Veterinary Services to Bill Clay, APHIS-Wildlife Services Administrator *et al*. (Nov. 16, 2012) (lead program public affairs specialist expressing gratitude that media were not present to witness comments by Mr. Olson to Conserve County, Wyoming Board Livestock Predator Control Board – *i.e.*, that "animal activist groups have nothing better to do than send the e-mails and then go hug a tree" – but bemoaning that Mr. Olson evidently had not "learned something from this").

[194] APHIS-Wildlife Services, *Selected advance questions from American Society of Mammalogists in preparation for forum with APHIS official on Wildlife Services (WS)* (June 2012).

[195] *See* APHIS-Wildlife Service, Wildlife Services' 2010 Program Data Reports, available at http://www.aphis.usda.gov/wildlife_damage/prog_data/2012_prog_data/index.shtml. Although FY 2012 ended 12 months ago and FY 2014 began two months ago, as of today's date, APHIS-Wildlife Services has yet to make FY 2012 Program Data available on its website. *See id*.

[196] Bergstrom *et al*. (2013) (note 9).

[197] *See* REPORT OF OLSON INVESTIGATION (note 179) at 4.

[198] In June 2013, Rep. Campbell published leaked documents on his website which show the results of the investigation of Mr. Olson. *See* John Campbell, Congressman, Leaked Documents Reveal Cover-Up of Animal Abuse Investigation in USDA's Wildlife Services Agency – Predator Defense (June 24, 2013).

[199] Initially, the agencies denied that any Mexican wolf had been killed in January 2013. *See* MEXICAN WOLF BLUE RANGE REINTRODUCTION PROJECT MONTHLY UPDATE (Jan. 1-31, 2013) (failing to report the shooting); Tony Davis, Possible Mexican Wolf Killing Under Investigation in N.M., *Arizona Daily Star* (Apr. 10, 2013) (reporting that "The killing occurred in January in Southwestern New Mexico, where rancher resistance to the release of the endangered Mexican gray wolves has been fiercest.").

advocacy by non-governmental organizations, and targeted, prolonged interest by members of Congress. It is telling that most of the incidents that do come to light involve members of the public and their pets – in other words, incidents that cannot be easily shielded from public view.[200] As one agency manager told investigative journalist Tom Knudson from the *Sacramento Bee*, "[w]e really don't have to tell anybody what we're doing."[201]

These major problems run counter not only to prevailing societal values, but also to a statutory scheme that authorizes a wildlife control program only if it can be done with transparency and based on reliable information.[202] Yet, it is clear that this is not the case in practice.

As Rep. Defazio has observed in advocating for the elimination of Wildlife Services' lethal predator control, "it's incredibly important that we bring the actions of this agency out of the shadows."[203]

IV. PETITION FOR RULEMAKING

APHIS-Wildlife Services manuals and directives set forth the official mission, philosophy and policies of the program.[204] They set forth an agency "management philosophy" to "conserve and manage wildlife resources while being responsive to public desires, views, and attitudes" and engaging in "control" of "injurious wildlife" only after "careful assessments" of an identified problem and its resolution, in accordance with "biologically sound, environmentally safe, scientifically valid, and socially acceptable" methods that are designed to minimize risks to humans, wildlife, non-target animals, and the environment.[205] Although it has long been known

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[200] *See supra* at 11 (discussing Boy Scout incident). The 1971 Boy Scout incident ultimately lead to President Nixon's signing of Executive Order 11643, which banned the use of certain toxicants on public lands. *See* Feldman (2007) (note 30) ("the 1971 discovery by a Boy Scout troop of 24 eagle carcasses near a poisoned bait station in Wyoming … brought intense public scrutiny on the federal program" followed by Congressional hearings, lawsuits, an investigation, and ultimately, President Nixon's signing of Executive Order 11643); *see also Calls for Investigation* (note 14) ("Why won't they let anyone go with them to see what they are doing? Why is there such a shroud of secrecy?" said Campbell. "Whose interests are they serving? That is the sort of thing we need to find out."). Citing the lack of transparency, Reps. Campbell and DeFazio have called for an investigation into APHIS-Wildlife Services, and Rep. Davis has introduced a bill that would require greater program transparency. Transparency for Lethal Control Act, H.R. 2074, 113th Cong. (1st Sess. 2013).

[201] *Neck Snares* (note 14).

[202] 7 U.S.C. § 426.

[203] *Federal Agency Accused of Stonewalling* (note 100) (quoting Rep. DeFazio).

[204] *See* APHIS-Wildlife Services Policy Manual (updated Mar. 1, 2013) (*see* Literature Cited section for complete set of program policies); *see also* USDA, APHIS-Wildlife Services Publication, PARTNERSHIPS AND PROGRESS (Aug. 2009) at 1 (noting that "[w]hile WS' authorizing legislation continues to be the base of its authority, it is the program's policy directives that guide WS personnel daily in responding to requests for assistance.") (hyperlink in original).

[205] USDA, APHIS-Wildlife Services Policy Directive 1.201, MISSION AND PHILOSOPHY OF THE WS PROGRAM (July 20, 2009) [hereinafter "APHIS-Wildlife Services Directive 1.201"].

that it does not do so in practice, APHIS-Wildlife Services claims that when it does take control actions, "[p]reference is [to be] given to nonlethal methods when practical and effective."[206] The directives also require APHIS-Wildlife Services to maintain accurate, relevant, and reliable records about program activities, and to make this information readily available to the public.[207] APHIS-Wildlife Services must also set forth the terms of its engagement on behalf of other Federal agencies, state agencies, and private parties in Memoranda of Understanding and cooperative agreements, and is to administer its cooperator agreements in an open and transparent manner.[208]

Yet, however far these pronouncements go, it is plainly evident that they do not work to ensure that APHIS-Wildlife Services is transparent and in compliance with the law or consistent with prevailing American values. Many key aspects of the program – including standards to ensure program transparency and reliability of information, definitions of key terms, standardized procedures for cooperator agreements, or procedures that fill in the gaps in the regulatory schemes and ensure strict adherence to the requirements of federal environmental laws – lack any policy directives at all. And the policy directives that do exist are merely supplanted by APHIS on occasion, evading the rigorous requirements of the APA including required notice and opportunities for public comment.[209]

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[206] USDA, APHIS-Wildlife Services Policy Directive 2.201, SELECTING WILDLIFE DAMAGE MANAGEMENT METHODS (Oct. 29, 2003). Despite this, it has been plainly evident that APHIS-Wildlife Services emphasizes the use of lethal control methods over nonlethal methods. *See* GAO (1995) (note 90) at 3 ("in practice, the role of nonlethal methods in the program's efforts to control livestock predators differs from that indicated by the guidance" and "field personnel rarely use nonlethal methods when controlling livestock predators"); *see also* Bergstrom *et al*. (2013) (note 9) ("there is no downward trend in lethal control, despite GAO (1995) admonishments").

[207] USDA, APHIS-Wildlife Services Policy Directive 156.1, FOIA/PRIVACY ACT GUIDELINES (Oct. 19, 1982) [hereinafter "APHIS Directive 156.1"] at §VII (recognizing that FOIA "is a disclosure statute designed to allow ease access to documents held by the administrative agencies of the executive branch of the Federal Government" and that "[e]ach Agency has the responsibility to expedite all releasable information as prescribed by the FOIA").

[208] USDA, APHIS-Wildlife Services Policy Directive 4.135, REQUESTS FOR INFORMATION (Oct. 7, 2005); *see also supra* at 19 (discussing CAPIT recommendations regarding cooperator agreement process).

[209] For example, in July APHIS-Wildlife Services quietly replaced its policy directive entitled "Reporting." *See* APHIS-Wildlife Service Policy Directive 4.205.1, DATA AND ACTIVITY REPORTING (July 2, 2013). Likely in response to the Jamie Olson incident – which has generated a public outcry, multiple investigative articles, calls for an investigation by members of Congress, and a petition to terminate Mr. Olson's employment with APHIS-Wildlife Services on Change.org from Project Coyote – the directive includes new requirements. These include the requirement that all agency personnel report all "critical issues or potential problems" "immediately to their supervisor for further action as appropriate." *Id*. at 3. This includes "situations, occurrences, and media events" which "may … [r]esult in publicity, substantial/national media and public inquiries, or Congressional inquiries, or … [a]ffect WS' relationship with other agencies, States, or cooperators." *Id*. Hence, as this was simply a policy directive, the public was never notified of the revisions or invited to comment – and to be able to urge APHIS, *e.g.*, to prioritize termination of employees who carry out such activities rather than to facilitate program's ability to minimize or control public scrutiny of such incidents.

As APHIS-Wildlife Services has never promulgated substantive regulations that are codified in the Code of Federal Regulations in accordance with the APA, Petitioners, other interested persons, and the general public have never been afforded an opportunity to guide APHIS-Wildlife Services, and to ensure that it maintains and adheres to a clear, consistent regulatory scheme that, in turn, ensures that the program is fully transparent and accountable to the public.

A. PETITION TO USDA-APHIS TO CONDUCT A FORMAL RULEMAKING UNDER THE ADMINISTRATIVE PROCEDURE ACT TO ESTABLISH A REGULATORY SCHEME FOR THE WILDLIFE SERVICES PROGRAM

Petitioners formally petition USDA and APHIS pursuant to APA section 553(e) and 7 C.F.R. § 1.28, for issuance and amendment of rules that govern the Wildlife Services program. USDA and APHIS have legal authority to conduct such a rulemaking, and promulgation of rules is necessary to fill the gaps in the statutory scheme.

The ADCA is the primary statutory authority for the Wildlife Services program.[210] The ADCA was enacted in 1931 to authorize the Bureau of Biological Survey to investigate, experiment, test, determine, demonstrate, and promulgate methods of eradicating, suppressing, or bringing under control mountain lions, wolves, coyotes, bobcats, prairie dogs, gophers, ground squirrels, jack rabbits, and other so-called "injurious" animals.[211] In 1986, administration of the Act was passed from the Secretary of the Interior to the Secretary of Agriculture.[212] An amendment passed in 2000 gave broad authority to the Secretary of Agriculture to control "injurious species" in accordance with agency policies but removed eradication as a goal of the law.[213]

APHIS-Wildlife Services is required to comply with many additional federal legal authorities as well.[214] These include laws and policies that:

- Require access to program records, public participation, transparency, and reliable information, including the Freedom of Information Act, 5 U.S.C. § 552, *as amended*; National Environmental Policy Act, 42 U.S.C. § 4321-4370h, 40 C.F.R. Parts 1500-1508, and the Data Quality Act, Public Law 106–554; H.R. 5658;

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[210] 7 U.S.C. §§ 426-426c.

[211] 1997 Programmatic FEIS (note 5) at 1-13.

[212] *Id*.

[213] *Id*.

[214] APHIS-Wildlife Services Policy Directive 1.210, LEGAL AUTHORITY (Sep. 19, 2003) [hereinafter APHIS-Wildlife Services Policy Directive 1.210"]; *see also* APHIS-Wildlife Services Policy Directive 2.210, COMPLIANCE WITH FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS (Oct. 27, 2009) [hereinafter APHIS-Wildlife Services Policy Directive 2.210"] ("[a]ll employees … are responsible for conducting official duties in compliance with all Federal laws" and "[s]upervisors shall ensure that all employees are aware of laws applicable to their official duties").

- Protect biodiversity and wildlife, like the Endangered Species Act, 16 U.S.C. §§ 1531-1544, *as amended* ("ESA"), the Bald and Golden Eagle Protection Act, 16 U.S.C. § 668-668d, *as amended* ("BGEPA"), the Migratory Bird Treaty Act of 1918, 16 U.S.C. §§ 703-711 ("MBTA"), and the Fish and Wildlife Act of 1956, 16 U.S.C. § 742j-l;

- Set a national policy for the humane treatment of animals, like the Animal Welfare Act, 7 U.S.C. §§ 2131-2159, the Humane Slaughter Act, 7 U.S.C. §§ 1901-1907, and require the humane treatment of wildlife that are protected under the ESA, MBTA, or BGEPA, 50 C.F.R. § 13.41; and

- Protect public health, like the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. §§ 135-136y, *as amended* ("FIFRA").

In addition to these authorities, Executive Order No. 13112 (Feb. 3, 1999) directs all federal agencies to use their programs and authorities to: "prevent the introduction of invasive species"; "detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner"; "monitor invasive species populations accurately and reliably"; and "conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species."

APHIS-Wildlife Services maintains a set of Program Directives and Policy Directives that are designed to fill the gaps in the regulatory scheme, and to specify the relevant statutory requirements.[215] On their face, these directives value and emphasize transparency, wildlife conservation, and minimal, direct control only when necessary and according to methods that are humane and socially acceptable.[216]

However, APHIS has never promulgated regulations under the APA to codify any policies and authorities in a regulatory scheme that will ensure program consistency with all applicable authorities. Therefore, Petitioners formally request that APHIS undertake a substantive

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[215] *See supra* at 37-38.

[216] *See* USDA, APHIS-Wildlife Services Policy Directive 1.201 (note 205); USDA, APHIS-Wildlife Services Directive 1530.1, OTHER GOVERNMENT AGENCY AND NON-FEDERAL REVIEWS OF APHIS (Mar. 23, 1993); APHIS Directive 156.1 (note 207) at §VII (FOIA "is a disclosure statute designed to allow eas[y] access to documents held by the administrative agencies of the executive branch of the Federal Government" and "[e]ach Agency has the responsibility to expedite all releasable information as prescribed by the FOIA"); PARTNERSHIPS AND PROGRESS (note 122) at 1 ("While WS' authorizing legislation continues to be the base of its authority, it is the program's *policy directives* that guide WS personnel daily in responding to requests for assistance.") (emphasis in original). That said, Petitioners do not suggest here that the existing policy directives cannot not be substantially improved in certain, key respects – *e.g.*, no longer engaging in ongoing predator control without any "end point." U.S. Department of Agriculture, APHIS-Wildlife Services, Policy Directive 2.201, DECISION MODEL (Jul. 21, 2008). Rather, these policies simply underscore the existence of gaps in the statutory scheme that governs the program, which can be appropriately addressed through a substantive rulemaking under the APA, including with notice and an opportunity for public comment.

rulemaking under the APA in order to fill the gaps in the existing statutory scheme.[217] Such rules must include:

1. definitions of key terms, such as “injurious,” “predator,” “control,” “invasive,” and “cooperator”;

2. procedures to ensure program transparency, such as rules specifying the information, documentation, data, and records that will be maintained by program personnel and routinely provided to the public;

3. criteria for the selection of specific control methods and the circumstances in which they may be utilized, with an emphasis on highly-selective, nonlethal, non-toxic, and non-capture methods, and with the goals of phasing out lethal methods and prophylactic control and of restoring apex predators to ecosystems;

4. criteria setting forth and requiring a documented correlation between specific wildlife problems that warrant a response by Wildlife Services as well as the appropriate methods that may be employed by program personnel, with an emphasis on and exhaustion of nonlethal measures in each situation;

5. procedures specifying the development and content of Wildlife Services work plans;

6. measures to ensure that “non-target” animals are not harmed or killed;

7. a standard of ethics and requirements to ensure professionalism of program personnel;

8. rules to ensure that all animals affected by the program are treated humanely and that agency personnel who commit acts of animal cruelty are subject to disciplinary action and/or employment termination;

9. factors for determining when previously-approved control activities must cease;

10. criteria that govern the selection of cooperators, the temporal scope for cooperator status, and cooperator agreements, the circumstances necessitating their modification or revocation, and public participation and disclosure requirements for determinations of cooperator status and cooperator agreements;

11. standardized procedures for processing cooperator agreements; and

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[217] *See Morton v. Ruiz*, 415 U.S. at 231 (“The power of an administrative agency to administer a congressionally created and funded program necessarily requires the formulation of policy and the making of rules to fill any gap left, implicitly or explicitly, by Congress.”).

12. procedures that ensure strict adherence to the requirements of federal environmental laws, including rules to clarify the type and frequency of environmental reviews of program work plans.

The time for a regulatory scheme for the Wildlife Services program is long overdue; indeed, observations from the Leopold Report 50 years ago still hold true today:

> … there is need for explicit criteria to guide control decisions, something that we find sadly lacking at present. Under properly enforced *regulations* and constraints the team of trained professional hunters can certainly achieve control with maximum efficiency and potentially with minimum damage to other values.[218]

Accordingly, Petitioners request promulgation of rules to govern the APHIS-Wildlife Services program, including rules to ensure legal compliance, as explained below.

B. SUBSTANTIVE RULES MUST ENSURE THAT THE PROGRAM MEETS AND IS CONSISTENT WITH ALL RELEVANT POLICIES AND LEGAL AUTHORITIES, AND SHOULD CODIFY AND MAKE BINDING SEVERAL EXISTING APHIS-WILDLIFE SERVICES POLICY DIRECTIVES.

Rulemaking must ensure strict compliance with all relevant legal authorities and national policies that guide the program. Specifically, rules must ensure: transparency and reliability; an emphasis on nonlethal methods; the humane treatment of animals; and strict adherence to all relevant procedural and substantive legal requirements. In the absence of such a regulatory scheme, the program will continue to render itself obsolete and out of step with societal values.

1. Rules Must Ensure that All Program Activities are Fully and Accurately Documented and Disclosed to the Public.

In its regular course, APHIS-Wildlife Services does not make available to the public basic information or records regarding its activities, only broad summaries.[219] The program does not document specific problems or efforts to emphasize nonlethal control methods. Its field reports and work plans and monetary expenditures are obscure, inconsistent, and difficult to obtain. APHIS-Wildlife Services does not post its work plans or all environmental reviews – which were prepared to satisfy NEPA and/or the ESA many years ago – on its website.[220] Even when it

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[218] Leopold report (note 40) at 24 (emphasis added).

[219] *See* USDA APHIS-Wildlife Services, 2012 Program Data Reports (*see* Literature Cited) (providing only summary data regarding resources and agency expenditures and omitting information or records about non-target mortalities and harm such as geographic areas of operation, results from monitoring to assess program efficacy, adverse effects incident reports or summaries, cooperative service agreements; cooperative agreements; interagency agreements; material transfer agreements, confidentiality agreements; memoranda of understanding; all APHIS-WS-related environmental reviews under NEPA, the ESA, or other laws).

[220] *See* USDA, APHIS-Wildlife Services, Wildlife Damage Management – National Environmental Policy (NEPA) Documents [available at http://www.aphis.usda.gov/regulations/ws/ws_nepa_environmental_documents.shtml]

makes completed NEPA documents available, many are heavily redacted.[221] Other programmatic environmental reviews are not easily accessible. Nor are agency handbooks, policy statements, guidance manuals, or best practices manuals. Many such documents must be requested under FOIA, but APHIS does not necessarily respond to FOIA requests in a timely manner.[222] Members of the news media are not permitted to observe agency personnel in the field.[223]

A defining characteristic of the Wildlife Services program is secrecy.[224] As just one example, a FWS investigation concluded that on January 19, 2013, a Wildlife Services employee shot and killed a critically-endangered Mexican wolf, one of the most critically-endangered land mammals in North America.[225] Yet, only after a public outcry did FWS law enforcement investigate the killing.[226]

(making available only recent environmental assessments and other NEPA documents available); *see also* USDA, APHIS-Wildlife Services, FOIA Reading Room [available at http://www.aphis.usda.gov/foia/foia_reading_room.shtml] ("APHIS only maintains an electronic reading room."); Wildlife Damage Management, eLibrary [available at http://www.aphis.usda.gov/wildlife_damage/library.shtml].

[221] *See* USDA, APHIS-Wildlife Services, FINAL ENVIRONMENTAL ASSESSMENT, PREDATOR DAMAGE MANAGEMENT ON FEDERAL LANDS IN ARIZONA (Nov. 1998).

[222] *Infra* note 223 (reporting that APHIS-Wildlife Services "hasn't promptly released numerous public documents about the animals it's killed [in San Diego]"); Memorandum from Administrator Kevin Shea & Deputy Administrator William H. Clay, APHIS-Wildlife Services to APHIS Management Team & Program Leaders Group (June 19, 2009) [hereinafter "Shea and Clay Memorandum") ("we still have much work ahead of us" to reduce the "FOIA backlog").

[223] *The Killing Agency* (note 14); *id*. (noting that even military agencies allow reporters in the field); *see also* Rob Davis, Congresswoman Pushes for Transparency from Secretive Agency: The Wildlife Killers, *Voice of San Diego* (Aug. 2, 2012) (reporting that Wildlife Services "doesn't allow reporters to watch its trappers in action and it hasn't promptly released numerous public documents about the animals it's killed [in San Diego], despite a formal request we filed under [FOIA]" and "[w]hen I asked for a database of kills it maintains, two of its employees laughed out loud at my request").

[224] *The Killing Agency* (note 14) ("because lethal control stirs strong emotions, Wildlife Services prefers to operate in the shadows"); *id*. (quoting former Wildlife Services District Manager Carter Niemeyer) ("The public has every right to scrutinize what's going on."); *see also Neck Snares* (note 14) (quoting Wildlife Services manager telling owner of dog maimed by agency snare as stating: "We really don't have to tell anybody what we're doing."); *Pandora's Box* (note 14) (discussing how Wildlife Services does not disclose the ranches where its employees conduct activities).

[225] *See* U.S. Department of the Interior, U.S. Fish and Wildlife Service Office of Law Enforcement, REPORT OF INVESTIGATION REPORT #: 2013200634R003 (Aug. 14, 2013).

[226] *See* Blake, R., One Mexican Wolf Killed; Two Pairs Transferred for Release into the Wild, *Public News Service*, (May 2013) [hereinafter "Blake (2013)"]; *see also* Press Release, *U.S. Fish and Wildlife Service Confirms Recent Canine Mortality in New Mexico Was a Mexican Gray Wolf* (undated). FWS originally stated that no wolves had been killed that January, until the Center for Biological Diversity provided contrary information to the media, suggesting that FWS concealing the truth on behalf of APHIS-Wildlife Services which also did not publicly disclose the incident until over two months later, and only then after being approached by reporters. *See also* Montoya-Bryan, S., Feds release few details in possible wolf shooting, *Associated Press* (Apr. 4, 2013).

Ultimately, the U.S. Attorney for New Mexico decided not to prosecute the APHIS-Wildlife Services employee, based on the employee's claim that he had mistaken the Mexican wolf (pictured below) for a coyote, even though APHIS-Wildlife Services personnel "who conduct … activities in occupied wolf range" are required to be "knowledgeable at a professional level in identification of Mexican wolf, their habitat and use of habitat, and their sign.":[227]

For decades, the program has mistakenly killed a "great many" animals "as innocent victims of the control operation."[228] Indeed, the extensive list of non-target animals that are indiscriminately killed and maimed by APHIS-Wildlife Services personnel includes, in addition to Mexican wolves, bald and golden eagles, San Joaquin kit fox, swift fox, Hawaiian ducks and geese, and scores of migratory birds that are protected under the MBTA, as well as coyote, river otter, black bear, beaver, porcupine, mountain lion, wolf, pronghorn antelope, mule deer, badger, white-fronted goose, great blue heron, wild turkey, hog-nosed skunk, mule deer, black-tailed jack rabbit, and dogs.[229] The non-target impacts of Wildlife Services' activities extend to domestic pets as well, which become injured and/or die horrible deaths in Wildlife Services' traps or from ingesting the program's poisons.[230]

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[227] *See* REPORT OF INVESTIGATION REPORT #: 2013200634R003 (note 225); *Blake* (2013) (note 226).

[228] Leopold report (note 40) at 8.

[229] Data Compilation (note 3).

[230] *See* Letter from Sharyn Aguiar to Joy Schnackenbeck, EPA (Sep. 14, 2007) (personal account of the day her German Shepherd was lured to a Wildlife Services-set M-44 cyanide trap set on public lands, where no warning signs were posted, as follows: "I kneeled at the top of his head, bending over him, crying and trying to figure out what happened to him. I remember crying out '1 don't understand, I don't understand' as I looked at his mouth. His mouth had a pinkish/salmonish colored foam coming from it."); *see also* Letter from A. Wood Kingsley to Whom it May Concern (Nov. 15, 2003) (thanking Predator Defense for helping to pursue answers in connection with the death of family dog by cyanide gas from a trap set on Ms. Wood Kingsley's family farm in the Willamette Valley); Wright Affidavit (note 187) (describing death of family dog from M-44 placed by Wildlife Services on neighbor's

Former agency trappers acknowledge that much of this non-target catch goes unreported.[231] Animal carcasses are "usually tossed behind a bush or into a ravine."[232] As one former program trapper characterized the status quo, "[t]he field guys do not report even a fraction of the non-target animals they catch."[233] The 2012 *Sacramento Bee* investigative series about the program documented 7,800 accidental killings of 85 non-target wildlife species from steel body-grip traps since 2006, reflecting an accuracy rate of only five percent.[234] Yet, even these details are only known today because *Sacramento Bee* reporter Tom Knudson conducted extensive investigative reporting, sent multiple FOIA requests, and interviewed experts, pet owners, and former agency employees.[235]

APHIS-Wildlife Services would claim that non-target mortalities are minimal. However, it is indisputable that large numbers of animals that were not the intended targets, including protected animals, are being harmed and killed – often painfully so – as a result of program activities, and that the agency does not even keep accurate data of these impacts.

Indeed, APHIS-Wildlife Services' own reported data is unreliable. It is incomplete and does not account for substantial numbers of unreported catch and/or non-target catch, nor does it account for animals that are injured or maimed from program activities.[236]

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property); *M-44s* (note 14) ("On that windy afternoon in Utah in 2006, Max joined the ranks of thousands of non-target animals – wild and domestic – that have been mistakenly killed by one of the most lethal tools in Wildlife Services' arsenal: spring-loaded metal cylinders that are baited with scent and fire sodium cyanide powder into the mouth of whatever tugs on them."); *id*. (noting that Ms. Aguiar's claim for $1,500 compensation from Wildlife Services for Max's death was rejected); *Efforts to Investigate* (note 14) (describing death of a family dog in Texas from M-44 cyanide trap: "It was a horrible thing. She had thrown up. You could tell it had been a horrible death. It was really, really heart-wrenching."). The *Sacramento Bee* reported that more than 1,100 dogs, including companion pets, have been killed since 2000, and M-44s have killed 250 dogs since 2006. Members of the petitioning organizations have had their companion animals harmed, maimed, and killed by traps set by APHIS-Wildlife Services, and/or avoid areas that they would otherwise frequent because of the risk to their companion pets.

[231] U.S. Fish and Wildlife Service, LAW ENFORCEMENT REPORT (Dec. 29, 2003) (describing illegal, unreported killing of a golden eagle in a steel-jaw leghold trap set by Wildlife Services in the Henry Mountains in Utah, and subsequent shooting); APHIS-Wildlife Services, MIS LEGACY REPORT (Mar. 4, 2005) (reporting neck snaring and killing of golden eagle on BLM lands in Lincoln County, Nevada in 2005); *Neck Snares* (note 14) (former Wildlife Services trapper Gary Strader stating that "The field guys do not report even a fraction of the non-target animals they catch.").

[232] *Neck Snares* (note 14) (quoting Dick Randall); *id*. (account of Wildlife Services manager stating: "We really don't have to tell anybody what we're doing."); *see also The Killing Agency* (note 14) (relating case in which federally-protected golden eagle was caught in a Wildlife Services strangling neck snare, and supervisor directed agency trapper to "go get a shovel and bury it and don't say nothing to anybody").

[233] *Neck Snares* (note 14) (quoting former agency trapper).

[234] *7,800 Animals Killed by Mistake* (note 14). FoxNews.com has also reported extensively on the program. *See* note 100.

[235] *Id*.

[236] *See supra* at 25 (discussing reports from former agency trappers of underreporting of non-target catch, including protected species).

There are, in addition, many aspects of the program for which the agency does not provide reported data at all – for instance, the agency does not specifically correlate its control actions with instances of injurious wildlife, the cooperators on whose behalf control actions were carried out, or the geographic areas where problems and control actions occurred. Nor does the agency maintain data about how many animals are injured but not necessarily killed – as portrayed by a former agency trapper Gary Strader:

> Some of the gunners are real good and kill coyotes every time. And other ones wound more than they kill. Who wants to see an animal get crippled and run around with its leg blown off? I saw that a lot.[237]

APHIS refuses to provide specific details about the cooperators on whose behalf the program kills so many animals.[238] It is unclear whether the agency even records such data.[239] It is likewise unknown whether it possesses all permits and licenses that are necessary to carry out Wildlife Services activities consistent with the ESA, BGEPA, MBTA, FIFRA, and other authorities. APHIS-Wildlife Services does not make such permits or any required records easily available to the public or even notify the public or interested persons of its intent to pursue such permits and licenses from FWS or EPA.

Members of Congress have made repeatedly demanded program transparency. Rep. Davis, D-San Diego, reintroduced H.R. 2074, the Transparency for Lethal Control Act, on May 21, 2013.[240] Ms. Davis' introductory remarks to the House of Representatives regarding H.R. 2074 called for APHIS-Wildlife Services to publish "clear and accessible information," and noted that the public and Congress "need to have the opportunity for vigorous oversight" and that "[t]his lack of transparency and public reporting makes oversight impossible," as "USDA could be acting inappropriately or recklessly and without this data, we can't know."[241]

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237 *Pandora's Box* (note 14).

238 *Critics* (note 14) (describing exchange during public meeting to address program critics, during which agency officials stated that it is official agency policy not to inform the public who its cooperators are or what they contribute to the program); *see also* WS Responses to American Society of Mammalogists (note 194) (noting that the program does not maintain information about the proportion of its expenditures go toward non-lethal versus lethal control methods, cooperator types (including public versus private cooperators), or updated information about the cost versus the benefits of its activities).

239 For instance, the agency stated that it cannot provide information about how much it spends on aerial gunning of coyotes and wolves. Katherine McGill, Wildlife Services Exterminates Over 4.1 Million Animals in 2009, *Examiner.com* (Oct. 12, 2010). The agency claims that it "does not have a managerial need" for basic facts. *Id*.; *see also* WS Responses to American Society of Mammalogists (note 194) (noting that the program does not know the proportion of its expenditures that go toward non-lethal versus lethal control methods, cooperator types (including public versus private cooperators), or updated information about the cost versus the benefits of its activities).

240 Transparency for Lethal Control Act, H.R. 2074, 113th Cong. (1st Sess. 2013).

241 Introducing Transparency for Lethal Control Act, H.R. 2074, 112th Congress (Aug. 2, 2012) (statement of Rep. Davis). In introducing the legislation, Congresswoman Davis also stated that that "efforts to gather adequate information regarding Wildlife Services operations have been difficult" and criticized Wildlife Services for not making detailed data regarding "where, why, how and which animals have been killed." *Id*.

Rep. Campbell has criticized APHIS for thwarting attempts to investigate Wildlife Services. Campbell stated, "[t]hey appear to be stonewalling every attempt by everybody to investigate why they're doing it."[242] And in advocating for its elimination, Congressman DeFazio remarked that it is "ineffective, indiscriminate, inhumane… [and] it's incredibly important that we bring the actions of this agency out of the shadows."[243]

Indeed, the absence of basic information about its activities stands in stark contrast with APHIS-Wildlife Services' avowed commitment to "openness and transparency" and to making information readily available to the public.[244] It is also inconsistent with FOIA and NEPA – laws that require APHIS-Wildlife Services to be transparent.

FOIA's "core purpose" is to allow the public to be informed about "what their government is up to."[245] FOIA requires every agency to proactively "make available for public inspection and copying" "statements of policy and interpretations" that are not published in the Federal Register, "administrative staff manuals and instructions to staff that affect members of the public[,]" and "copies of all records, regardless of form or format" as well as a "general index" of all records "which have been released to any person" that "have become or are likely to become the subject of subsequent requests for substantially the same records[.]"[246] "In no uncertain terms," President Obama directed federal agencies to "share information proactively on policies and decisions so that members of the public don't have to use the FOIA to obtain information held by their Government."[247] Agencies are to "use modern technology to inform

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[242] *Federal Agency Accused of Stonewalling* (note 100).

[243] *Id*.

[244] *See* Shea and Clay Memorandum (note 222) (characterizing President Obama's FOIA Memorandum as a "tall order" and stating that "we still have much work ahead of us" to reduce the "FOIA backlog" and "to operate in an exceedingly open, transparent, and accessible way for all the customers and stakeholders we serve"); APHIS-Wildlife Services, FOIA Reading Room [available at http://www.aphis.usda.gov/foia/foia_reading_room.shtml] (stating that under FOIA, APHIS must make available, among other records, "statements of policy and interpretations adopted by the agency").

[245] *Dep't of Justice v. Reporters Comm. for Freedom of the Press*, 489 U.S. 749, 772-73 (1989); *see also Dep't of Air Force v. Rose*, 425 U.S. 352, 361 (1976) (Congress enacted FOIA to "open agency action to the light of public scrutiny") (quotation omitted).

[246] 5 U.S.C. § 552(a)(2).

[247] President Obama directed all federal agencies to "take affirmative steps to make information public" without waiting for specific requests and to "use modern technology to inform citizens about what is known and done by their Government." *Presidential Memorandum for Heads of Executive Departments and Agencies Concerning the Freedom of Information Act*, 74 Fed. Reg. 4683 (Jan. 21, 2009); *accord* Attorney General Holder's Memorandum for Heads of Executive Departments and Agencies Concerning the Freedom of Information Act (Mar. 19, 2009) [hereinafter "Attorney General FOIA Guidelines"]. Additionally, federal agencies are to "exercise their discretion to make a broader range of records available beyond the minimum required by the statute." DOJ FOIA Reference Guide at 10 (citing 74 Fed. Reg. at 4683) stating that agencies should automatically disclose information about "what is known and done by … Government"); *see also* Attorney General FOIA Guidelines (calling for an increase in the systematic online posting of information in advance of FOIA requests); *id.*; (advising that making more information public is a "key area where agencies should strive for significant improvement").

citizens what is known and done by their Government."[248] Attorney General Eric Holder has explained that this means "agencies should readily and systematically post information online in advance of any public request" because "[p]roviding more information online reduces the need for individualized requests and may help reduce existing backlogs."[249]

FOIA's broad disclosure mandate also requires federal agencies to disclose agency records upon request unless they fall within one of the statute's nine, narrowly-construed exemptions.[250] The statutory time period for making a determination in response to a request for agency records submitted under FOIA is 20 days, which may only be extended in "unusual circumstances."[251] President Obama and Attorney General Eric Holder emphasize a policy of prompt disclosure in responding to FOIA requests.[252]

NEPA, one of the nation's preeminent environmental protection statutes, mandates federal transparency as well.[253] NEPA is a disclosure statute (in part). It requires all agencies, for every action that they propose to undertake that will significantly affect the quality of the human environment, to prepare a "detailed statement" on the environmental impact of the proposed action and its adverse and unavoidable environmental effects, in order to inform the public and decisionmakers about the environmental consequences of federal actions before it is too late to reverse those consequences.[254] In a 1993 report, the CEQ recommended that all federal agencies "[a]cknowledge the conservation of biodiversity as national policy and incorporate its consideration in the NEPA process."[255]

Additionally, the Data Quality Act was enacted in 2005 to "ensur[e] and maximize[e] the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies."[256] Guidelines issued by the Office of Management and Budget ("OMB")

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[248] *Id*.

[249] Attorney General FOIA Guidelines (note 247) at 3.

[250] *U.S. Dep't of the Interior v. Klamath Water Users Protective Ass'n*, 532 U.S. 1, 7 (2001)).

[251] 5 U.S.C. § 552(a)(6)(A); *id*. § 552(a)(6)(B)(i).

[252] *See Presidential Memorandum for Heads of Executive Departments and Agencies Concerning the Freedom of Information Act*, 74 Fed. Reg. 4683 (Jan. 21, 2009); *accord* Attorney General Holder's FOIA Guidelines (note 247); *see also FOIA Post*, "OIP Guidance: President Obama's FOIA Memorandum and Attorney General Holder's FOIA Guidelines Creating a New Era of Open Government" (posted Apr. 17, 2009).

[253] 42 U.S.C. § 4331(a) (declaring as the "continuing policy of the Federal Government" "to use practicable means and measures … to create and maintain conditions under which man and nature can exist in productive harmony.").

[254] 42 U.S.C. § 4332(C).

[255] CEQ, INCORPORATING BIODIVERSITY CONSIDERATIONS INTO ENVIRONMENTAL IMPACT ANALYSES UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT (Jan. 1993) at 23.

[256] Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554).

urge agencies to "issue guidelines" to meet these objectives.[257] OMB updated the guidelines on February 22, 2002 and March 4, 2002.[258] Pursuant to these guidelines, USDA has issued "information quality guidelines" that "apply to all types of information disseminated by USDA agencies and offices," specifying that these agencies and offices will set a "basic standard of quality" for information they disseminate and ensure the information meets this standard, and that such information will be accurate, reliable, unbiased, useful, and transparent.[259]

In contrast to these mandates, as explained above APHIS-Wildlife Services does not currently make available reliable, detailed information about its activities or programmatic environmental reviews, or disclose records promptly when requested under FOIA.[260] Therefore, when completing a substantive rulemaking pursuant to the APA, APHIS must promulgate binding rules to clarify the categories of information that it will making readily available to the public on its website. Moreover, it should clarify where such information will be provided to the public, such as on the agency's eLibrary website. Accordingly, Petitioners request that USDA and APHIS amend the FOIA implementing regulations at 7 C.F.R. Part 1 in order to maintain and routinely make available, on the agency's "eLibrary," the following categories of agency records:

1. All information regarding its practices and activities, including work plans and field reports;
2. Complete, accurate data regarding the numbers of animals killed, maimed, and injured on a periodic basis;
3. Data reflecting all affected animals, both wild and domestic, and all species and geographic areas where it conducts activities;
4. Complete monitoring information regarding all effects of its activities, including direct, secondary, and cumulative effects;
5. All environmental reviews and supporting documents (without redactions), including but not limited to work plans, environmental assessments,

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257 Office of Management and Budget, *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies* (Oct. 1, 2001).

258 66 Fed. Reg. 49,718 (Sep. 28, 2001); 67 Fed. Reg. 8452 (Feb. 22, 2002); 67 Fed. Reg. 9797 (Mar. 4, 2002). OMB also issued supplementary guidance that discussed important issues, identified noteworthy approaches for consideration, and provided guidance on those provisions that need to be adopted uniformly in all agency guidelines. Memorandum from John D. Graham for the President's Management Council, Agency Draft Information Quality Guidelines (June 10, 2002); Memorandum from John D. Graham for the President's Management Council, Agency Final Information Quality Guidelines (Sep. 5, 2002).

259 USDA, Office of the Chief Information Officer, Information Quality Activities, General Requirements [available at http://www.ocio.usda.gov/policy-directives-records-forms/information-quality-activities].

260 *See*, *e.g.*, USDA, Office of the Chief Information Officer, *Chief Freedom of Information Act (FOIA) Officer Report* (Mar. 2012) (Revision 1.5).

environmental impact statements, biological opinions, biological assessments, letters of concurrence, conference reports, incidental take statements and/or permits, and underlying documents;

6. Specific information that disclose the identities and affiliations of the cooperators on whose behalf APHIS-Wildlife Services carries out control actions; and

7. Correlations of the above with identified wildlife problems in specific areas and cooperator funding arrangements in response to such problems.

Proactively making such information available for public inspection on the agency's website is the most effective way to bring agency practice in line with its purported commitment to transparency, national policy, FOIA's disclosure mandate, and the Data Quality Act.[261] It is impossible for the program to demonstrate – and therefore, for the American people to be assured – that APHIS Wildlife Services is fully complying with the law without specific information being available that identifies wildlife problems and the efforts that were made to solve those problems without lethal methods. Indeed, the public simply cannot assess the program's efforts to employ non-lethal methods without greater transparency. Binding regulations could also work to ensure that APHIS-Wildlife Services' is consistent with congressional calls for greater transparency.

2. Rules Should Phase Out Lethal Control, Restore Predators to Ecosystems, and Set Substantive and Procedural Criteria for Determinations of Injurious Wildlife Problems for Which an APHIS-Wildlife Services Response May be Warranted.

As observed in the Leopold Report nearly 50 years ago:

> Particularly when professional hunters are employed, control tends to become an end in itself, and following Parkinson's law, the machinery for its accomplishment can easily proliferate beyond real need.[262]

The 1979 DOI Policy recommended long-term "phase out" of "the use of lethal preventative controls." But a quarter-century later, APHIS-Wildlife Services still routinely engages in "preventative" (prophylactic) predator control, and does not limit its activities to situations in which, *e.g.*, "substantial calf losses are established on a basis of irrefutable evidence."[263] For example, the program does not justify killing the approximately 75,000 coyotes that it kills every year – often prophylactically, prior to lambing season, and before any damage has been verified.

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[261] *See* Shea & Clay Memorandum (note 222).

[262] Leopold report (note 40) at 2.

[263] *Id*. at 8; *see also* 1979 DOI Policy (note 78) at 2 (setting near-term goal of limiting "preventative control" to "specific situations where unacceptably high levels of losses have been documented during the preceding 12 months").

The program refuses to phase out – or even meaningfully limit – its prophylactic lethal control, despite decades of criticism of this practice.

Accordingly, Petitioners seek promulgation of regulations that would finally bring an end to lethal control, and in particular prophylactic lethal control. Additionally, all lethal control should be phased out in all but the rarest of circumstances involving serious, verified, and documented injurious wildlife problems. Moreover, promulgation of regulations should involve a delineation – based on public comment and the best and most reliable data and information – of the narrow circumstances in which a lethal method by APHIS-Wildlife Services may be considered to be acceptable, and in such narrow circumstances, the procedures by which APHIS-Wildlife Services must verify and document the presence of such circumstances as well as the specific methods that may be utilized.

Moreover, such a rulemaking should conclude that any permission to graze livestock on public lands shall not be subsidized by lethal predator control by APHIS-Wildlife Services, *e.g.*, through lethal control; rather, the risk of livestock losses to predators should be borne by the livestock producer(s) who use public lands and resources.[264] Furthermore, such rules should clarify that no control method – for example, leg-hold traps, which catch only an estimated *five percent of the intended targets* – should be deemed acceptable if it "results in the advertent death of a great number of animals during the process of killing a few that are causing damage."[265]

Finally, whatever methods it does employ, APHIS-Wildlife Services should have a regulatory scheme which requires it to carry out its activities in a fully transparent manner, based on reliable information, in response to specific, local situations involving injurious animals that have been verified and documented based on irrefutable evidence; and/or where necessary in order to minimize the adverse effects of invasive animals or plants to endangered and threatened species. Such rules should set a standardized, rigorous, and complete process for verifying and documenting specific injurious wildlife problems and the use of non-lethal methods to address them, and should clarify the procedures by which such records of such problems shall routinely be made available to the public at large and to Congress. And as explained above, the rules identify and phase out specific lethal control methods that are known to be ineffective and non-selective. Moreover, such rules should extend to all control activities that are carried out by the program.

Such rules may codify APHIS-Wildlife Services' "management philosophy" – *i.e.*, to "control" "injurious wildlife" only after "careful assessments" of an identified problem, as well as its

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[264] *See Long Struggles* (note 14). A growing body of science has found the agency's war against predators, waged to protect livestock and big game, is altering ecosystems in ways that diminish biodiversity, degrade habitat and invite disease.").

[265] *See id.* (investigative journalism reporting that out of 80,800 animals captured in leg-hold traps between 2006 and 2011, only five percent (4,300 animals) were the intended targets); Leopold report (note 40) at 9 ("No method is acceptable if it results in the inadvertent death of a great number of animals during the process of killing a few that are causing damage.").

resolution, in accordance with "biologically sound, environmentally safe, scientifically valid, and socially acceptable" methods that are designed to minimize risks to humans, wildlife, non-target animals, and the environment.[266]

Although there is now plenty of evidence, generated over the course of many decades, that illustrates beyond any doubt the ineffectiveness of many of the program's existing, commonly-utilized lethal control methods and warrants immediate cessation of their use – or at a minimum, immediate cessation of their general use over large areas – a rulemaking with an opportunity for public comment will allow interested members of the public at large (including Petitioners) and/or experts in the fields of academia, science, and law to advise the agency about how to effectively achieve these important objectives. Indeed, as shown by the Marin County, California example, there are viable non-lethal and alternative measures that can be implemented, thereby eliminating altogether or substantially reducing any need both to kill, injure, or maim any wildlife, including protected animals and domestic pets, and put species, animals, pets, and humans at risk.[267]

3. Rules Must Set Professional, Ethical Standards for the Humane Treatment of Animals, and a Clear, Consistent Disciplinary Process for Violations of Such Rules by Program Personnel.

As reflected by state and federal laws, prevailing social attitudes in the United States value the humane treatment of animals. Forty-seven states now have felony laws that prohibit animal cruelty.[268] Several federal laws seek to protect animals from inhumane treatment or cruelty as well. The Animal Welfare Act, 7 U.S.C. §§ 2131-2159, reflects the national policy objective of furthering the humane treatment of animals.[269] The Humane Slaughter Act, 7 U.S.C. §§ 1901-1907, seeks to further the humane treatment of animals in slaughterhouses and the prevention of their "needless suffering."[270] FWS regulations require the humane treatment of all wildlife that

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[266] APHIS-Wildlife Services Policy Directive 1.201 (note 205); *see also* Leopold report (note 40) at 24:

> … the justification for each local control program should be documented far better than at present, and such proof of need should be available when requested by the Advisory Board or the Secretary. The mere appeal for additional control by local groups of ranchers or the offer to help pay for a control program by a county or state is not of itself deemed justification that the program should be undertaken. As a form of justification, narrative descriptions of damage should be supplemented with quantitative statistics on the true extent of damage.

[267] *Supra* at 21-22 (discussing Marin County program); *see also supra* at 30 (discussion of nonlethal methods).

[268] HSUS, *Animal Cruelty Facts and Statistics: Statistics on the victims and current legislative trends* [available at http://www humanesociety.org/issues/abuse_neglect/facts/animal_cruelty_facts_statistics html] (the exceptions are Idaho, North Dakota, and South Dakota). Reflecting changing times and the progression of American values, 42 of the 47 states with felony animal cruelty laws have enacted their laws within the last three decades. *Id*.

[269] *Id*. § 2131.

[270] *Id*. § 1901.

is protected under the ESA, MBTA, and/or BGEPA.[271] APHIS-Wildlife Services' policy directives recognize the need for consistency with these laws and policies.[272] The agency has long promised to adapt its practices to changing societal attitudes about animal treatment.[273]

Nevertheless, many observe a "culture of animal cruelty" that persists at APHIS-Wildlife Service.[274] Despite demurrals by USDA and APHIS, stories steadily emerge about an agency that does not fire or discipline personnel – or even take much if any action at all – when they commit cruel acts against animals or break the law. Jamie Olson, the Wildlife Services employee who posted photographs on his Facebook page depicting his dogs attacking and killing coyotes in leg-hold traps, and who left his traps unchecked for up to 69 days, has not been fired or even disciplined.[275] Instead of disciplining Mr. Olson, APHIS-Wildlife Services has chosen to supplant a policy directive on the use of dogs and create an entirely-new directive that, among other things, prohibits Wildlife Services personnel from "post[ing] or shar[ing] photographs taken or documents developed, during the course of their or their colleagues' official duty" – *e.g.*, on Facebook – unless first cleared "through official channels."[276] Russell Files, the trapper who deliberately trapped a neighbor's dog, was not disciplined. Neither was Kyle Traweek, another trapper who deliberately trapped a neighbor's dog. Nor was the agency employee who killed a Mexican wolf in January 2013. A former agency trapper has indicated that these incidents are not unusual or isolated; indeed, there are many examples of professional program hunters and trappers committing similar acts of animal cruelty or illegal behavior.[277]

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271 50 C.F.R. § 13.41 ("Any live wildlife possessed under a [ESA, MBTA, or BGEPA] permit must be maintained under humane and healthful conditions.").

272 *See* APHIS-Wildlife Services Policy Directive 2.210 (note 214) (requiring agency personnel to comply with all Federal and state laws); *see also*, *e.g.*, USDA, APHIS-Wildlife Services Policy Directive 2.445, USE OF TRAINED DOGS IN WILDLIFE SERVICES (WS) ACTIVITIES (July 2, 2013) ("WS personnel shall not allow their trained dogs to have physical contact or in any way attack, bite, or kill animals that are restrained in a trap or any other device."); APHIS-Wildlife Services Policy Directive 1.301 (note 122) (requiring all program personnel to "show exceptionally high levels of respect for people, property and wildlife" and to "strive to use the most selective and humane methods available, with preference given to nonlethal methods when practical and effective").

273 *See*, *e.g.*, Feldman (2007) (note 30) (describing "spring cleaning" of the agency which occurred during the 1970s, in part in response to public criticism over its treatment of animals); 1997 Programmatic FEIS (note 5) at Summary 8 (promising to use nonlethal methods "whenever practical").

274 *Supra* at 34.

275 *Id*.

276 APHIS-Wildlife Services Policy Directive 4.104, USE OF NEW MEDIA BY PERSONNEL (June 20, 2013).

277 *See* Utah Division of Wildlife Resources, INITIAL REPORT OF INVESTIGATION (Dec. 2, 2003) (reporting 2003 discovery of trapping and shooting by APHIS-Wildlife Services trapper of a golden eagle caught in APHIS-Wildlife Services' leg-hold trap in Utah, and of decomposing carcasses of red fox and coyote trapped nearby); *supra* note 230 (describing instances of dogs becoming caught in APHIS-Wildlife Services traps and being injured or killed); *see also Torture, Abuse a Regular Practice* (note 100) (former trapper describing situation when he and supervisor found nine coyotes caught in leg hold snares and, "[a]s was routine" he "signaled his dogs to attack" while his supervisor "watched and laughed as the dogs circled the coyotes and ripped into them"); *id*. (quoting former trapper as stating that "[t]hat was regular practice").

To be sure, the program's preferred methods (*e.g.*, snares, leghold traps, and poisons) inherently cause tremendous pain and suffering. This is made much worse because the agency does not require (but merely recommends) that agency personnel check their traps frequently, much less enforce their failure to do so. And, as former agency trappers have revealed and as made evident by the Olson Investigation, "traps … are not checked for literally months at a time" as animals are "left to die of starvation, thirst, heat, stress, and exposure."[278] While most Americans would be appalled by such atrocities, such accounts paint the picture of an agency that excuses such acts, and in so doing, condones the inhumane treatment of animals.[279]

The culture of animal cruelty at APHIS-Wildlife Services hangs like a dark cloud over American society, and runs counter to values and the policies that support laws to protect animals. A rulemaking must, at long last, correct this problem and bring APHIS-Wildlife Services into compliance with all relevant national policies, federal laws, its own policies, and prevailing societal values. If APHIS-Wildlife Services cannot show itself to be humane, then it cannot (and need not) continue at all.[280]

Therefore, in conducting a rulemaking, USDA and APHIS must "completely reassess its function and purpose in the light of changing public attitudes toward wildlife," as the Leopold Report recommended decades ago.[281] Petitioners request promulgation of regulations that strictly prohibit acts such as those committed by Mr. Olson, Mr. Files, Mr. Traweek, and others, set forth legal and ethical standards for the treatment of animals by agency personnel, and set forth a clear and consistent process for ensuring that employees who violate such prohibitions are subjected to a disciplinary process and terminated. In addition, Petitioners seek rules that

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278 *Long Struggles* (note 14) (quoting former agency trapper); *see id*. (quoting former agency trapper) ("Remember, these animals have fur coats on. They exert themselves trying to get out. They over-stress with the heat and keel over and die. *Most coyotes die this way*, and when the trapper gets there, all that is left is a bunch of hair, bones and maggots. I've seen it hundreds of times and it always bothered me. It has to be a horrendous and torturous way to die.") (emphasis added); *see also Pandora's Box* (note 14) (noting that animals often rot away before they are found by agency hunters). Although APHIS-Wildlife Services would assert that it complies with state laws that regulate trapping, as Mr. Strader's direct experience shows, this is clearly not the case. No state trapping laws allow traps to be left unchecked for longer than a few days.

279 *Torture, Abuse a Regular Practice* (note 100).

280 The ADCA provides authority for a wildlife services program, but does not mandate its existence. *See* 7 U.S.C. § 426 ("The Secretary of Agriculture *may* conduct a program of wildlife services") (emphasis added).

281 Leopold report (note 40) at 23.

> There persists a traditional point of view that the [animal control program] is responsible primarily to livestock and agricultural interests, and that the growing interest of the general public in all wild animal life, including predators, is a potential obstruction to the progressive control program and is to be evaded and circumvented wherever possible.
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> …
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> In point of fact, the segment of the public interested in husbandry and wise use of all animal resources represents a substantial majority and can no longer be suppressed. Even in farming and ranching communities there is a growing reaction against unwarranted killing of animals not actually creating a problem.

provide a transparent process for program selection of control methods, with opportunities for the public to participate, as well as the development of method selection criteria that would bar the use of methods that – by design or in practice – are either known to or may cause pain or suffering to wildlife, companion animals, or members of the public.

4. Rules Must Ensure that APHIS-Wildlife Services is in Strict Compliance with All Legal Authorities and Policies Which Protect Wildlife and the Public

APHIS is required to comply with procedural and substantive requirements of many federal laws in administering the Wildlife Services program, including the ESA, BGEPA, MBTA, FIFRA, and NEPA, as well as the Fish and Wildlife Act, 16 U.S.C. § 742j-l ("FWA"). APHIS-Wildlife Services policy directives require compliance with these laws.[282]

The ESA, BGEPA, and MBTA impose strict permitting requirements to conserve and protect certain species.[283] These laws make it unlawful for any person to "take," "depredate," or commit other detrimental acts against protected animals or species without a permit from the FWS, applying specific regulatory criteria, terms and conditions, and record-keeping and monitoring requirements to permittees.[284] FIFRA imposes conditions on the use of registered pesticides such as M-44s.[285] NEPA requires APHIS-Wildlife Services to take a hard look at the consequences of its actions; publicly disclose what it is doing; allow the public to participate and to inform USDA and APHIS decisionmaking regarding the program; and ensure that program choices are based on current law, knowledge, and societal values.[286] The FWA imposes a permit requirement for aerial gunning to help ensure public safety and provides enforcement authority to FWS.[287] In so doing, the ESA, BGEPA, MBTA, FIFRA, NEPA, and FWA further a national policy of transparency, wildlife protection and conservation, the humane treatment of animals, and protection of the public health and welfare.[288]

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[282] APHIS-Wildlife Services Policy Directive 1.210 (note 214).

[283] 16 U.S.C. § 1538(a)(1)(B) (ESA take prohibition); *id*. § 668a (prohibiting take of protected bald or golden eagles without permit from the Secretary of Interior); *id*. § 703 (prohibiting take of protected migratory birds); *id*. § 704 (setting forth circumstances when migratory birds may be taken, killed, or possessed).

[284] *See generally id*.; *see also* 50 C.F.R. Part 13 (general permit requirements); *id*. Part 17 (imposing permitting and conditions for take of endangered and threatened species); *id*. Part 20 (permitting and reporting requirements for BGEPA take permits); *id*. Parts 20 and 21 (general management regulations and MBTA control order for Canada geese); *id*. §§ 21.43, 21.44 and 21.48 (MBTA depredation orders).

[285] *Id.* § 136(j)(a)(2)(F).

[286] 42 U.S.C. § 4321; 40 C.F.R. Parts 1508-1525 (CEQ regulations).

[287] 16 U.S.C. § 742j-l .

[288] *See* 16 U.S.C. § 1531(a)(1) (ESA declaring as the "policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act"); *id*. § 668a (controlling the take, possession, and transportation of bald and golden eagles); *id*. § 703 (prohibiting take of protected migratory birds). In addition, NEPA declares as the "continuing policy of

In the regular course, however, APHIS-Wildlife Services takes and/or depredates – *i.e.*, it kills, harms, and harasses – animals that are protected under the ESA, BGEPA, and MBTA, including: gray wolves, Mexican gray wolves, and red wolves; grizzly bears; black-footed ferrets; Hawaiian ducks; Hawaiian geese; swift foxes and San Joaquin kit foxes; bald and golden eagles; and scores of protected migratory birds.[289] Yet, APHIS-Wildlife Services cannot demonstrate that it has all of the necessary authorizations to conduct its control actions consistent with these laws.

a. Endangered Species Act

Petitioners seek substantive rules that specify the substantive conservation measures and the procedures by which APHIS-Wildlife Services will strictly satisfy its obligations under the Endangered Species Act.

ESA section 9 prohibits the unauthorized "take" of listed animals, which means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.[290] ESA section 7(a)(1) requires all federal agencies to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species … ."[291] ESA section 7(a)(2) requires all federal agencies to "insure that any action" that they authorize, fund, or carry out "is not likely to jeopardize" any listed species.[292]

The only way that APHIS can satisfy these mandatory duties is through strict compliance with the procedural requirements set forth in the ESA's implementing regulations at 50 C.F.R. Part 402.[293] These procedures require strict adherence to permitting requirements for all "take" and consideration of all relevant factors and the effects of its actions, based on the best scientific information, to endangered and threatened species, including both "direct" and "indirect" effects as well as "cumulative" effects.[294] This can only be achieved through consultation with FWS and reinitiation of consultation when new species become listed, circumstances change, or new information about the agency's impacts comes to light.[295]

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the Federal Government" "to use practicable means and measures … to create and maintain conditions under which man and nature can exist in productive harmony." 42 U.S.C. § 4331(a).

[289] GAO (1990) (note 89).

[290] 16 U.S.C. §§ 1532(19) and 1638(a)(1)(B).

[291] *Id*. § 1536(a)(1).

[292] *Id*. § 1536(a)(2).

[293] *Id*. § 1536(c), (d); 50 C.F.R. Part 402 (ESA consultation procedures).

[294] 50 C.F.R. Part 402.

[295] 50 C.F.R. §§ 402.24 and 402.16.

APHIS-Wildlife Services routinely engages in activities that adversely affect the survival and recovery of endangered and threatened species. For example, APHIS-Wildlife Services engages in the "control" of critically-endangered Mexican gray wolves in the American Southwest at the behest the livestock industry.[296] The Mexican wolf is one of the rarest land mammals on Earth, and its population size remains well below 100 animals – about 75 wolves at the last census count – with 100 wolves considered to be the bare minimum population size for survival.[297] Indeed, Mexican wolves already occur in numbers that are too low to be viable and too low relative to elk, their primary prey. The loss of even one Mexican wolf is detrimental to the species' survival.[298]

The primary reasons for the Mexican wolf's suppressed numbers are shootings and capture – including shootings and trappings by APHIS-Wildlife Services. Over the years APHIS-Wildlife Services has shot and killed 12 Mexican wolves, caused the accidental deaths of 18 wolves, and captured and removed many more dozens of Mexican wolves from the wild.[299] This year, a FWS investigation concluded that an APHIS-Wildlife Services' employee shot and killed a critically-endangered Mexican wolf on January 19, 2013.[300] Like many prior Mexican wolf killings committed by APHIS-Wildlife Services, the killing of this wolf was inadvertent – *i.e.*, it was not done because the wolf was "injurious" – and, hence, the killing of this wolf is out of compliance with any "take" coverage under ESA section 9.[301] Moreover, by taking Mexican

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[296] The *Arizona Republic* recently called for a reexamination of the issuance of granting grazing leases for public lands, citing the "entitlement attitude" of public lands ranchers that "should not be allowed to doom wolf-recovery efforts." *See* Arizona Republic, *Give Wolves a Chance: Ranchers' entitlement hurting population* (June 4, 2013). The Mexican wolf has been listed as endangered since 1978. In a recent proposed rule to reclassify its listing status under the ESA, FWS reiterated the dire status of the Mexican wolf. 78 Fed. Reg. 35,719 (June 13, 2013).

[297] FWS, MEXICAN GRAY WOLF RECOVERY PLAN (1982) at 23, 28. The most recent FWS population count for the Mexican wolves in the wild is 75, including only three breeding pairs. The 1996 FEIS for Mexican wolf reintroduction predicted that by 2006, the population would grow to 102 animals and include 18 breeding pairs. FWS, REINTRODUCTION OF THE MEXICAN WOLF WITHIN ITS HISTORIC RANGE IN THE UNITED STATES, FINAL ENVIRONMENTAL IMPACT STATEMENT (1996) at 2-8, table 2-2. Scientists recommend a recovery target of a minimum of 750 Mexican wolves in 3 interconnected populations. FWS, MEXICAN WOLF CONSERVATION ASSESSMENT (2010) [hereinafter "MEXICAN WOLF CONSERVATION ASSESSMENT"] at 78.

[298] Ripple and Beschta (2011) (note 148); *See* MEXICAN WOLF CONSERVATION ASSESSMENT (note 297) at 61; *see also* 1997 Programmatic FEIS (note 5) at 4-17 ("As defined by the Act an impact to even one individual of the species could constitute an unacceptable impact.")

[299] *See* Data Compilation (note 3) (totaling 10 Mexican wolf deaths directly caused by APHIS-Wildlife Services since 1996).

[300] *See One Mexican Wolf Killed; Two Pairs Transferred for Release into the Wild* (note 226); *see also* FWS Press Release (note 226) (confirming canine mortality in New Mexico in January 2013 was a Mexican wolf).

[301] *Blake* (2013) (note 226); *see also* REPORT OF INVESTIGATION (note 225) at 62 (biological opinion terms and conditions requiring that "WS personnel who conduct … Program activities in occupied wolf range shall be knowledgeable at a professional level in identification of Mexican wolf").

wolves, APHIS-Wildlife Services prevents healthy populations from re-establishing in ecosystems where they are sorely needed.

The Mexican wolf is just one example of many. According to APHIS-Wildlife Services' own data, the program has killed hundreds of protected species since 1996, including 340 swift foxes,[302] 17 grizzly bears, four Louisiana black bears, and five pearly-eyed thrashers.[303]

The program also uses a variety of methods – including "pyrotechnics" such as shell crackers, bombs, firecrackers, rockets, and Roman candles – to "disperse" thousands of endangered Hawaiian ducks, Hawaiian geese, Hawaiian coots, Hawaiian hawks, Newell's shearwaters, Hawaiian stilts, pearly-eyed thrashers, and wood storks every year.[304] In addition, the program has dispersed 19 Louisiana black bears.[305] While dispersing these species may not necessarily (immediately) kill them, such acts are still a "take" under the ESA; the ESA's definition of "take" is broadly defined to include the harassment or harm of endangered and threatened species, and since "dispersing" these bears is a form of harm and/or harassment, it constitutes a take of these threatened animals as well.[306]

It bears noting that these totals are from program data reports, which are not reliable in light of a substantial number of killings that are not reported, a clear disincentive not to report killings of legally-protected species, and a lack of any information about other forms of take (*e.g.*, injuries

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[302] APHIS-Wildlife Services kills about 25 swift foxes annually. *See* Data Compilation (note 3). APHIS-Wildlife Services is likely under the misimpression that swift foxes are not protected under the ESA, but this is in error. The swift fox has been federally protected since 1970, when it was listed throughout its range and therefore was legislatively placed on the endangered list in 1973 upon enactment of the ESA. In 1980, FWS published a notice saying that the 1970 listing for the northern swift fox and six other species (including jaguar, thick-billed parrot, wood bison, margay, short-tailed albatross) violated state-notice requirements of the 1969 Endangered Species Conservation Act and thus was invalid. 45 Fed. Reg. 49,844 (July 25, 1980). Based on this legal opinion, and without going through the ESA delisting process, FWS summarily declared that the species were henceforth not to be considered as listed in the United States. In 2009, however, FWS issued a legal opinion that confirms that the northern swift fox (and many similarly-situated species) "is currently protected in its entirety and is not listed as a distinct population segment under the Act." 74 Fed. Reg. 33,957 (July 14, 2009).

[303] Data Compilation (note 3).

[304] 1997 Programmatic BiOp (note 88) at 3 (stating that dispersals involve the use of pyrotechnics); *see also* Data Compilation (note 3).

[305] Data Compilation (note 3).

[306] 16 U.S.C. § 1532(19). The ESA's definition of "harm" includes "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." 50 C.F.R. § 17.3. The term "harass" means "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." *Id.* The ESA's legislative history supports "the broadest possible" reading of "take." *Babbitt v. Sweet Home Chapter of Cmtys. for a Great Oregon*, 515 U.S. 687, 704-05 (1995). "Take" includes direct as well as indirect harm and need not be purposeful. *Id.* at 704. FWS has promulgated a regulation which prohibits the unlawful take of threatened species. 50 C.F.R. § 17.31.

or maimings) that result from attempts to kill or disperse protected wildlife.[307] Whatever the true numbers may be, many endangered and threatened species that are killed or harmed by APHIS-Wildlife Services can ill afford to lose even a few individuals and meet recovery objectives, as the take of even a minimal number of individuals can jettison their survival.[308]

Direct killings and animal dispersals are not the only ways in which APHIS-Wildlife Services takes listed species; APHIS-Wildlife Services also does so through its "indirect effects."[309] For example, the 1997 Programmatic BiOp acknowledges that northern aplomado falcons can be indirectly affected by APHIS-Wildlife Services' reduction in the "the number of available blackbirds … through the use of avicides and rodenticides."[310] In Fiscal Year 2012, the program eliminated 359 Brewer's and 145 red-winged blackbirds in New Mexico, where the falcon occurs.[311] This reduces the number of animals on which the aplamado falcon depends in order to survive and recover from the threat of extinction.[312] All told, the program reports that it has killed over 45,000 Brewer's blackbirds and 3.7 million red-winged blackbirds since 1996.[313]

As a related matter, it is estimated that only 10 percent of the bodies of poisoned animals are ever recovered, and the other 90 percent are left to enter the ecosystem as food for other animals, leading to the "secondary poisoning of thousands of innocent companion animals and unoffending wildlife, including threatened and endangered species."[314] Consequently, it is reasonable to conclude that even the reported figures regarding take of Brewer's and red-winged blackbirds, for example, represent only a small fraction of the total animals affected and cannot account for the secondary effects of poisoning, including (possibly) to other protected species.

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[307] For example, a grizzly bear carcass was discovered southwest of Helmville, Montana in August 1998. The bear had evidently been poisoned many months prior by a cyanide gun that had been set for coyotes by Wildlife Services. *See* Preliminary overview of grizzly bear management and mortality 1998-2005. Montana Fish, Wildlife and Parks. LIVING WITH PREDATORS PROJECT WORKING PAPER 0004 at 29.

[308] 1997 Programmatic FEIS (note 5) at 4-17 ("As defined by the Act an impact to even one individual of the species could constitute an unacceptable impact.").

[309] *See* 50 C.F.R. § 402.02 (an action's "indirect effects" are "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur")..

[310] 1997 Programmatic BiOp (note 88) at 38.

[311] APHIS-Wildlife Services, TABLE G: ANIMALS TAKEN BY COMPONENT/METHOD TYPE AND FATE BY WILDLIFE SERVICES – FY 2012 (Sep. 30, 2012).

[312] Another example is the black-footed ferret. The 1997 Programmatic BiOp states that program activities can adversely affect black-footed ferrets by using gas cartridges and other toxic chemicals and leg-hold traps to kill prairie dogs – specifically, black-tailed or white-tailed prairie dogs – which are the primary prey base of the black-footed ferret, and that this will adversely impact the ferret's survival and recovery. 1997 Programmatic BiOp (note 88) at 14.

[313] Data Compilation (note 3).

[314] Fox, *Huff Post* (note 139).

Thus, APHIS-Wildlife Services' reported numbers do not reflect actual take given the inability of agency personnel to recover all poisoned animals.

APHIS-Wildlife Services would likely claim that it routinely consults with FWS under the ESA to consider the effects of its activities to listed species, but it cannot establish that this is in fact the case. Section 7(a)(2) consultation with FWS over the programmatic effect of APHIS-Wildlife Services activities to listed species last occurred in 1997, about 16 years ago.[315] At that time, a programmatic biological opinion (the 1997 Programmatic BiOp) concluded that program activities adversely affect many endangered and threatened species, including the Utah prairie dog, northern aplamado falcon, whooping crane, desert tortoise, blunt-nosed leopard lizard, eastern indigo snake, and San Francisco garter snake.[316] For these species, the 1997 BiOp includes an "incidental take statement" ("ITS") with mandatory terms and conditions.[317] However, there are substantial gaps in information about: the agency's activities; unreported killings, injuries, and maimings; non-target catch; secondary (indirect) and cumulative effects; and the effects from harassing activities such as dispersals. Hence, there is simply no documentation that could demonstrate that APHIS-Wildlife Services is in strict compliance with these conditions or the ESA.[318]

Additionally, the 1997 Programmatic BiOp concluded that APHIS-Wildlife Services activities are likely to *jeopardize* the continued existence of six endangered and threatened species that are protected under the ESA, including the black-footed ferret, San Joaquin kit fox, Attwater's prairie chicken, Mississippi sandhill crane, California condor, and Wyoming toad.[319] Considering the ITS terms and conditions that are set forth in the 1997 Programmatic BiOp and in light of the agency's lack of transparency, APHIS-Wildlife Services simply cannot establish that it is in compliance with its mandatory "reasonable and prudent alternatives."

The agency's activities are also contributing to the need to list species under the ESA. For example, FWS proposed to list the American wolverine as threatened in February 2013 in accordance with an historic settlement agreement reached between the Center for Biological Diversity and FWS in 2011.[320] In the preamble to the proposed rule to list the wolverine as threatened, FWS noted that APHIS-Wildlife Services trapped and killed a wolverine in Montana in 2010.[321] According to FWS, this was "possibly locally significant for wolverines in [this]

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[315] 1997 Programmatic BiOp (note 88).

[316] *Id*.

[317] *Id*.

[318] 50 C.F.R. § 402.16.

[319] *Id*.

[320] 78 Fed. Reg. 7864 (Feb. 4, 2013) (proposed rule to list the wolverine as threatened species); *see also* Center for Biological Diversity, Saving the American Wolverine [available at: http://www.biologicaldiversity.org/species/mammals/American_wolverine].

[321] *Id*. at 7881.

area" because it occurred near a population that occurs in a small, isolated mountain range.[322] Also in 2010, Wildlife Services shot another wolverine that had been caught in a leg-hold trap in Idaho in 2010.[323] Nonetheless, the agency has failed to confer with FWS to consider the impacts of APHIS-Wildlife Services' activities to the wolverine.[324]

In addition to the wolverine, the fisher is declining toward extinction due in part to trapping, including by APHIS-Wildlife Services.[325] Fisher populations are particularly sensitive to the effects of trapping because of their life-history traits, including slow reproductive rate, the sensitivity of population numbers to prey fluctuations, and the strong influence of adult survival on fisher life history.[326] Removing adults from populations even by light levels of trapping can cause local extirpation, and biologists suspect that incidental trapping mortality is limiting fisher recovery in Idaho.[327]

In Fiscal Year 2010 alone, for example, APHIS-Wildlife Services reported killing five fishers and freeing 18 unintentionally-caught fishers.[328] Fishers are difficult to remove from traps when found still alive, and suffer broken bones, hemorrhage, self-mutilation, and predation as consequences of capture; the estimated survival rate for incidentally-captured fishers after release is as low as 50 percent.[329] Thus, in addition to the five fishers that are reported to have been intentionally killed by APHIS-Wildlife Services in Fiscal Year 2010, at least another nine

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[322] *Id*.

[323] WT Detail Page (note 32). Incidentally, only one of these wolverine deaths – the killing in Idaho – was reported in the program data for Fiscal Year 2010. *See* U.S. Department of Agriculture, APHIS-Wildlife Services, Table G: Animals Taken by Wildlife Services - FY 2011 (Sep. 30, 2010) [hereinafter "FY 2010 Program Data"].

[324] 16 U.S.C. § 1536(d) (requiring federal agencies to confer to consider the impacts of federal activities to species that are proposed for listing).

[325] Fishers are classified as furbearers under state codes in both Idaho and Montana. In addition to trapping by individual permit holders, however, fishers are also caught in traps set by APHIS-Wildlife Services.

[326] Powell, R. A. & W. J. Zielinski, 1994, *The Fisher*, *in* THE SCIENTIFIC BASIS FOR CONSERVING FOREST CARNIVORES: AMERICAN MARTEN, FISHER. LYNX, AND WOLVERINE IN THE WESTERN UNITED STATES: GENERAL TECHNICAL REPORT RM-254) 38-73 (1994); Buskirk, S.W., Bowman, J. & Gilbert, J.H., *Population Biology and Matrix Demographic Modeling of American Martens and Fishers*, *in* BIOLOGICAL AND CONSERVATION OF MARTENS, SABLES, AND FISHERS: A NEW SYNTHESIS (2012).

[327] Powell, R.A., 1979, Fishers, population models and trapping. *Wildlife Society Bulletin*, v. 7, p. 149; Powell, R.A., THE FISHER: LIFE HISTORY. ECOLOGY AND BEHAVIOR (1982); Jones, J.L., 1991, Habitat use of fishers in north-central Idaho, *M.S Thesis, University of Idaho. Moscow*; Heinemeyer, K.S., 1993, Temporal dynamics in the movements, habitat use, activity, and spacing of reintroduced fishers in northwestern Montana, *M.S. Thesis, Univ. of Montana, Missoula*; Idaho Department of Fish and Game, THE FISHER (*MARTES PENNANTI*) IN IDAHO: HABITAT CONSERVATION ASSESSMENT (HCA) (Feb. 15, 1995).

[328] FY 2010 Program Data (note 323).

[329] Lewis, J.C. & Zielinski, W.J., 1996. Historical harvest and incidental capture of fishers in California. *Northwest Science*, v. 70(4), p. 291..

were likely also killed but not recorded. APHIS-Wildlife Service's killing and injuring of fishers threatens the population of fishers in the northern Rocky Mountains and is one of the reasons that the fisher now warrants protection under the ESA.[330]

For the foregoing reasons, Petitioners seek substantive rules that specify the substantive conservation measures and the procedures by which APHIS-Wildlife Services' activities will not result in the unlawful take any protected species, by which the program will satisfy its affirmative duty to utilize any Wildlife Services program in furtherance of the conservation of endangered and threatened species, and by which it will satisfy its affirmative duty to ensure that the program is not likely to jeopardize the continued existence of such species. 16 U.S.C. §§ 1536(a)(1), 1536(a)(2) & 1538(a)(1)(B). In addition, such rulemaking should set forth the reasonable and prudent measures and the procedures that the program will apply in order to prevent the decline of, and the need to list as endangered or threatened, any species.

b. Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act

Petitioners seek promulgation of regulations to specify the substantive conservation measures and the procedures by which APHIS-Wildlife Services will ensure that strictly complies with the BGEPA and MBTA.

APHIS-Wildlife Services kills thousands of protected migratory birds every year.[331] Reported data show that its non-target catch of migratory birds – such as bald and golden eagles, which are protected under the BGEPA as well as the MBTA – is frequent.[332] The unreported catch is likely far greater.[333]

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[330] Indeed, trapping is one of the primary threats to the Northern Rockies fisher population, according to a recent petition to list the Northern Rocky Mountain population of fishers that was submitted to FWS by the Center for Biological Diversity and numerous other organizations pursuant to the ESA's citizen petition process. *See* Center for Biological Diversity, Defenders of Wildlife, Friends of the Bitterroot, Friends of the Clearwater, Western Watersheds Project & Friends of the Wild Swan, PETITION TO LIST THE NORTHERN ROCKIES DISTINCT POPULATION SEGMENT OF FISHER (*PEKANIA PENNANTI*) AS THREATENED OR ENDANGERED UNDER THE ENDANGERED SPECIES ACT (Sep. 23, 2013).

[331] Data Compilation (note 3).

[332] *See* Utah Division of Wildlife Resources, INITIAL REPORT OF INVESTIGATION (Dec. 2, 2003) (note 277) (describing illegal, unreported killing of golden eagle in steel-jaw leghold trap set by Wildlife Services in the Henry Mountains in Utah); U.S. Department of the Interior, U.S. Fish and Wildlife Service Office of Law Enforcement, REPORT OF INVESTIGATION (Feb 17, 2004); APHIS-Wildlife Services, MIS Legacy Report (Mar. 4, 2005) (note 231) (describing death of golden eagle in snare trap on BLM lands in Nevada in 2005); Letter from R. Merrell, Wildlife Services to Interested Parties (May 24, 2011) (describing deaths of two golden eagles from snare traps set in Wyoming in 2009).

[333] An investigation by FWS in 1990 revealed a covert operation – performed, condoned, and/or promoted by APHIS-Wildlife Services supervisors and personnel – using poisons to kill bald and golden eagles suspected to be preying on sheep herds, including Compound 1080 (which had been prohibited for sale or use in Wyoming). Memorandum from Regional Director, FWS, Region 6 to Director, FWS, Washington, D.C.,(Nov. 1990).

The BGEPA protects the bald eagle and golden eagle from harm.[334] It imposes criminal penalties for the knowing, or with "wanton disregard," take, possession, sale, or other acts that are detrimental to bald or golden eagles without a permit, and for violating any permit or regulation issued pursuant to the law.[335] The BGEPA imposes civil penalties for committing prohibited acts as well.[336]

The MBTA establishes a federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention ... for the protection of migratory birds ... or any part, nest, or egg of any such bird."[337] The original MBTA implements treaties for the protection of migratory birds between the U.S. and Great Britain (for Canada), the U.S. and Mexico, the U.S. and Japan, and the U.S. and the Soviet Union (now Russia).[338] The MBTA's prohibition applies to birds that are included in these respective international conventions. This list of birds that are protected under the MBTA is extensive.[339]

The BGEPA and MBTA authorize the Secretary of Interior to enforce their prohibitions and to issue permits to engage in the otherwise-prohibited acts against protected birds.[340] APHIS-Wildlife Services must comply with these laws and obtain all necessary permits in order to take such species or otherwise commit prohibited acts in connection with control activities. Yet, although it states that it does so, neither APHIS-Wildlife Services nor FWS notify the public when it submits applications to FWS to obtain such permits. APHIS-Wildlife Services does not make available on its website all current permits that it may hold under these laws. Furthermore, even assuming that it does have such permits, such permit coverage cannot cover unreported and/or non-target catch.

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334 16 U.S.C. § 668-668d.

335 *Id*. § 668.

336 *Id*. § 668(b).

337 16 U.S.C. § 703.

338 FWS, DIGEST OF FEDERAL RESOURCE LAWS OF INTEREST TO THE U.S. FISH AND WILDLIFE SERVICE: MIGRATORY BIRD TREATY ACT OF 1918 [available at http://www fws.gov/laws/lawsdigest/migtrea.html].

339 FWS, MIGRATORY BIRD PROGRAM, LIST OF BIRDS PROTECTED BY THE MIGRATORY BIRD TREATY ACT [available at http://www fws.gov/migratorybirds/RegulationsPolicies/mbta/mbtintro html].

340 16 U.S.C. 668b (BGEPA enforcement); 50 C.F.R. Part 22 (BGEPA permitting); 16 U.S.C. §§ 704 (MBTA permits) and 706 (MBTA enforcement).

c. Federal Insecticide, Fungicide and Rodenticide Act

Petitioners seek promulgation of regulations to specify the substantive measures and the procedures by which APHIS-Wildlife Services will ensure that it strictly complies with FIFRA.

The authors of the Leopold Report identified the need for regulatory restrictions on the use of toxicants by APHIS-Wildlife Services nearly 60 years ago. Concerned about the use of Compound 1080 in 1964, they urged regulation of the "distribution and the use of 1080 or any other poison capable of having a secondary effect" and admonished the program for the "need for much stricter adherence to operational rules" for its use.[341] President Nixon and DOI Secretary Andrus later sought to prohibit the use of toxicants on public lands.[342]

The Federal Environmental Pesticide Control Act was passed eight years later, in 1972.[343] It amended FIFRA and mandated the Environmental Protection Agency ("EPA") to regulate the use and sale of pesticides to protect public health and the environment.[344] To that end, FIFRA section 3 requires that all new pesticides to be registered by EPA before they may be used within the United States.[345] The EPA must classify pesticides for general or restricted use, depending on their particular risks, and must classify (or reclassify) a pesticide as "restricted" when necessary to guard against unreasonable adverse environmental effects. Restricted use pesticides may only be applied by a certified applicator or under his/her direct supervision, and application must follow all limitations on the frequency, type, location, or protective measures associated with its use.[346]

EPA classified sodium cyanide, which is used in M-44s, as a restricted use pesticide in 1994.[347] EPA classified sodium fluoroacetate, which is used in Compound 1080, as a restricted use

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[341] Leopold report (note 40) at 26-27.

[342] *See supra* at 12, 13.

[343] Envtl. Protection Agency, FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA): OVERVIEW OF FIFRA [available at http://www.epa.gov/oecaagct/lfra.html].

[344] *Id*.

[345] 7 U.S.C. § 136a. To be registered as a pesticide, EPA must determine that:

- Its composition is such as to warrant the proposed claims for it;
- Its labeling and other material required to be submitted comply with the requirements of the Act;
- It will perform its intended function without unreasonable adverse effects on the environment; and
- when used in accordance with widespread and commonly recognized practice, it will not generally cause unreasonable adverse effects on the environment.

Id. § 136a(c)(5).

[346] 7 U.S.C. §§ 136 *et seq*.

[347] EPA, R.E.D. FACTS: SODIUM CYANIDE (Sep. 1994).

pesticide in 1995.[348] The agency placed both sodium cyanide and sodium fluoroacetate into Toxicity Category 1, reflecting the "highest degree of acute toxicity."[349] Although APHIS-Wildlife Services employs strychnine to poison rodents in underground burrows today, EPA has maintained restrictions on the use of above-ground, non-arboreal field use of this toxicant.[350] The EPA has set forth 26 "Use Restrictions" for M-44s. Hence, under FIFRA, APHIS-Wildlife Services may use these poisons only in accordance with restricted conditions.[351]

APHIS-Wildlife Services claims that it is in compliance with FIFRA, yet the EPA and state agricultural agencies have notified the agency of multiple violations of EPA restrictions in connection with using M-44s on federal public lands, in recreational areas, on private party without permission from landowners, in standing water, and/or close to roads.[352] Citizen enforcement led the EPA to fine APHIS-Wildlife Services for multiple violations of FIFRA in New Mexico.[353] Notwithstanding whatever compliance with FIFRA's requirements APHIS-Wildlife Services may claim, it cannot cover the thousands of accidental animal deaths caused by Wildlife Services' M-44s or Compound 1080.[354]

Moreover, in many circumstances the use of pesticides to control predators simply does not comport with the purpose of FIFRA. A pest is defined as an animal that is "deleterious to man or the environment."[355] Yet, given their ecosystem benefits, apex predators and mesopredators

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[348] EPA, REREGISTRATION ELIGIBILITY DECISION: SODIUM FLUOROACETATE (Sep. 1995).

[349] EPA, REREGISTRATION ELIGIBILITY DECISION (RED): SODIUM FLUOROACETATE (Sep. 1995).

[350] PREDATORY BUREAUCRACY (note 24) at 330; EPA, REREGISTRATION ELIGIBILITY DECISION: STRYCHNINE (July 1996); Memorandum from Jane Smith, Health Effects Division, EPA to Jay Ellenberger, Special Review and Reregistration Division, STRYCHNINE, HED Chapter of the Reregistration Eligibility Decision Document (RED), Case #3133 (Jan. 22, 1996).

[351] 7 U.S.C. § 135(t) (definition of "pest"); *id.* § 135(u) (definition of "pesticide").

[352] *See* Letter from M. Chalfant and D. Janik, Region 8, Environmental Protection Agency to M. Linnell, Utah State Director, APHIS-Wildlife Services (Mar. 20, 2008); Texas DOA Notice of Violation (note 188) (notifying APHIS-Wildlife Services employee of violations of use restrictions for M-44, which was placed "less than six-tenths of a mile from [a] house near roadways that [resident], her family, and family's dog frequently traveled" and which killed the family dog); Wright Affidavit (explaining how M-44 that killed family dog was "sitting in a pool of water that was overflow from the irrigation ditch," in violation of EPA Use Restriction 12).

[353] New Mexico Department of Agriculture, Investigative Report, Consent Agreement and Final Order for Case No. 96-24 (fining APHIS-Wildlife Services $1,000 in 1994 for illegally placing several M-44s in the Gila National Forest).

[354] *M-44s* (note 14) ("Agency records show that more than 3,400 animals have been mistakenly killed by M-44s since 2006, including black bears, bobcats, raccoons, opossums, ravens, ringtails, red fox, gray fox, kit fox, swift fox, turkey vultures and dogs."); 1997 Programmatic FEIS (note 5) at 3-46-47 (acknowledging that non-target species may be inadvertently attracted to baits placed for other species"; for example, "swift foxes may be attracted to the bait placed for coyotes or other canids, resulting in … death by an M-44").

[355] 40 C.F.R. § 152.5(a).

such as wolves and coyotes are not "deleterious to man or the environment" – to the contrary, they have tremendous environmental benefits.[356] Therefore, they cannot accurately be classified as "pests."

Thus, a rulemaking is necessary in order to ensure that Wildlife Services complies with FIFRA; the circumstances in which toxicants such as M-44s, Compound 1080, strychnine, or any new toxicants may be used, if at all, and if so, where they may be used; and the strict consequences for agency personnel who violate such rules are minimal requisites.

d. National Environmental Policy Act

Petitioners seek promulgation of regulations to specify the procedures by which APHIS-Wildlife Services will ensure strict compliance with NEPA.

NEPA requires federal agencies to analyze the environmental impact of a particular federal action before proceeding with that action. 42 U.S.C. § 4332(2)(C). NEPA is designed to "insure that environmental information is available to public officials and citizens before decisions are made and actions are taken," and to "help public officials make decisions that are based on understanding of environmental consequences ... ." *Id*. § 1500.1(b)-(c). "Public scrutiny [is] essential to implementing NEPA." *Id*.

To accomplish these purposes, NEPA requires all federal agencies to prepare a "detailed statement" regarding all "major federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332(C). This statement is known as an environmental impact statement ("EIS"). The EIS is the cornerstone of NEPA. An EIS is required for all "major Federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332(2)(C). An agency may first prepare an environmental assessment ("EA") to determine whether an EIS is required. *See* 40 C.F.R. § 1501.4(b).

An EA must take a "hard look" at the potential consequences of the proposed action and provide enough evidence and analysis for determining whether to prepare an EIS or a "finding of no significant impact." After preparing an EA or EIS, NEPA requires an agency to prepare a supplemental NEPA analysis when "[t]he agency makes substantial changes in the proposed action that are relevant to environmental concerns; or...[t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed actions or its impacts." 40 C.F.R. § 1502.9(c)(1).

A "programmatic" FEIS for the APHIS-Wildlife Services program is more than 15 years old and is outdated.[357] Currently, APHIS-Wildlife Services routinely prepares EAs under NEPA to consider the effects of its activities in various areas around the country. The focus of these EAs is generally limited to activities related to the killing of predators and other so-called injurious

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[356] *See supra* at 27-28.

[357] 1997 Programmatic FEIS (note 5).

animals; these EAs do not encompass the full scope of APHIS-Wildlife Services' activities or consider the consequences of these activities to biodiversity. Indeed, APHIS-Wildlife Services is already aware that it is out of compliance with NEPA with regard to numerous old EAs.[358]

For example, APHIS-Wildlife Services' EAs do not provide any information about the cumulative impact of APHIS-Wildlife Services' activities to ecosystems or rigorously analyze or consider alternatives to standard agency practices. The risk assessment for the 1997 Programmatic FEIS assumed that "no individual application" of any one of the dozens of chemical control methods used by APHIS-Wildlife Services will cause an "adverse nontarget exposure," and therefore, the total, programmatic exposure from the program would be negligible.[359] As discussed above, however, this stands in stark contrast to numerous examples of adverse non-target exposures since 1997.

APHIS-Wildlife Services EAs are also often out of date and do not reflect changes in state trapping laws. For example, in California APHIS-Wildlife Services relies on four district EAs that have not been updated since the 1998 passage of Proposition 4, which prohibited certain traps and poisons statewide.

Therefore, a rulemaking is necessary to set regulatory procedures that govern APHIS-Wildlife Services' NEPA compliance, including rules to specify when programmatic environmental reviews and site-specific environmental analyses are necessary and when they must be updated. Frequent reviews of the program under NEPA are the only way to ensure that the public has an ongoing opportunity to guide the program and that program activities are based on current scientific understanding, knowledge, and societal values.

e. Fish and Wildlife Act

The FWA prohibits anyone from shooting any animal from an aircraft without a license or permit.[360] APHIS-Wildlife Services engages in aerial gunning of wildlife, including wolves and coyotes – primarily on behalf of livestock and hunting interests. However, it is not clear that the agency has obtained the necessary permission to carry out these activities under the FWA.[361] Therefore, a rulemaking is necessary to set the regulatory procedures for FWA compliance as well.

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[358] *See*, *e.g.*, Email from Alton Dunaway, APHIS-Wildlife Services to William H. Clay, APHIS-Wildlife Services (July 13, 2010) ("O[regon] has done almost nothing to help with their predator EA for the last 6 - 8 months and has not even cooperated in establishing a time schedule to complete the EA."): Email from Alton Dunaway, APHIS-Wildlife Services to William H. Clay, APHIS-Wildlife Services (July 8, 2010) (noting legal vulnerability of several outdated EAs).

[359] 1997 Programmatic FEIS (note 5) at 4-29.

[360] 16 U.S.C. § 742j-l.

[361] Evidently, APHIS-Wildlife Services does not even know how much it spends on aerial gunning, *supra* note 238, so it pushes belief that that is all of the necessary permits to carry out this activity.

f. Invasive Species Control

As a final note, Petitioners acknowledge the adverse impact that some invasive species have on endangered and threatened species. Invasive species have been identified as one of the greatest threats to imperiled species in the United States. Petitioners note the efforts of APHIS-Wildlife Services to study and control invasive species to mitigate such impacts.

That said, Petitioners note two important guiding principles. First, it is imperative that regulations are promulgated to guide the program's invasive species control activities informed by comment from the public including non-governmental organizations, the scientific community, experts, ethicists, and academics. Second, such regulations must include criteria for transparent determinations of whether specific invasive species conflicts warrant a response by APHIS-Wildlife Services and how such conflicts should be addressed, ensuring humane treatment of animals, while reducing/eliminating impacts on non-target species. Petitioners recognize the value of invasive species control using humane, effective and selective techniques at the site- and species-specific level in order to protect and recover federally-listed endangered and threatened species, but do not favor the preventative killing of species over large geographic areas at the behest of livestock, agricultural, or other interests under the auspices of invasive species control.

V. CONCLUSION

For all of the foregoing reasons, Petitioners seek promulgation of rules to set forth a clear, consistent regulatory scheme for Wildlife Services, to ensure program transparency, reliability, humaneness, and compliance with all federal laws that protect and conserve wildlife, including the ESA, BGEPA, MBTA, FIFRA, FWA, NEPA, and other authorities.

Thank you for your consideration. We look forward to a timely response.

Respectfully submitted,

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Exhibit 3

USDA

United States Department of Agriculture

Office of the Secretary
Washington, D.C. 20250

NOV 1 4 2014

Ms. Amy R. Atwood
Senior Attorney
Center for Biological Diversity
Portland, Oregon 97211-0374

Dear Ms. Atwood:

Secretary Thomas J. Vilsack, asked that I send you this letter as further response to the petition dated December 2, 2013, submitted on behalf of the Center for Biological Diversity, Project Coyote, the Animal Welfare Institute, and the Animal Legal Defense Fund, in which you requested that the Animal and Plant Health Inspection Service (APHIS) promulgate a regulatory framework to govern the Wildlife Services (WS) Program.

The U.S. Department of Agriculture (USDA) has now thoroughly reviewed the petition and I have requested that APHIS respond in more detail, enclosed. We hope this is helpful.

Sincerely,

Edward M. Avalos
Under Secretary
Marketing and Regulatory Programs

Enclosure

Animal and Plant Health Inspection Service (APHIS) Response to December 2, 2013 Petition for Rulemaking

Your petition requests appeared in various phrasings on page 2 of your cover letter, in the Petition on pages 5, 40-51, and throughout the petition. Your petition was titled as requesting the "promulgation of a regulatory framework." We interpreted your title to mean you were requesting notice and comment rulemaking pursuant to the Administrative Procedure Act (APA) and in reference to the two Federal authorizing statutes for the Wildlife Services (WS) program, namely the Acts of March 2, 1931 (7 U.S.C. 426-426b), as amended, and December 22, 1987 (7 U.S.C. 426c), unless you specified you were requesting rulemaking pursuant to another statute. However, in an effort to thoroughly respond to your petition as fully as possible, we have also sought to respond to your request in the context of other types of regulatory actions and/or other statutes.

Although we did not receive a primary list of all of your requests, or any specific rulemaking language (regulatory text) for the rules you propose (or would like to see issued), we have tried our best to identify, categorize, and respond to your general requests as thoroughly as possible by consolidating and organizing them into six main categories:

1. Request for APA Notice and Comment Rulemaking for Rules Codifying the WS' Procedures for Lethal Animal Control and Less Lethal Control[1];
2. Request for APA Notice and Comment Rulemaking for Rules Governing WS' Humane Treatment and Establishing Consequences for WS Personnel who Violate Those Rules[2];
3. Request for APA Notice and Comment Rulemaking for Rules Governing WS' Compliance with other Federal agency statutes, including the Endangered Species Act (ESA), the Bald and Golden Eagle Protection Act (BGEPA), the Migratory Bird Treaty Act (MBTA), and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)[3];
4. Request for APA Notice and Comment Rulemaking for Rules Codifying WS' National Environmental Policy Act (NEPA) Compliance and Environmental Goals, Including Invasive Species Work[4];
5. Request for APA Notice and Comment Rulemaking for Rules governing WS' cooperative service agreements (CSAs) and Work Plans,[5] and
6. Request for APA Notice and Comment Rulemaking for Rules to make the WS program fully transparent, including making all of its documents routinely available and requesting that USDA and APHIS amend the Freedom of Information Act (FOIA) implementing regulations at 7 C.F.R. Part 1 to maintain and make available seven categories of agency records.[6]

Below is APHIS' response to each of these six broad categories of requests listed above.

[1] Cover letter at page 2; Petition at pages 5, 40-41, and 51.
[2] Cover letter at page 2, petition at pages 5, 40-41, and 54.
[3] Petition at 5, 62, 64, 67
[4] Petition at 5, 41, 66-67, 68
[5] Petition at 40-41.
[6] Page 2 of cover letter, Petition at 40-41, 49-50

1. Your Request for APA Notice and Comment Rulemaking for Rules Codifying WS Procedures for Lethal Animal Control and Less Lethal Control[7]

You request APHIS-WS to promulgate a variety of Federal regulations specifying how APHIS-WS will select wildlife control methods, plus the phasing out of lethal control methods, and outlining other procedural criteria for how APHIS-WS will conduct its wildlife control activities.

WS' enabling Acts are the Acts of March 2, 1931 (7 U.S.C. 426-426b), as amended, and December 22, 1987 (7 U.S.C. 426c).[8] APHIS-WS has never promulgated any APA Federal rules under those two enabling Acts since neither of those Acts specifically provide for the legal authority to promulgate regulations. APHIS-WS has publically issued on its websites its written policies and procedures with regard to how and when WS typically implements its wildlife control actions, including both lethal and nonlethal methods. For example, there are two WS policy directives that provide guidance to WS employees for the appropriate procedure to follow when selecting wildlife control methods: APHIS-WS Policy Directive 2.101, Selecting Wildlife Damage Management Methods (Jul. 20, 2009), cited[9] by Petitioners in footnote 206, p. 38 of the petition, and policy Directive 2.201, Decision Model (Jul. 21, 2008), cited by Petitioners in footnote 216, p. 40.

In addition to these program-wide policy directives, APHIS-WS's policies and procedures for selecting wildlife control methods—as described in documents such as cooperative agreements, MOUs, and NEPA documents—are by necessity (because of the particular biology of the wildlife impacted, as well as the specific geographical and weather factors of the area where the wildlife are found) tailored to regional and/or local projects.

Moreover, and most importantly, APHIS-WS wildlife control and management assistance is provided only in response to requests for assistance, see APHIS-WS Directive 2.201, Decision Model (Jul. 31, 2008). In other words, WS neither unilaterally nor proactively initiates any wildlife control or management action. The actual requestor may be public or private: Federal agencies, States, local jurisdictions, public and private agencies, organizations, and institutions, or individuals.

Once a request is received, WS will evaluate the requested wildlife control action to determine if it is indeed an appropriate and reasonable control action to implement. If the requested action is not appropriate and reasonable, WS will usually suggest an alternative appropriate and reasonable control action, if one is feasible. If WS does determine that the control action is appropriate and reasonable, and WS has the available personnel and equipment to implement the action, it will determine the costs to implement the action. Usually, WS will

[7] Cover letter at page 2; Petition at pages 5, 40-41, and 51.

[8] "The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program." As amended, 7 U.S.C. 426. "[T]he Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases..." 7 U.S.C. 426c.

[9] Petitioners cite the 2003 version of this directive.

enter into a cooperative service agreement with the requestor and require the requestor to cover most or all of the costs for the service provided by WS. The cooperative service agreement between WS and the requester describes the requested wildlife service action, how it will be done, and the costs involved. Accordingly, WS' wildlife control actions arise from and are directly driven by specific wildlife service requests from the public or from private entities—Federal agencies, States, local jurisdictions, public and private agencies, organizations, and institutions, or individuals—and are evaluated and determined by WS' wildlife control decisionmaking process.

In essence, WS' wildlife control decision-making process is determined by whom, where, when, and how a wildlife control action is requested and when, where, and how the control method can be appropriately and reasonably implemented depending upon the biology of the wildlife, the geographical area, the weather, etc. So WS' wildlife control actions are based on specific requests and specific localized needs and the appropriateness of their implementation is evaluated by WS. In addition, because of laws unique to various State and local governments (including Native American Tribes), and differing management philosophies of the various Federal land management agencies, the WS cooperative arrangements with the specific entity or individual can vary considerably. For example, some State wildlife management agencies may require that WS program officials obtain approval on a case-by-case basis to lethally take certain game species such as black bears and mountain lions that are killing livestock, but by contrast, other State wildlife management agencies may not.

Your petition included a request that WS undertake APA rulemaking for a Federal rule that would require "a documented correlation between specific wildlife problems that warrant a response by WS as well as the appropriate methods that may be employed by program personnel..."[10] Such correlation is already factored into WS' wildlife control decision-making process and various WS Policy Directives. As explained above, WS does not unilaterally initiate a wildlife control action, nor does it implement a control action until it determines that there is an appropriate and reasonable control action and that it is feasible to implement it. Very often the public or private entity, organization, association, or individual person requesting some wildlife control assistance has made the determination that a wildlife problem exists and what type of control (lethal or nonlethal) is needed before they contact WS for assistance. Once WS receives a request for lethal or nonlethal control assistance, WS does not immediately accept the requestor's suggested control action. Rather, when responding to requests for assistance, WS evaluates the requested action, the situation, and the related facts in order to make reasonable and appropriate control recommendations, using the specific criteria provided in the enabling legislation for WS and in WS policy directives. The WS professional responding to each complaint and request for control assistance documents the correlation between specific damage caused by wildlife and the affected resource harmed or damaged. Methods selection is analyzed and determined by WS and then discussed with the requestor. Additionally, WS evaluates the selected method and, as appropriate, addresses it in relation to applicable Federal and State laws including, for example, the applicable and relevant environmental laws.

[10] Petition at 41.

You also requested that WS phase out lethal control and ensure that WS exhaust nonlethal measures for each situation.[11]

It is important for you to know that WS policy (WS Directive 2.101, Selecting Wildlife Damage Management Methods), requires preference be given to nonlethal methods when the nonlethal method can be implemented in a practical and effective manner. The WS program applies an integrated wildlife damage management (WDM) approach to reduce or prevent wildlife damage (WS Directive 2.105, The WS Integrated Wildlife Damage Management Program, WS Directive 2.101 Selecting Wildlife Damage Management Methods). In selecting WDM methods, as explained above, consideration is given to the specific biologic, sociocultural, economic, physical, and other environmental circumstances associated with a given wildlife species and wildlife damage problem as well as legal and administrative factors. The available and appropriate methods are screened and evaluated to formulate an effective integrated strategy which may or may not include lethal removal (WS Directive 2.201, WS Decision Model). When appropriate and applicable, WS provides information on, and recommends to cooperators, nonlethal methods which are suitable for application without WS assistance. If nonlethal methods are not appropriate, or are unavailable or ineffective, cooperators frequently contact WS for direct lethal assistance. As necessary, WS will use lethal damage management methods when nonlethal techniques are not reliable, available, appropriate, or cannot be applied effectively. Lethal control, more accurately described as the lethal take or removal of wild animals, is a long-established method used by professional wildlife experts and managers to manage renewable wildlife resources. The lethal removal of animals to reduce wildlife damage or threats to other resources or humans is sometimes necessary and appropriate depending upon the specific wildlife involved and the particular circumstances and is an accepted and legitimate means of reducing wildlife damage. In many situations, damage or threats caused by wildlife cannot be successfully managed without the lethal removal of some individual wild animals from a population. WS will continue to use lethal methods to remove individual animals from certain wild animal populations as necessary to professionally manage wildlife damage while protecting the sustainability of the wildlife species involved. WS personnel are expected to and do exhibit a high level of respect and professionalism when taking an animal's life, regardless of the method used.

An important component of the WS Program is the National Wildlife Research Center (NWRC). Millions of dollars of the WS budget are set aside for research, and the majority of that funding is dedicated to the development and improvement of nonlethal methods. WS has made excellent progress in the development of nonlethal methods and will continue to place a priority on effective nonlethal methods. For example, as part of its program to develop tools for managing populations of overabundant wildlife species, NWRC scientists have developed a gonadotropin-releasing hormone (GnRH) immunocontraceptive vaccine named GonaCon™ that shows promise as a wildlife infertility agent for some wildlife population- and disease-management applications.

When WS uses certain specific pesticides as a form of animal control, the use, storage, and disposal of those pesticides conforms to the mandatory label instructions and applicable Federal, State, Tribal, and local laws and regulations including application, certification, storage, transportation, shipment, disposal, and supervision. Restricted-use pesticides used or

[11] Cover letter, p. 2 and Petition at 5, 41.

recommended by WS personnel must be registered by the U.S. Environmental Protection Agency (EPA). Pesticides must be used in accordance with EPA's FIFRA. WS employees must comply with WS Directive 2.401, Pesticide Use and the WS Standard for Storing Pesticides (WS Directive 2.401, Attachment 1). When immobilizing and euthanizing substances are administered, WS personnel comply with policy set forth in WS Directive 2.430, Controlled Chemical Immobilization and Euthanizing Agents.

Your petition also included a request that WS phase out prophylactic lethal control.[12] WS responds to requests to conduct preventive wildlife damage management based on the specific biologic, sociocultural, economic, physical, and other environmental circumstances associated with a given wildlife species and its historical losses. For example, research on the preventive control of coyotes on sheep depredation demonstrated that aerial coyote control 3-6 months in advance of the arrival of sheep in summer pastures resulted in a 2/3 reduction of summertime sheep depredations (Wagner and Conover 1999). Prophylactic lethal control of predators is sometimes required to ensure the survival of game species. For example, at the request of the Utah Division of Wildlife Resources, WS implemented a coyote control program to relieve predation on fawns in a declining mule deer and antelope population. Coyote removal resulted in an increase in fawn survival from 9 to 42 percent. Similarly, in one Utah population of sage grouse, a species under consideration for protection under the Endangered Species Act, annual adult mortality due to predation (primarily by non-native red fox) was reduced from 82 percent to 33 percent after fox control was implemented. GAO Wildlife Services Program: Information on Activities to Manage Wildlife Damage (Nov. 2001). See WS Directive 2.105, The WS Integrated Wildlife Damage Management Program.

Your petition raised concerns about WS ensuring that nontarget animals are not harmed or killed.[13] WS' integrated wildlife damage management approach incorporates nonlethal, nontoxic, and non-capture methods such as cultural practices, habitat modification, and animal behavior management when these methods are likely to be effective in reducing damage in a particular management situation (WS Directive 2.101). These nonlethal methods are the first approach WS employs to minimize nontarget species impacts. If it is determined that lethal controls are necessary to resolve damage complaints, WS carefully considers its method selection and conducts training programs to avoid nontarget animals. WS personnel receive specialized training in field WDM techniques. Training for selective trapping methods and nontarget avoidance techniques takes place in a variety of settings including classroom/ workshop settings, group field exercises, and/or through individual instruction. Field activities, including incidences of nontarget captures are monitored by supervisors and through routine reviews of Management Information System (MIS) reports. All WS WDM methods are employed to be as selective as possible for the specific animal(s) causing damage and/or human safety conflicts, using techniques developed by WS' NWRC and learned through many years of field experience and wildlife techniques training. A combination of these nonlethal methods and selective removal of target species allows WS to effectively reduce damage while minimizing impact on nontarget species.

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[12] Cover letter at page 2.

[13] Petition at 41.

You also requested that WS promulgate rules that would set forth factors for determining when previously-approved control activities must cease.[14] However, this is not necessary since WS already has a specific policy in place that sets forth the factors for terminating WS assistance activities. When WS provides technical advice or recommendations for a requestor or cooperator to take action to address a wildlife problem, WS' involvement normally ends after the recommendations or advice is provided to the requestor. WS personnel normally terminate an operational project once damage has ceased or been reduced to an acceptable level. (WS also solicits feedback from the requestor to ensure that damage has been reduced to an acceptable level.) Resolving some wildlife problems, such as bird hazards to aviation in an airport environment, chronic livestock predation, or damage at aquaculture facilities, often requires ongoing attention and may have no well-defined end point. In these cases, WS monitors the results of the management activity as outlined in the WS Decision Model. Monitoring is important for determining whether further assistance is required or whether the problem has been resolved (WS Directive 2.201, WS Decision Model).

On page 51 of your petition, you request that WS promulgate rules that "...conclude that any permission to graze livestock on public lands shall not be subsidized by lethal predator control by APHIS-WS . . . rather, the risk of livestock losses to predators should be borne by the livestock producer(s) who use public lands and resources." WS has no statutory authority to regulate grazing on public lands or to determine the conditions under which livestock grazing occurs on public lands.

Your petition also requested that APHIS undertake substantive rulemaking, including rules that define key statutory terms, such as "injurious, "predator," "control," "invasive," and "cooperator."[15] Petitioners believe that there are gaps in the existing WS statutory scheme that require the agency to promulgate regulations to define these terms. APHIS-WS has been working pursuant to the Act of March 2, 1931, as amended, since 1986 and the Act of December 22, 1988, since 1989. Both statutes have been used and applied consistently by APHIS-WS, so it has not felt any need or necessity to define those commonly understood terms. Moreover, as stated above, WS employs a variety of mechanisms (policy directives, environmental documents, cooperative agreements, etc.) to outline its policies for conducting wildlife damage management and makes sure to align those policies with the manner in which WS has commonly used and applied those terms.

2. Your Request for Notice and Comment Rulemaking for Rules Governing Humane Treatment and Establishing Consequences for Personnel who Violate Those Rules[16]

Your petition acknowledges that there are many State and Federal laws that protect animals from inhumane treatment or cruelty and that APHIS requires its employees to comply with them.[17] That is correct, and 47 States have adopted felony laws that prohibit animal

[14] Petition at 41.
[15] Petition at 41.
[16] Cover letter at page 2, petition at pages 5, 40-41, and 54.
[17] Petitioners at 52-53, citing Policy Directive 2.210

cruelty. APHIS-WS must comply with all Federal Statutes, and several Federal agencies, including APHIS itself, have specific statutes that protect animals and wildlife. For example, the Animal Welfare Act, the Horse Protection Act, and the Commercial Transportation of Equines for Slaughter are all under APHIS' jurisdiction and enforcement. However, those APHIS statutory authorities for the welfare and protection of animals are administered by other APHIS Program Areas and not by the APHIS-WS Program Area. Moreover, other Federal agencies exercise additional authorities including the Humane Methods of Slaughter Act enforced by USDA's Food Safety and Inspection Service and the Wild Horses and Burros Act, enforced by the Bureau of Land Management. In addition, the U.S. Fish and Wildlife Service (USFWS) has promulgated numerous regulations requiring the humane treatment of all wildlife protected under the ESA, MBTA, and/or BGEPA.[18]

APHIS-WS has adopted policy directives that require compliance with State and Federal laws, including those that require the humane treatment of animals. APHIS directives also set out requirements for the use of trained dogs in program activities,[19] and they require all program personnel to "show exceptionally high levels of respect for people, property and wildlife" to "strive to use the most selective and humane methods available, with preference given to nonlethal methods when practical and effective."[20]

APHIS-WS personnel are also required to follow the American Veterinary Medical Association (AVMA) Guidelines on Euthanasia (2007), and by policy must conduct themselves with a high level of respect and professionalism when it is necessary to take an animal's life, regardless of the method (WS Directive 2.505, Lethal Control of Animals).

WS recognizes the value and use of the trapping Best Management Practices (BMP) guidelines for private fur harvest and other trapping activities being developed and promulgated by State wildlife management agencies and the International Association of Fish and Wildlife Agencies. WS recognizes that these guidelines for different regions of the United States are under development and continuing revision for 23 species of North American mammals, and that they will be periodically updated based on the availability and public use of commercial capture devices. Insofar as they are allowed by law and are practical, WS intends to utilize these guidelines as a basis for policy formulation, recognizing that some devices used in wildlife damage management are not commercially available, and that not all devices recommended in the BMP guidelines for general public use meet the more stringent performance requirements, particularly for efficiency and durability, for use in Federal wildlife management activities.

In light of all of these State and Federal laws, regulations, policy directives, and guidelines, WS does not agree with your assertion that there are "gaps in the statutory scheme,"[21] that require APHIS to promulgate additional rules that prohibit animal cruelty, set forth legal and ethical standards for the treatment of animals by agency personnel, and set forth a clear and consistent process for ensuring that employees who violate such prohibitions are subject to a

[18] Petition at 52-53.
[19] Petitioners at 52-53, citing 2.445
[20] Petitioners at 52-53, citing 1.301.
[21] Petition at 40-41

disciplinary process and terminated.[22] If, at any time, the agency believes that the existing framework of laws, regulations, directives, and guidelines under its jurisdiction and enforcement authorities does not sufficiently set forth legal and ethical standards for the treatment of animals and provide an adequate process for disciplining employees who violate those standards, then the Agency will address such concerns.

Adherence to the Code of Ethics developed for WS program personnel is mandatory for all WS employees (Federal and non-Federal, including volunteers, interns, and personnel conducting official WS duties). See WS Directive 1.301, Code of Ethics. The WS Code of Ethics promotes public service and helps WS to maintain high personal and professional standards individually and collectively.

Unacceptable Federal employee conduct and behavior are defined by the Office of Personnel Management, the USDA, and APHIS and WS policies and guidelines. USDA has a longstanding and detailed process for disciplining employees who violate USDA policy directives. Under 5 CFR 752, USDA is authorized to discipline an employee for misconduct, including and up to removal, for such cause as will promote the efficiency of the service. USDA Departmental Directive 4070-735-001 establishes the Department's overall policies, procedures, and standards on employee responsibilities and conduct. Included in this Directive is USDA's policy that its employees maintain high standards of honesty, integrity, and impartiality; adhere to the rules set forth in this directive; comply with lawful supervisory direction; and comply with work-related laws, regulations, and policies. USDA's Guide for Disciplinary Penalties provides the guidelines for penalties administered to employees. The Guide includes penalties where an employee is found to have engaged in conduct that is prejudicial to the best interests of the agency such as where an employee is convicted of a criminal charge which is related directly to the duties of the employee's position or the mission of the Agency or where an employee engages in off-duty conduct that adversely affects the employee's job performance or trustworthiness, or adversely affects the ability of the Agency to accomplish its mission. Additionally, APHIS-WS has further expounded on employee responsibilities and conduct in WS Directive 1.101. All APHIS-WS personnel are subject to disciplinary action in cases where the employee violates any USDA, APHIS, and/or APHIS-WS ethical standards or policies. An employee may be removed from service for an ethical violation if the violation warrants removal.

In summary, employees who are found to have violated USDA, APHIS, and/or APHIS-WS directives may face disciplinary action in accordance with applicable law and regulations. USDA has the structure in place to hold its employees accountable in order to ensure that it provides its customers with the highest degree of quality and care.

3. Your Request for Notice and Comment Rulemaking for Rules Governing Compliance with other Federal agency statutes, including ESA, BGEPA, MBTA, FIFRA[23]

[22] Petition at 54.

[23] Petition at 5, 62, 64, 67

APHIS does not agree with Petitioners that there are gaps in the existing and statutory and regulatory scheme governing ESA, BGEPA, MBTA, and FIFRA. As Petitioners recognize,[24] these statutes are administered by either the USFWS or EPA and not by APHIS, and the regulations administering those statutes are promulgated under the authority granted by each respective statute. For example, See ESA 16 U.S.C 1533(d)

> "Whenever any species is listed as a threatened species pursuant to subsection (c) of this section, the Secretary [of the Department of the Interior] shall issue such regulations as he deems necessary and advisable to provide for the conservation of such species. The Secretary may by regulation prohibit with respect to any threatened species any act prohibited under section 1538(a) (1) of this title, in the case of fish or wildlife, or section 1538(a) (2) of this title, in the case of plants, with respect to endangered species; except that with respect to the taking of resident species of fish or wildlife, such regulations shall apply in any State which has entered into a cooperative agreement pursuant to section 1535(c) of this title only to the extent that such regulations have also been adopted by such State"; BGEPA 16 U.S.C. 668(b), 50 C.F.R. 22; MBTA 16 U.S.C. 704, 706; FIFRA 7 U.S.C. 136w (a) "The Administrator is authorized, in accordance with the procedure described in paragraph (2), to prescribe regulations to carry out the provisions of this subchapter." Fish and Wildlife Act of 1956, 16 U.S.C. 742j-1.

As a pesticide registrant, APHIS-WS is required to follow FIFRA regulations. Also, State regulatory requirements can be more restrictive, but not less restrictive, than EPA FIFRA requirements. WS follows these State requirements in addition to those for each FIFRA product label that WS employs, as well as following applicable WS policy directives (WS Directive 2.401, Pesticide Use, WS Directive 2.405, Pesticide Registration and Permits).

The Airborne Hunting Act is included as a section of the FWA.
As a Federal statute, the Airborne Hunting Act prohibits shooting or attempting to shoot or harassing any bird, fish, or other animal from an aircraft except for certain specified reasons, including protection of wildlife, livestock, and human life as authorized by a Federal- or State-issued license or permit. States authorized to issue permits are required to file reports with the Secretary of Interior containing information on any permits issued. Each State may have varying requirements for this activity. WS complies with the Airborne Hunting Act requirements by obtaining any applicable permits and meeting any other State requirements and supplies the required information for the reporting of WS aerial activities.

The Petitioners also claim that APHIS has an affirmative duty to conduct rulemaking to satisfy affirmative duties under the ESA. APHIS does not agree with that claim since it does not believe that the ESA mandates that every Federal agency must issue their own additional regulations to satisfy ESA's affirmative duties. The ESA clearly provides, "All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this chapter by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 1533 of this

[24] *See, e.g.*, petition at nn. 293, 340.

title." 16 U.S.C. 1536(a)(1). This statute requires APHIS-WS to carry out programs for endangered species' conservation within its existing authorities, in consultation with and with the assistance of the Secretary of the Department of Interior. APHIS-WS does, in fact, use its authorities to help with the conservation of endangered species and threatened species. The USFWS has on various occasions specifically requested APHIS-WS to assist it in protecting endangered species and threatened species and APHIS-WS has developed certain programs for that very purpose. For example, for over a decade WS has conducted a major effort to reduce the brown tree snake's population on the Island of Guam and to prevent the snake's introduction to other Pacific islands. Since its accidental introduction to Guam, the snake— having no natural predators on the island—has eliminated 10 of the 13 species of the island's forest birds and most of its terrestrial vertebrates. WS coordinates operational efforts on Guam aimed at keeping the snake from reaching other destinations. WS personnel use snake trapping in high-risk areas, trained snake-detector dogs in cargo, nighttime spotlight searches, toxicants, and public education as tools to achieve this goal.

In addition, petitioners acknowledge that APHIS has adopted policy directives that require compliance with State and Federal laws, including the ESA, BGEPA, MBTA, and FIFRA.[25] APHIS is aware of and does comply with these statutes, regulations, policies, and directives, and therefore does not believe that there is any need for any additional rulemaking to ensure WS' compliance with the ESA, BGEPA, MBTA, and FIFRA.

4. Your Request for Notice and Comment Rulemaking for Rules Codifying NEPA Compliance and Environmental Goals, Including Invasive Species Work[26]

Petitioners request APHIS-WS to promulgate regulations that would specify how the agency conducts itself in order to restore apex predators and ecosystems, mitigate the effects of climate change, control invasive species, and to ensure the Agency's compliance with NEPA. WS addresses Federal NEPA compliance and its environmental goals through WS' preparation and issuance of its environmental documents (e.g., for NEPA and ESA) pursuant to APHIS NEPA implementing procedures (7 C.F.R. 372 et seq.), cooperative agreements, directives, and policy statements. For example, APHIS-WS Directive 2.320, Invasive Species Damage Management (Feb. 6, 2004) provides guidelines for WS' actions in the control of invasive species, including feral animals and exotic wildlife in fulfillment of the objectives of Executive Order 13112 (1999), the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 as amended (1996), and the ESA of 1973 as amended, when invasive vertebrate species threaten those species covered under the ESA. Since the WS program operates on a request-for-assistance basis, and does not take unilateral, proactive control actions, WS does not implement initiatives on its own to identify and then control invasive species outside of specific cooperator agreements in effect for cooperator-controlled properties.

As part of its NEPA compliance, APHIS considers all of the relevant environmental impacts that may result from a control action or program that it decides to implement. In

[25] Petitioners at 52-53, citing Policy Directive 2.210; *see also* APHIS-WS Directive 2.310, ENDANGERED AND THREATENED SPECIES (Jul. 28, 2003).
[26] Petition at 5, 41, 66-67, 68

addition, WS likewise evaluates all its actions and projects to determine if they are subject to the provisions of the ESA or other Federal environmental statutes. If, for example, ESA provisions do apply to a WS action or project, then such action or project is evaluated by WS and the USFWS to determine what, if any, potential effects to listed threatened and endangered (T&E) species will result from that action or project. Thus, as appropriate and in compliance with the ESA, Section 7 consultations with USFWS are completed for WS State program activities to ensure T&E species protection.

Petitioners request that APHIS-WS consider promulgation of a rule that would restore apex predators and ecosystems. APHIS-WS' two enabling statutes, the Acts of March 2, 1931 (7 U.S.C. 426-426b) and December 22, 1987 (7 U.S.C. 426c) neither mandate nor authorize APHIS-WS to restore wildlife populations or ecosystems. However, other Federal and State agencies charged with such conservation goals often call upon WS for help in their efforts. WS has played an important role in assisting USFWS and State wildlife agencies to achieve conservation goals for threatened or endangered apex predators. These have included the gray wolf, red wolf, grizzly bear, and bald eagle. For example, during FY2013, WS' research and operational efforts contributed to the conservation of 165 T&E species: birds (50), mammals (28), reptiles (14), amphibians (4), fish (9), clams (3), snails (4), insects (1), and plants (52). WS activities that helped conserve T&E species were conducted in 34 States, as well as in Guam and the Virgin Islands. More than $6.6 million in funds were expended by WS on such T&E conservation projects during FY 2013.

The Petitioners also requested that APHIS-WS promulgate rules that would ensure that WS mitigates the likely effects of climate change.[27] WS, like all Federal agencies, is involved in developing mitigation plans for offsetting the effects of climate change under the direction of the President's Council on Environmental Quality (CEQ). WS works directly with the APHIS Environmental and Risk Assessment staff in addressing climate change issues. A WS biologist and an environmental coordinator co-chair a government-wide committee on climate change and invasive species. Accordingly, APHIS-WS is actively involved in mitigating likely effects of climate change and does not believe that there is any need for regulations to ensure action APHIS-WS is already taking.

The petition asks APHIS-WS to promulgate rules that would "specify when programmatic environmental reviews and site-specific environmental analyses are necessary and when they must be updated." The CEQ regulations require agencies to adopt procedures to supplement the CEQ's NEPA regulations, 40 CFR 1507.3. APHIS has already promulgated its NEPA Implementing Procedures at 7 CFR 372. As part of APHIS, WS follows and abides by these APHIS NEPA Implementing Procedures, which do codify how APHIS expects its various Program Areas to comply with NEPA. The APHIS NEPA Implementing Procedures at 7 CFR 372 et seq. specify when actions or projects of the various APHIS Program Areas (WS being one of those Program Areas) normally require an environmental assessment or an environmental impact statement. For example, APHIS Program Areas' actions that normally require an environmental assessment include actions that may involve the agency as a whole or an entire program, but generally are related to a more discrete program component and are characterized by their limited scope (particular sites, species, or activities) and potential effect (impacting

[27] See cover letter at 2.

relatively few environmental values or systems); 7 CFR 372.5(b). The APHIS-WS Program Interim Specific Guidance for Environmental Compliance likewise specifies the types of APHIS actions and projects for which programmatic environmental reviews and site-specific environmental analyses are necessary and normally prepared. Thus, APHIS-WS believes no additional regulations are needed to codify NEPA compliance.

Petitioners also request that APHIS-WS specify by regulation when environmental reviews must be updated. Existing CEQ regulations explain when environmental documents must be supplemented. See 40 CFR 1502.9(c).[28] This rule provides valuable and reliable guidance on when APHIS-WS must update its environmental reviews. Moreover, APHIS-WS makes a point to periodically review and evaluate its NEPA documents in order to determine if such documents need to be updated or otherwise revised or supplemented. The APHIS-WS Program Interim Specific Guidance for Environmental Compliance addresses when and how WS' NEPA documents should be reviewed and evaluated. Activities specified in environmental assessments are reviewed annually for applicability and accuracy of the documents and the need for further analysis and documentation due to new information or changes in activities. Monitoring reports of these reviews are prepared in accordance with APHIS Directive 5640.1, Environmental Monitoring in APHIS Programs.

5. Your Request for Notice and Comment Rulemaking for Rules governing Work Plans and Cooperative Service Agreements[29]

The Act of December 22, 1987 authorizes the Secretary of the United States Department of Agriculture (whose authority has been delegated to APHIS-WS) to "enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions." (426(c)). The Act of March 2, 1931, before it was amended in 2000, provided the identical "cooperative" authority. When the Act of March 2, 1931, was amended in 2000, it directed the Secretary of Agriculture to administer WS "in a manner consistent with all of the wildlife services authorities in effect on the day before October 28, 2000." Thus, both of WS' primary statutory authorities provide WS with the authority to enter into agreements to carry out its program activities. As petitioners note, many of WS activities are conducted through CSAs. These agreements are governed by the Federal Grant and Cooperative Agreements Act (31 U.S.C. 6301 et seq.). USDA has issued implementing regulations that, among other things, contain the general provisions that apply to all grants and cooperative agreements made by USDA agencies. (7 CFR Part 3015 et seq). APHIS has also issued WS Directive 3.101 to further govern its use of CSAs.

WS also has specific directives and established procedures governing the development of work plans. All agreements include a Financial Plan that provides for direct, indirect, and pooled costs, as indicated in WS Directive 2.215, Financial Control and Risk Management

[28] "Agencies... [s]hall prepare supplements to either draft or final environmental impact statements if: (i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or (ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." 40 C.F.R. § 1502.9(c).

[29] Petition at 40-41.

Directive. An example of a summary plan for costs is contained in enclosure (2) of the aforementioned directive. However, each agreement has some unique features, and the level of detail required to outline the tasks to be performed, or statement of work, and the associated costs, are typically memorialized in a narrative format.

As a Federal cooperative wildlife damage management agency, WS is authorized to enter into agreements with beneficiaries of services, and to collect funds to offset the costs incurred. Agreements with non-Federal agencies are memorialized in the form of CSAs; agreements with other Federal agencies are executed in accordance with the Economy Act, and memorialized in the form of Interagency Agreements (IAs). Our agreements comport with the procedural and substantive requirements outlined in the APHIS Agreements Manual. The APHIS Agreements Manual, Chapter 6, Exhibit 6-7, contains a table and an outline that aid in the development of CSA work plans. The topics in the table are not intended to be all inclusive, but to serve as a reference for items that should be discussed in development of the program narrative.

WS does not seek out cooperators; instead, cooperators request the assistance of Wildlife Services as the Federal program that is authorized to provide wildlife services, including wildlife damage management. There are many other service providers for wildlife damage management, both private and public. WS does not provide services for every cooperator who wishes to engage the program. WS has national priorities that include both High Priority Core Functions and Lower Priority Core Functions. The WS Deputy Administrator's office reviews every prospective cooperator—and the service(s)—they require, and provides its approval, as appropriate, based on whether performing the service(s) comports with WS' strategic priorities (USDA-APHIS-WS Strategic Plan (2013-2017)). Additionally, because some wildlife damage management issues are highly localized, the Deputy Administrator's office also considers State or local priorities, and whether those priorities contribute to mission and strategic imperatives.

APHIS-WS ensures that all of its agreements are in compliance and accordance with all of the applicable Federal, USDA, and APHIS laws, regulations, and policies. Likewise, WS also has specific directives and established procedures governing the development of all work plans related to its CSAs. Therefore, APHIS-WS does not agree with Petitioners that the existing statutory and regulatory scheme governing cooperative service agreements and work plans is insufficient to govern its agreements, and the agency does not agree that notice and comment rulemaking is needed for these topics.

6. **Your Request for Notice and Comment Rulemaking for Rules to make the agency fully transparent, including making agency documents routinely available and requesting that USDA and APHIS amend the FOIA implementing regulations at 7 C.F.R. Part 1 to maintain and make available seven categories of agency records[30]**

[30] Page 2 of cover letter, Petition at 40-41, 49-50

APHIS-WS utilizes a variety of opportunities to make its actions transparent. As a science-based, professionally managed program there are numerous controls over accountability to ensure that WS operations are effective and within the scope of existing Federal laws, regulations, directives and policies enacted at the program, Agency, Department, and government-wide levels.

Technology has allowed APHIS-WS to increase its transparency in recent years. APHIS-WS maintains a website that provides public access to a tremendous amount of information about various aspects of the WS program. Detailed information can be found about WS program areas including research, wildlife disease initiatives, airport wildlife hazard work, National Environmental Policy Act documentation, WS policy directives, program data reports, protected resources, T&E species work, integrated management approaches, and WS reports and publications. In 2014, WS implemented GovDelivery, an automated email and digital subscription-management system which allows the public to subscribe and receive information and updates from WS on program areas of interest. As of October 2014, a total of 2,144 interested people have already registered to receive program updates on the new WS GovDelivery site.

Further, APHIS-WS provides public access to program data on its website in the form of Program Data Reports. This data is collected through the WS Management Information System (MIS) which is used by WS field employees to report field activities. Program data is reviewed and certified by the WS State programs and Regional Offices before publishing by the WS Operational Support Staff (OSS) including the review and certification of MIS data and hazardous materials data from the Control Materials Information Tracking System by OSS and APHIS.

Additionally, the public is encouraged to review and provide comments on WS operational program-planning initiatives by participating in WS' NEPA processes. WS notices the public about public participation opportunities through its web site, newspaper notices, individual letters to interested parties, GovDelivery, and, in the case of national-level proposals, the Federal Register. WS makes sure to provide the public with the opportunity to review and comment on all WS draft environmental assessments and draft environmental impact statements. All public comments are reviewed and considered and, as appropriate, changes are made to proposed actions based on public comments or suggestions.

APHIS-WS is committed to and actively involved in providing program information requested through the FOIA. During 2012 and 2013, WS responded to 239 FOIA requests requiring 7,397 search hours and provided 349,000 pages of responsive records on WS operations and research.

WS accountability is monitored in many ways, from supervisory controls in the form of individual employee performance plans and semi-annual supervisory reviews to scheduled internal State program reviews by headquarters and regional office officials and periodic reviews by the USDA Office of the Inspector General or other regulatory agencies. Periodic field inspections, program audits, report monitoring, and customer feedback help to ensure program compliance with applicable laws, regulations, and policies. See the WS Policy Manual at http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/wildlifedamage

WS Policy Directives are updated regularly and new policies added when needed to enhance accountability. Recurring employee training provided in many program areas at the State program level and national level emphasizes accountability as well as job effectiveness. Examples include training courses in NEPA and ESA, firearms safety and efficiency, airport wildlife hazards assistance, explosives safety and certification, field methods applications, pesticide use and security, immobilization and euthanasia drug certification, computer and information security, and Management Information System applications.

In conducting field operations, WS personnel operate within the boundaries of applicable Federal, State, and local laws and regulations (WS Directive 2.210, Compliance with Federal, State, and Local Laws and Regulations). WS activities are also conducted under formal agreements with landowners and also often with a Memorandum of Agreement or Memorandum of Understanding.

As Petitioners recognize, USDA has regulations implementing FOIA.[31] These regulations detail public access to certain materials (7 CFR 1.4); how to request records (1.5); Agency response to requests for records (7 CFR 1.7); appeals (7 CFR 1.14); and general provisions respecting the release of records (7 CFR 1.15). APHIS also has its own implementing regulations that further detail the procedures by which the public can obtain APHIS records (7 CFR 370). APHIS-WS believes these regulations are valid and fully implement FOIA. Additionally, APHIS maintains an eFOIA reading room at http://www.aphis.usda.gov/, which provides online access to documents specifically identified for inclusion by the FOIA, as well as documents for which APHIS has received multiple FOIA requests.

[31] Petition at 49, citing 7 CFR 1.

Exhibit 4

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Lethal control of an apex predator has unintended cascading effects on forest mammal assemblages

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Disruption to species-interaction networks caused by irruptions of herbivores and mesopredators following extirpation of apex predators is a global driver of ecosystem reorganization and biodiversity loss. Most studies of apex predators' ecological roles focus on effects arising from their interactions with herbivores or mesopredators in isolation, but rarely consider how the effects of herbivores and mesopredators interact. Here, we provide evidence that multiple cascade pathways induced by lethal control of an apex predator, the dingo, drive unintended shifts in forest ecosystem structure. We compared mammal assemblages and understorey structure at seven sites in southern Australia. Each site comprised an area where dingoes were poisoned and an area without control. The effects of dingo control on mammals scaled with body size. Activity of herbivorous macropods, arboreal mammals and a mesopredator, the red fox, were greater, but understorey vegetation sparser and abundances of small mammals lower, where dingoes were controlled. Structural equation modelling suggested that both predation by foxes and depletion of understorey vegetation by macropods were related to small mammal decline at poisoned sites. Our study suggests that apex predators' suppressive effects on herbivores and mesopredators occur simultaneously and should be considered in tandem in order to appreciate the extent of apex predators' indirect effects.

1. Introduction

Globally, apex predators play a vital role in the functioning of ecosystems, and their importance has been underestimated because their effects often only become evident after they have been removed from ecosystems [1,2]. Apex predators typically have conspicuous effects on the populations and phenotypes of prey and smaller predators (mesopredators) that arise from direct killing and the fear they instil [3–5]. The disruption to species-interaction networks caused by the irruptions of herbivores and mesopredators that frequently accompanies the loss of apex predators can trigger regime shifts that result in the reorganization of species assemblages [2,6] and has been identified as a key driver of biodiversity loss [1]. Consequently, restoration of apex predator populations and the ecosystem services they provide has been highlighted as a critical imperative for the conservation of biodiversity [7].

While predators' direct effects are readily observed, they can also propagate a myriad of indirect effects because species that interact with their herbivorous prey and mesopredators are likely to be affected by the removal or introduction of an apex predator [1,8]. Trophic cascade theory predicts that the suppression of apex predators' effects will result in the irruption of herbivores and subsequent depletion of plant biomass [9]. A related concept, the mesopredator release hypothesis, predicts that the removal of apex predators leads to the irruption of mesopredators with concomitant declines in the abundances of their prey owing to elevated rates of predation by mesopredators [10]. Despite the existence of theory and field studies showing that apex predators can influence ecosystem structure through a multitude of interaction pathways, most studies have considered apex predators' effects on herbivores and mesopredators and associated ecological cascades in isolation [1]. Few studies have considered how irruptions of herbivores and mesopredators could have interactive effects on other species [11]. Consequently, our appreciation of the magnitude, complexity and extent of apex predators' effects on ecosystems may not be fully realized.

Although it is widely acknowledged that vertebrate predators in terrestrial ecosystems can regulate populations of their prey [12], debate exists regarding the relative strength and even the existence of their indirect effects [13]. One reason for this debate is that relatively few studies have attempted to quantify the indirect effects of mammalian apex predators [9,14] because the temporal and spatial scales required to conduct controlled experiments on large carnivores are logistically prohibitive [14]. Moreover, in many jurisdictions legal and ethical considerations often prevent manipulations of their abundance. Another reason for the paucity of studies on large predators in terrestrial ecosystems is that they have been extirpated from much of their former ranges [15]. Hence, there are few places where studies can be undertaken to investigate their ecological effects.

One way to advance knowledge of the role of large predators is to use 'natural experiments' whereby the abundance of apex predators vary in time or space in otherwise similar landscapes [4,6,16]. If properly conducted, such studies can provide valuable insights into ecological processes at spatial and temporal scales that cannot be achieved through experimentation. In the forested landscapes of southeastern Australia, the existence of long-term eradication programmes that aim to reduce the impacts of Australia's largest terrestrial predator, the dingo (*Canis dingo*, also known as wild dog; 12–22 kg), on livestock provides the opportunity to conduct a 'large-scale' natural experiment to examine the role that apex predators have in structuring ecosystems. In eastern New South Wales, dingo populations are controlled in many but not all conservation reserves by distributing baits impregnated with the toxin sodium fluoroacetate (compound 1080) [17]. This variation in the intensity of dingo control thus permits comparisons to be made of ecosystem attributes in nearby ecosystems where dingoes are common and rare, respectively. In this context, the term 'dingo' refers to both dingoes and dingo–domestic dog (*Canis familiaris*) hybrids [11].

Relatively little is known about the dingo's ecological role in the forests of southeastern Australia, although there is evidence that they can suppress the populations of macropods and red foxes [18,19]. In arid regions, dingoes' influence on the abundances of mammal species scales with body size. Dingoes suppress the abundances of macropods (more than 15 kg) and the smaller red fox (*Vulpes vulpes*) (3.5–8 kg) [20]. In turn, where dingoes are common, small mammals (less than 200 g) increase in abundance owing in part to release from predation by foxes [11]. Also, as predicted by trophic cascade theory, the removal of dingoes results in the depletion of pasture biomass owing to an increase in herbivore grazing impact [20]. Theory and results of predator studies from other continents suggest that dingoes' ecological effects may be weaker or more focused in higher-productivity forest ecosystems than in desert ecosystems [4,21]. This is because the greater complexity of ecosystems that accompanies increases in primary productivity may be expected to diffuse predators' impacts across a greater number of interaction pathways [11,22].

Applying trophic cascade theory, the mesopredator release hypothesis and existing knowledge of dingoes' effects on other species, we predicted that the effect of dingo suppression on other mammals in forest ecosystems should alternate with trophic group and scale with body size [11]. Our specific predictions were: (i) that abundances of herbivorous macropods (*Macropus* spp.; *Wallabia bicolor*; 15–64 kg) and smaller invasive mesopredators, the red fox (3.5–8 kg) and feral cat (*Felis catus*; 2.5–6.5 kg), should increase in areas where dingo populations are controlled because they would experience less predation or harassment; (ii) smaller ground-dwelling mammals—bandicoots (700–1500 g), rodents (15–200 g) and dasyurid marsupials (20–100 g)—should increase where dingoes were not controlled owing to reduced predation and habitat disturbance from mesopredators and macropods, respectively; (iii) for arboreal mammals, possums (975–2400 g) should increase in baited areas because they are subjected to predation by dingoes, but gliders (120–1300 g) should show little response to dingo control because they occur relatively infrequently in the diets of dingoes and other ground-dwelling predators; and (iv) that the complexity of understorey vegetation structure should decrease in areas subjected to dingo control owing to increased consumption from large herbivores. We tested our predictions by comparing the activity or abundance of all groups and the species composition of the mammal assemblages at seven paired locations in forested conservation reserves in southeastern Australia. Each pair consisted of an area subjected to systematic dingo removal and a control area, with similar environmental attributes, where consistent dingo control was not undertaken. We pooled the results from our paired comparisons using meta-analysis to determine the effects of dingo control on the response variables. We then used structural equation modelling (SEM) to further investigate the hypothesized direct and indirect relationships among the response variables.

2. Material and methods

(a) Study sites

This study was conducted in the *Eucalyptus* spp.-dominated forest ecosystems of New South Wales, southeastern Australia (figure 1). The main technique used by government authorities to suppress dingo populations is the distribution of poisoned meat baits containing 6 mg of the toxin sodium fluoroacetate (compound 1080) [17]. The baits are typically distributed along unsealed dirt roads or from the air via helicopter or light aeroplane. In some places, baiting is complemented by trapping of dingoes.

Each of our seven study areas consisted of a pair of sub-sites located less than 50 km apart (electronic supplementary material, table S1). Each sub-site pair consisted of a site where dingo control had been undertaken at least once each year for at least 5 years prior to our surveys, and a comparison site that had not been subjected to consistent dingo control. All sites were situated within conservation reserves managed by the New South Wales National Parks and Wildlife Service, with each paired sub-site surveyed within the same two-week period and season. Paired sub-sites were selected on the basis that they shared the same dominant overstorey *Eucalyptus* species [23] and had similar underlying geology and landforms.

(b) Mammal abundance and vegetation assessments

At each sub-site, we measured the activity of predators (*Canis dingo*, *Vulpes vulpes*, *Felis catus*) and bandicoots using 20 track detection stations, placed at 500 m intervals along unpaved vehicle tracks with washed sand spread across the track at a width of 1 m

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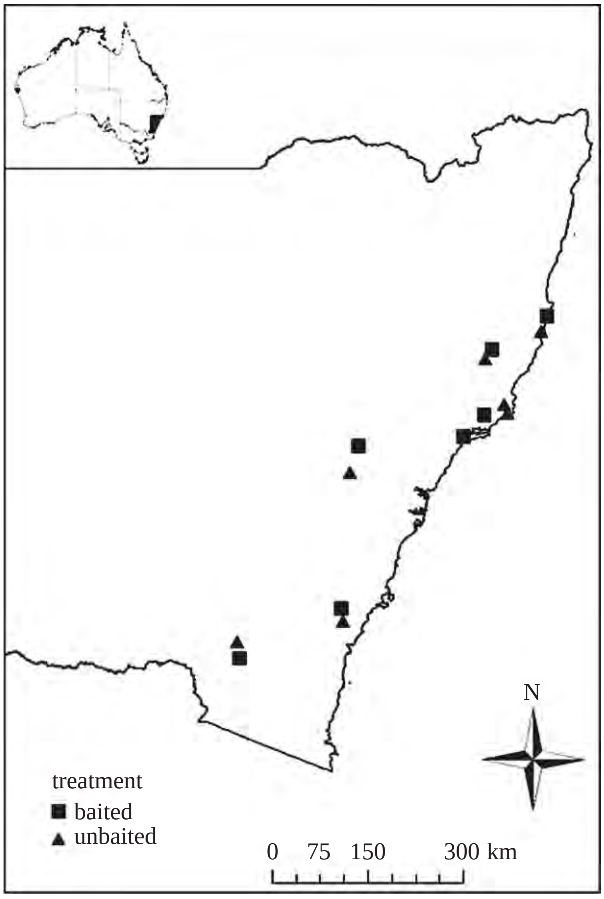

Figure 1. Study site locations in New South Wales, southeastern Australia. Each location consisted of a conservation reserve where dingoes were controlled using poison baiting (squares) and a conservation reserve where dingoes were not subjected to poison baiting (triangles).

[24]. To determine whether rain had potentially erased tracks during the course of the evening, an intentional mark was made in the left-hand corner each afternoon. Plots were determined to be unreadable if the unique mark was obscured when the plot was examined the following morning. Animal footprints were identified for three nights. Owing to the difficulty in identification between bandicoot species (*Perameles nasuta*/*Isoodon macrourus*), these tracks were recorded as bandicoot in accordance with Catling & Burt [25]. An index of activity for each species at each site was expressed as the percentage of plots on which the tracks were detected during the three-night tracking session [20].

We assessed the abundances of macropods by counting the number of kangaroos (*Macropus giganteus*) and wallabies (*Macropus rufogriseus* and *Wallabia bicolor*) sighted during two to four transect surveys conducted along single lane dirt tracks within each sub-site [26]. During surveys, two observers seated in a four-wheel drive vehicle visually scanned the habitat while moving at a speed of 15 $\mathrm{km\,h^{-1}}$. Two to four replicate surveys were performed on a different track at a distance of 5–15 km [26]. The surveys were conducted in the hour preceding dusk. An index of macropod abundance on each survey transect was calculated as the number macropods sighted per kilometre of survey.

The abundance of arboreal mammals—possums (*Trichosurus vulpecula* and *Pseudocheirus peregrines*) and gliders (*Petaurus breviceps* and *Petauroides volans*)—was assessed using two to four 3–16 km spotlight transects at each sub-site. The surveys were conducted at night from the back of a four-wheel-drive utility vehicle along single-lane dirt tracks using a 100-watt spotlight. The vehicle was driven at a speed of 10 $\mathrm{km\,h^{-1}}$. An index of abundance for each survey was calculated as the number of animals observed per kilometre of survey [27].

Small mammal abundance was assessed over three consecutive nights on seven to eight 1 ha trapping grids within each sub-site. Because time since last fire can influence the abundance of small mammals, we did not place study grids in areas that had been burnt less than 3 years previously, as informed by records provided by the Rural Fire Service of New South Wales. On each grid, we placed 24 Type A Elliott traps (Elliott Scientific Equipment, Upwey, Australia), baited with a mixture of peanut butter, oats and honey, 20 m apart. We identified the small mammals to species level and temporarily marked them to identify recaptures. Indices of rodent abundance (*Pseudomys novaehollandiae*, *Mus musculus*, *Rattus fuscipes*, *R. lutreolus*, *Mastacomys fuscus* and *R. rattus*) and dasyurid (*Antechinus stuartii*, *A. swainsonii* and *A. agilis*) abundance at each sub-site were calculated as the mean number of unique individuals per 100 trap nights. For SEM, we calculated the abundance of all small mammals as the sum of rodent and dasyurid abundance on each trapping grid.

The intensity of herbivory by macropods on each trapping grid was estimated by scoring the presence of groups of recent macropod dung on two 1×100 m belt transects on each study grid [26,28,29]. An index of macropod grazing intensity was calculated for each grid as the mean number of macropod scats per grid.

We assessed the complexity of the understorey vegetation of each trapping grid by sampling within four 5×5 m quadrats. Within each quadrat, we recorded the percentage of a 20×50 cm chequered coverboard obscured by vegetation within five strata (0–20, 20–50, 50–100, 100–150 and 150–200 cm) above ground level [30]. For meta-analyses, we calculated two variables for analysis by summing our observations in the strata between 0–100 and 100–200 cm. For the SEM, we calculated a single vegetation structure variable by summing the observations for the entire 0–200 cm strata.

Because fire and recent rainfall are known to influence the structure of understorey vegetation [31], we obtained data on the average cumulative rainfall received at each sub-site for 2 years prior to trapping from the Australian Bureau of Meteorology, and the fire history of each trapping grid from the New South Wales Rural Fire Service. These variables were used as predictor variables in SEM described later.

(c) Statistical analyses: meta-analysis

As the dominant vegetation communities of the sites differed and each was sampled at a different time, we treated each site as an independent comparison of the effect of systematic dingo population control and pooled the results of these comparisons using a meta-analytic approach [20]. Specifically, we used a random-effects meta-analysis to test our *a priori* hypotheses regarding the effects of dingo control on the measured response variables. This approach allowed us to determine whether the biological effects of dingo control were consistent among sites and that the mean effect of dingo removal differed significantly from zero [20,32]. A random-effects model was used because we expected the effects of dingo control to vary among sites owing to differences in the intensity of poison baiting and the longevity of the baiting programme (electronic supplementary material, table S1). We used the log response ratio as the metric of effect size [33]. To avoid the problems of taking logs of zero or dividing by zero, comparisons were made on $\ln[(N_{\mathrm{control}} + 0.01)/(N_{\mathrm{treatment}} + 0.01)]$ [33,34]. Tests for homogeneity of the effect sizes were conducted using the Q-statistic. The mean effect size was considered statistically significant if the bias-corrected bootstrapped 95% CIs calculated from 999 simulations excluded zero [32]. Analyses were undertaken using METAWIN v. 2 [35].

(d) Structural equation modelling

SEM can be used to investigate the direct and indirect relationships between variables in trophic networks based on *a priori* knowledge of interactions theorized to occur between species [36]. We used piecewise SEM based on information theoretic principles to test hypotheses to explain the inter-relationships between the response variables, fire history and rainfall (figure 3*a*; electronic supplementary material, tables S1 and S2). We constructed our *a priori* SEM model based on trophic cascade theory, the mesopredator release hypothesis, and prior knowledge of the factors influencing vegetation structure and the abundances of forest mammals (see Model justification). Unlike classic SEM, which uses covariance matrices, piecewise SEM uses localized estimates to infer direct and indirect effect pathways [37,38]. Piecewise methods allow for the modelling of data that struggle to meet the assumptions of classic SEM analysis, or for the incorporation of exogenous factors into models such as spatial dependence [38]. All localized estimates within our SEM were fitted using generalized linear mixed-effects models with a Poisson or negative binomial distribution, except for the vegetation complexity model, in which case we used a linear mixed-effects model with a Gaussian distribution. To account for biogeographic and temporal variation between sites, site was treated as a random factor in all models. Our initial model was populated with mean values obtained for each sub-site for data using track plots and spotlight surveys (e.g. baiting, dingo activity, fox activity, cat activity, arboreal mammal activity, bandicoot activity; $n = 14$) and with values obtained for each trapping grid for the variables macropod grazing activity, vegetation structure, small mammal abundance and average rainfall over 2 years and time since fire; $n = 111$). We used a backwards step-wise elimination process for model simplification, whereby non-significant pathways were sequentially deleted from models until only significant interaction remained [38]. Standardized path coefficients and deviance explained were then calculated for each model [37].

(e) Model justification

The interaction pathways between variables were determined by *a priori* knowledge and included the following hypothesized pathways (figure 3*a*). Dingo baiting should negatively affect both dingo and fox activity as even though the control programmes targeted dingoes, it is possible that both species consume baits impregnated with 1080 poison and both species have been observed to decline following baiting programmes [39]. Dingo activity should negatively affect fox activity owing to direct killing or competitive exclusion [19,40]. Cat activity was hypothesized to be affected negatively by dingo and fox activity but not by baiting because cats rarely take baits [41,42]. Dingo and fox activity were hypothesized to negatively affect macropod grazing intensity by suppressing macropod abundance through direct predation [18,43]. Macropod abundance determined by driving surveys was omitted from the SEM because dung count is a proxy measure of abundance [26]. Fox and cat activity were hypothesized to negatively affect small mammal and bandicoot abundance and activity, respectively, owing to predation [44]. Dingo activity and fox activity were hypothesized to negatively affect possums owing to predation but to have little effect on glider because they rarely occur in the diets of terrestrial predators [39,44]. Time since fire was hypothesized to positively affect arboreal possums and gliders, as a previous study has demonstrated negative effects of fire on arboreal mammals [45]. Defoliation resulting from grazing by macropods was hypothesized to have a negative effect on understorey vegetation structure [46]. Rainfall was hypothesized to positively affect understorey vegetation by promoting plant growth [31]. Time since fire was hypothesized to have a negative effect on understorey vegetation cover at our sites, which were aged more than 3 years post-fire, because a previous study has shown that the density of ground cover vegetation initially increases until about 6 years post-fire before decreasing with time since fire [47]. Vegetation structure was hypothesized to positively affect small mammal abundance and bandicoot activity as previous studies have observed small mammal abundance to increase with increasing understorey complexity [48,49].

3. Results

(a) Paired site comparisons

Confirming the effectiveness of poison baiting at reducing dingo populations, dingo activity was on average greater in unbaited than in baited sub-sites (figure 2*a*; $Q = 5.02$, d.f. = 6, $p = 0.541$). Fox activity was consistently lower at unbaited sub-sites (figure 2*a*; $Q = 7.43$, d.f. = 5, $p = 0.190$). Cat activity was unaffected by the dingo baiting (figure 2*a*; $Q = 5.81$, d.f. = 6, $p = 0.445$). Macropod abundance was consistently greater in abundance in baited sub-sites (figure 2*a*; $Q = 3.81$, d.f. = 6, $p = 0.703$). Possums (figure 2*a*; $Q = 5.88$, d.f. = 6, $p = 0.437$) and gliders were detected more frequently at baited sites (figure 2*a*; $Q = 5.65$, d.f. = 6, $p = 0.463$). The activity of bandicoots was unaffected by baiting (figure 2*a*; $Q = 5.32$, d.f. = 5, $p = 0.378$), while abundance of ground-dwelling rodents (figure 2*a*; $Q = 7.67$, d.f. = 6, $p = 0.263$) and dasyurid marsupials (*Antechinus* spp.; figure 2*a*; $Q = 4.68$, d.f. = 6, $p = 0.586$) was greater in unbaited areas.

Grazing activity of macropods, as estimated by counts of dung, was consistently higher in baited areas (figure 2*a*; $Q = 5.46$, d.f. = 6, $p = 0.486$). The density of understory vegetation between 0–100 cm (figure 2*a*; $Q = 6.70$, d.f. = 6, $p = 0.350$) and 100–200 cm (figure 2*a*; $Q = 4.19$, d.f. = 6, $p = 0.651$) above ground level was on average greater in unbaited than in baited sub-sites.

(b) Structural equation modelling

The variable rainfall was excluded from the final SEM model. Excluded pathways were between dingo activity and fox activity, dingo/fox activity and cat activity, and dingo, fox and cat activity with bandicoot activity. All other variables were included within the final SEM explaining vegetation structure and small mammal abundance (figure 3*b*). Dingo baiting was correlated negatively with dingo activity, but, counter to our *a priori* SEM model, was correlated positively with fox activity (Fig. 3*b*). In accordance with the *a priori* SEM model, dingo activity was correlated positively with small mammal abundance, and fox activity was correlated negatively with small mammal abundance (figure 3*b*). Thus, dingo baiting had a negative indirect relationship on small mammal abundance mediated through both dingoes and foxes. Cat activity was unaffected by dingo and fox activity, and, counter to our *a priori* SEM model, had a positive relationship on small mammal abundance. Dingo activity also as hypothesized had a weak negative correlation with possum activity. Glider activity was positively correlated with fox activity and time since fire.

In line with our *a priori* SEM model, dingo activity was correlated negatively with macropod grazing activity. In turn, macropod grazing activity and time since fire were correlated negatively with vegetation structural complexity. Also in line with our expectations, vegetation structural complexity was correlated positively with small mammal abundance and bandicoot activity (figure 3*b*). Thus, dingo baiting had a negative indirect relationship on small mammal abundance and bandicoot activity mediated through dingo activity, macropod grazing activity and vegetation structure.

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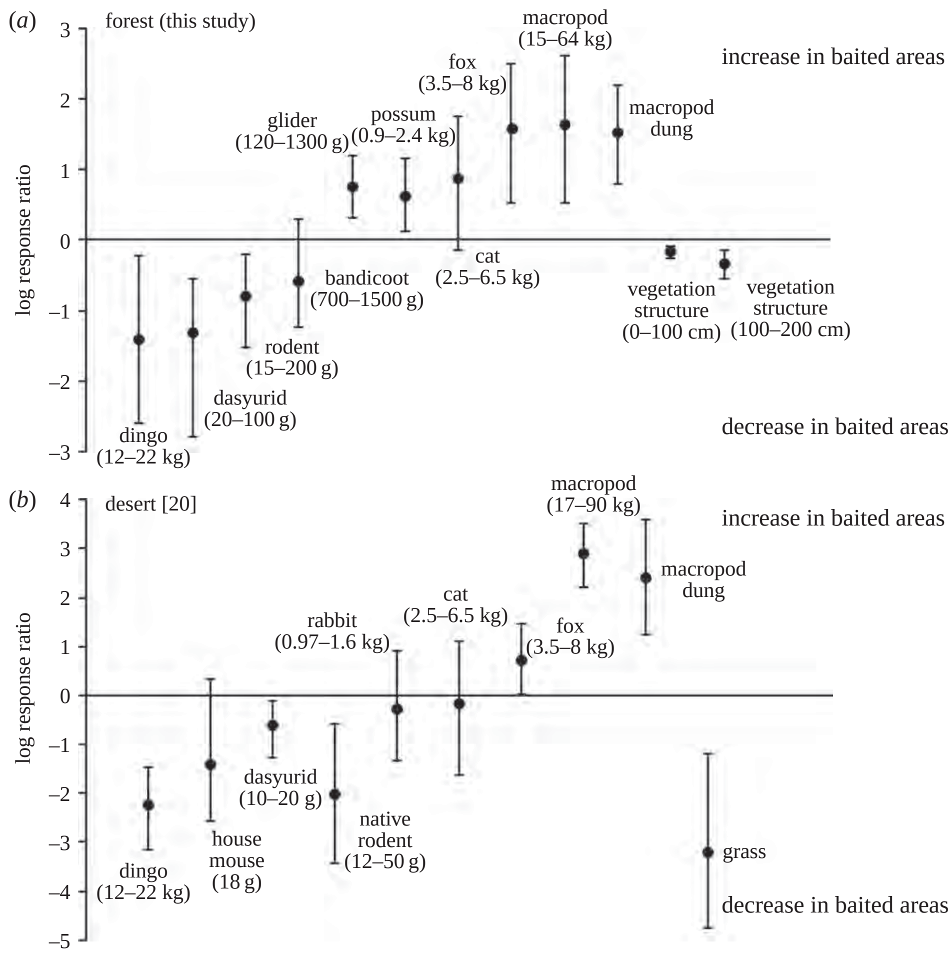

Figure 2. (*a*) The mean effect size (log response ratio) of dingo control ±95% bias-corrected bootstrapped confidence intervals (CIs) on each of the study variables in this study and (*b*) from a study of the effects of dingo removal on desert ecosystems in Australia (adapted from [20]). Negative values indicate variables that decreased in the absence of dingoes; positive values indicate variables that increased in the absence of dingoes. The mean effect size was considered statistically significant if the 95% CIs excluded zero. Values in parentheses indicate the body size range of species that contributed to each variable.

4. Discussion

(a) Ecological cascades induced by dingo control

Our results demonstrate marked differences in the relative abundances of mammals and the complexity of understorey vegetation between areas with consistent dingo removal compared to those without. These differences accorded well with our *a priori* predictions generated from trophic cascade theory and the mesopredator release hypothesis. Our results (figure 2*a*) were also remarkably consistent with previous studies undertaken in desert (figure 2*b*) and forest biomes in Australia that have found negative relationships between the presence of dingoes and the abundances of macropods and foxes [11,18,19] and positive relationships between the abundances of dingoes and small mammals [50]. In summary, our findings are consistent with the idea that large mammalian carnivores can function as keystone species owing to their direct suppressive effects on herbivores and mesopredators, and that ecological cascades induced by their removal result in the reorganization of ecosystems [5].

In common with previous studies on the effects of mammalian carnivores, our study used a pre-existing land-management framework, the presence or the absence of dingo population control, for the experimental treatment [6,20]. During the design of our study, we matched our paired sub-sites as closely as possible for vegetation type, underlying geology, land use and recent fire history, but without having conducted a manipulative experiment causation remains difficult to attribute as it remains possible that confounding factors could have influenced our results. One potential weakness of our study was that long-term fire regimes of the paired sub-sites were unlikely to have been identical as we could only control for contemporary land use and the occurrence of recent fires. However, given the concordance between the results and our *a priori* predictions generated from theory, as well as previous studies investigating the effects of dingo control (figure 2*a*,*b*), we contend that it is unlikely that any other source of variation, other than the presence/absence of dingo control, could have caused the consistent effects that we observed with respect to trophic group and body size.

Trophic cascade theory, the mesopredator release hypothesis and previous field studies suggest that apex predators can function as ecosystem architects by propagating cascades of direct and indirect effects on species at lower trophic levels. Indirect effects can arise if apex predators moderate the top-down effects of herbivores and mesopredators [5,11]. The most parsimonious structural equation model (figure 3*b*) provides support for the hypothesis that the negative responses of vegetation structural density, small mammals and bandicoots to dingo control were indirect effects of predator suppression and that these effects occur simultaneously. Specifically, our SEM provided support for the following hypotheses. (i) Predation by dingoes reduced macropod grazing activity, which in turn simplifies the structure of understorey vegetation [46]. The ensuing simplification of vegetation results in lower

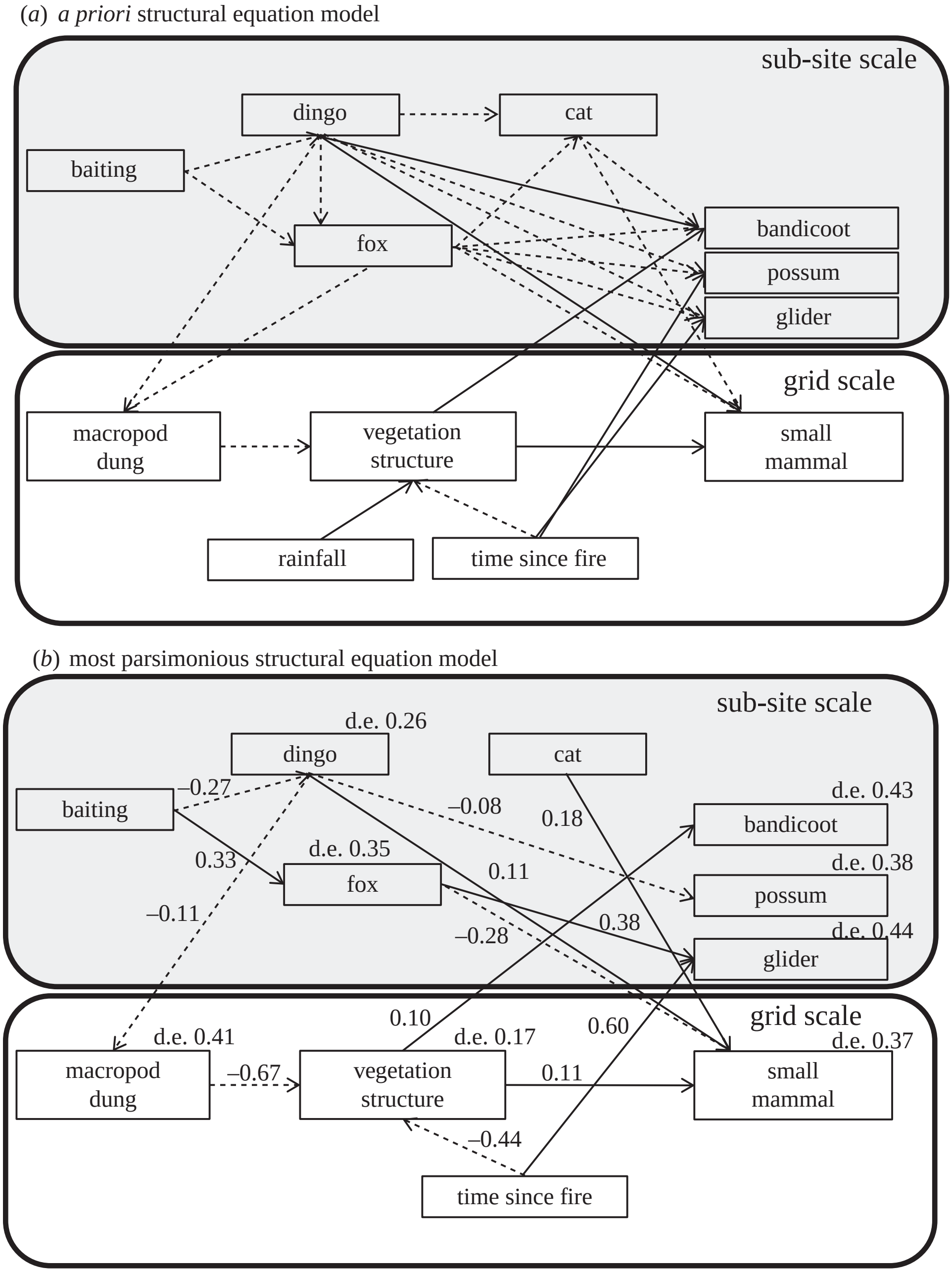

Figure 3. (*a*) *A priori* piecewise structural equation model describing small mammal responses to dingo baiting in *Eucalyptus* spp. forests of eastern Australia. (*b*) Most parsimonious structural equation model showing direct and indirect interaction pathways influencing small mammal abundance. Path co-efficient estimates are shown alongside arrows and deviance explained (d.e.) is shown for all endogenous variables. Dashed lines represent negative interaction pathways, and solid lines represent positive interaction pathways. Grey polygons show sections of the structural equation model sampled at the sub-site scale ($n = 14$), and white polygons show sections of the structural equation model sampled at the grid scales ($n = 111$).

abundances of ground-dwelling small mammals and bandicoots which require dense vegetation for shelter [48]. (ii) Dingo control reduced dingo activity but increased fox activity, presumably because fox populations increase where dingo control is undertaken (figure 2). Abundant foxes would then have a negative impact on small mammals because of increased levels of predation (figure 3*b*).

These findings suggest that apex predators' suppressive effects on herbivores and mesopredators can have interactive effects on other species and should be considered in tandem in order to appreciate the extent of apex predators' indirect effects. We caution, however, that controlled experiments are required to test these hypotheses.

The absence of a significant correlation between dingo and fox activity obtained in the SEM was unexpected, because previous studies have found evidence for negative correlations between indices of dingo and fox abundance [11,19]. While it is possible that dingoes only have negligible effects on fox abundance/activity or that baiting aimed at dingoes suppressed populations of both dingoes and foxes, our meta-analysis does not support these explanations and showed that, in accordance with our predictions, fox activity was greater at baited sites. The negligible correlation observed in the SEM may have been due to the relatively low power of this test, which was conducted at the scale of sub-site ($n = 14$). Further studies are recommended to explore the interactions between dingoes and foxes in forest environments.

Although our results are in accordance with the mesopredator release hypothesis and previous studies demonstrating that fox activity was greater in areas where dingoes were subjected to population control [19], dingo control had no effect on cat activity. In addition, contrary to our prediction, cat activity was correlated positively with small mammal abundance. These findings are not inconsistent with those of previous studies, which have reported positive, neutral and negative relationships between dingo activity and cat activity, and positive relationships between cat activity and small mammal abundance [8,42,51]. Taken together, the results of our study and previous studies suggest that cat activity may be influenced by both the abundances of larger predators and the availability of their prey.

Our meta-analysis showed that, as predicted, semi-arboreal possums responded positively to dingo control, but counter to our predictions, strictly arboreal gliders also responded positively to dingo control. The SEM showed that dingoes were negatively associated with possums, which is consistent with dietary studies showing that possums are frequently consumed by dingoes [39]. The positive correlation evident in the SEM between fox and glider lends support to a hypothesized indirect trophic interaction mooted by Dexter [52], whereby suppression of foxes results in an increase in the abundances of species frequently preyed on by large owls. Subsequent increases in owl abundance and predation may then lead to the suppression of gliders. The positive correlation between gliders and time since fire is consistent with the results of previous studies showing that fires can suppress their abundances [45,49].

(b) Unintended effects of dingo control and the management of forest ecosystems

Disturbance by fire is an important factor influencing plant and animal assemblages in the forested landscapes of southeastern Australia [49,53]. Consequently, much research on forest mammals in Australia has focused on how fire, particularly through its effects on vegetation structure, influences the species abundances and community composition [45,47,49,53]. However, there has been growing awareness of the influence that predation by terrestrial predators can have on forest ecosystems through both their direct predatory effects and indirectly by influencing grazing pressure [46,47,54].

Our study has implications for the management of forest ecosystems, because it provides evidence that ecological cascades induced by the lethal control of an apex predator can produce unintended shifts in the composition of species assemblages and vegetation structure. In the forests of southeastern Australia, where this study was undertaken, the control of dingo populations is associated with the reorganization of mammal assemblages whereby relatively large-bodied species, such as macropods and red foxes, and arboreal mammals benefit from dingo control while small-bodied terrestrial mammal species decline in abundance.

Predation by foxes has been identified as one of the major (if not the most important) threatening processes to terrestrial native mammals weighing less than 5 kg and ground nesting birds in Australia [55]. If dingo control releases foxes from top-down control by dingoes it will probably exacerbate the predatory impact of foxes [50]. In addition, increased macropod abundance and subsequently grazing pressure in areas where dingoes are controlled may also have suppressive effects on small mammals by simplifying the structure of understorey vegetation [56]. Such changes could affect small and medium-sized terrestrial mammals by removing their preferred shelter habitats and increasing their exposure to predators.

The broad-scale benefits that dingoes appear to provide for ground-dwelling small and medium-sized mammals provides evidence that dingo control programmes in conservation reserves may be counter-productive from a biodiversity conservation perspective. Indeed, the results of this and other studies suggest that actively seeking to maintain dingo populations or restoring them in areas where they have previously been extirpated has potential to be used as a strategy to mitigate the impacts of herbivores and foxes [11,55]. However, such strategies are likely to be controversial owing to the adverse impacts that dingoes can have on livestock producers. Further research is required to develop management strategies that can allow both for the maintenance of ecologically effective dingo populations while simultaneously minimizing their impacts on livestock producers.

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Data accessibility. Data files containing necessary data to perform meta-analysis and structural equation model are included in the electronic supplementary material, S1 and S2.

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Exhibit 5

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Carnivore conservation: shifting the paradigm from control to coexistence

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For 90 years, the American Society of Mammalogists (ASM) has made science-based challenges to widespread lethal control of native mammals, particularly by the United States federal government targeting carnivores in the western states. A consensus is emerging among ecologists that extirpated, depleted, and destabilized populations of large predators are negatively affecting the biodiversity and resilience of ecosystems. This Special Feature developed from a thematic session on predator control at ASM's 2013 annual meeting, and in it we present data and arguments from the perspectives of ecology, wildlife biology and management, social science, ethics, and law and policy showing that nonlethal methods of preventing depredation of livestock by large carnivores may be more effective, more defensible on ecological, legal, and wildlife-policy grounds, and more tolerated by society than lethal methods, and that total mortality rates for a large carnivore may be driven higher than previously assumed by human causes that are often underestimated.

Key words: carnivores, depredation, nonlethal control methods, predator control

> "…this is why the caribou and the wolf are one; for the caribou feeds the wolf, but it is the wolf who keeps the caribou strong."
>
> Eskimo legend as told to Farley Mowat (Mowat 1973:85)

This Special Feature developed from a special thematic session on mammalian predator control at the 94th annual meeting of the American Society of Mammalogists (ASM) held in June 2013 in Philadelphia. Sponsored by the ASM Conservation Committee, the thematic session explored a range of perspectives—from wildlife managers, carnivore biologists, and sociologists—on issues of managing human conflicts involving native large carnivores. For 90 years, ASM has presented science-based critiques of lethal control of native wildlife—particularly large carnivores—by the United States federal government, starting with its 1st published Society resolution (Jackson 1924) and continuing to the present (ASM 2012; others reviewed in Bergstrom et al. 2014). Additionally, prominent early ASM members, including Aldo Leopold, C. Hart Merriam, and E. Raymond Hall, individually published letters stating that lethal control of large carnivores, particularly in the western United States, was driven by politics rather than science and was excessive in its direct effects on targeted as well as nontargeted species of native mammals (Bergstrom et al. 2014). These concerns by early 20th century mammalogists were well founded, given that, first, grizzly bears (*Ursus arctos horribilis*), and then, by the 1930s, gray wolves (*Canis lupus*) were extirpated from the western contiguous states by private and government agents (Robinson 2005).

The 1973 Endangered Species Act (16 U.S.C. 1531–1544, 87 Stat. 884, as amended—Public Law 93–205) alleviated concerns of American mammalogists that their government would allow or directly cause extinction or wide-scale extirpations of native mammals. However, in the United States as well as globally, most large carnivores have experienced substantial range contractions and population reductions; in fact, the American black bear (*Ursus americanus*) is the world's only large terrestrial carnivore species that has a global population of more than 200,000 and is one of the very few whose population trend is not "decreasing" (Ripple et al. 2014). Even in areas still occupied by large carnivores, predator removal locally in less-developed landscapes causes concern about nontarget mortality of certain rare species and indirect effects on biodiversity and ecosystem function from disruption of "top-down forcing" (sensu Estes et al. 2011; Bergstrom et al. 2014). In the United States, legal public harvest takes 2.5 million native carnivores annually (Association of Fish and Wildlife Agencies 2014). Additional human-caused mortality of carnivores due to poaching and road-kill is hard to quantify but may be higher than commonly assumed. Vehicles on roads, for example, have killed 13% of the gray wolf (*C. lupus*) population annually in Wisconsin (Treves et al., this issue). Lethal control of large carnivores in the United States by professional federal, state, and private agents constitutes a fraction of the total human-caused mortalities nationwide, but they are done primarily to benefit livestock producers in western states, often intensely at a very local scale (e.g., 884 coyotes [*Canis latrans*] killed on a single ranch in Nevada in a 2-year period by aerial gunning—Knudson 2015), and they can result in removal of 1 or more carnivore species from local ecosystems (Bergstrom et al. 2014).

Wildlife Services, a division of the United States Department of Agriculture's Animal Plant Health Inspection Services, is tasked by law "to provide Federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist" (Wildlife Services 2015). Wildlife Services' research scientists do important studies on nonlethal methods of reducing carnivore–livestock conflict (e.g., Stone et al., this issue), but its field operations in the western United States have been criticized for their over-reliance on lethal means of resolving wildlife conflicts with livestock (Government Accountability Office [GAO] 1995; Niemeyer 2010; ASM 2012; Bergstrom et al. 2014). In Fiscal Year 2013, Wildlife Services killed > 75,000 coyotes (not counting 366 dens destroyed), 320 gray wolves, 345 cougars (*Puma concolor*), 3,546 red and gray foxes (*Vulpes vulpes* and *Urocyon cinereoargenteus*, respectively), and 372 badgers (*Taxidea taxus*—Wildlife Services 2015). The annual number of control kills of coyotes has remained remarkably constant since 1939, varying between 50,000 and 110,000 and has exceeded 70,000 annually since 1985 (Berger 2006; Bergstrom et al. 2014). Also typical, Wildlife Services in Fiscal Year 2013 *unintentionally* killed 397 river otters (*Lontra canadensis*), 14 kit foxes (*Vulpes macrotis*), and 41 swift foxes (*V. velox*—Wildlife Services 2015). Wildlife Services does not monitor populations of species it targets for control nor those unintentionally killed, but one of the few published estimates of an overall mortality rate is that Wildlife Services, along with state managers, removed 23.2% of the estimated coyote population of Wyoming in 1994–1995 (Taylor et al. 2009). This level of human-caused mortality of mammalian predators may have negative unintended consequences for native ecosystems and biodiversity. Lethal control of carnivores may also be unnecessary and counterproductive to its ostensible goals (see Treves et al. 2016 for a recent review). We will explore these consequences in this Special Feature. We invited individual research scientists from the National Wildlife Research Center (the research arm of Wildlife Services) to contribute a science-based defense of lethal control of native carnivores to this Special Feature, but they each, as well as the center, collectively via their director, declined the offer (L. Clark, in litt., 13 November 2013).

There are 5 categories of reasons why mammalogists and conservation biologists should be interested in guiding governments—and society at large—toward replacing localized predator removal or population reduction (lethal control) with nonlethal means of wildlife conflict resolution: 1) potential disruption of top-down forcing and consequent loss of ecosystem resilience and biodiversity; 2) "bycatch" or unnecessary killing of nontarget species of mammals and other wildlife that occurs with nonselective methods of lethal control; 3) population reduction of certain species of native wildlife valued by many parts of society for the benefit of a few favored interest groups; 4) ineffectiveness of lethal control of predators at either reducing livestock depredation or, secondarily, enhancing game populations, over the long term; and 5) ethical considerations about both the intrinsic value of carnivores and humane methods of killing them. Some of these deserve brief attention in this overview, and others will be dealt with in more detail in the 5 other papers in this Special Feature, including new empirical evidence for the efficacy of nonlethal methods as alternatives to lethal predator control.

The Important Role of Both Apex Predators and Mesopredators in Maintaining Ecosystem Function

With this topic currently under considerable empirical and theoretical scrutiny, the evidence assembled as of 2011 led 23 prominent ecologists to conclude that loss of apex predators was a major driver of destabilization and collapse of their native ecosystems, leading to pandemics, irruptions of invasive species, and lost ecosystem services (Estes et al. 2011). Aldo Leopold was one of the 1st biologists to argue that mammalian predators played an indispensable role in controlling ungulate prey, thus preventing depletion of their resources, citing the irruption of the early 20th century herd of Kaibab deer (*Odocoileus hemionus*) after widespread predator removal (Leopold 1943). A recent review of several lines of evidence concluded that Leopold was right (Binkley et al. 2006). The poor condition of rangelands in much of the western United States can be attributed partly to native ungulates whose predators have been depleted (Beschta et al. 2013). Hebblewhite et al. (2005) documented that top-down forcing exerted by wolves on browsing prey had indirect positive effects on songbird communities in the Canadian Rockies. Restoration of a putative wolf-driven trophic cascade has restored certain riparian plant and animal communities in Yellowstone National Park (e.g., Ripple and Beschta 2012; though see Mech 2012). Top-down forcing (also known as a trophic cascade, i.e., the many indirect effects predation has on lower trophic levels and the ecosystem as a whole) by wolves may be enhanced by facilitative interactions with sympatric large carnivores (e.g., cougar—Atwood et al. 2007), or it may be dampened in more human-dominated landscapes (Muhly et al. 2013). A possible indirect effect of wolf predation is to reduce abundance of songbirds and rodents in a 4-species interaction chain, by releasing the lowest of the 3 trophic levels of carnivores (Levi and Wilmers 2012). In some systems, an apex large carnivore causing mesocarnivore suppression and, indirectly, small-carnivore release may be the more natural state. Removal of the apex carnivore, conversely, causes mesocarnivore release and small-carnivore suppression, which allows an irruption of rodent populations. Such an altered trophic cascade is exemplified by the recent colonization of eastern North America by coyotes following extirpation of wolves and may explain the rapid increase in the incidence of Lyme disease (Levi et al. 2012). Lethal control of the Australian apex predator the dingo (*Canis dingo*) has caused similar state shifts, resulting in dominance of introduced mesopredators and herbivores, which then cause damage to native plant and animal communities (Wallach et al. 2010).

Ineffectiveness and Unintended Consequences of Predator Removal

The consistent annual efforts by Wildlife Services at lethal control of coyotes in the western United States, described above, did not succeed in ameliorating the long decline of the nation's sheep industry, which began in the post-war years (Berger 2006). And, local-scale removal of coyotes has been found to cause population irruptions and reduced diversity in rodent communities (Henke and Bryant 1999). Use of public harvest of cougars in Washington state to remediate livestock depredation was found to be ineffective (Peebles et al. 2013). Similarly, recreational hunting of Eurasian lynx (*Lynx lynx*) was found to have little effect on sheep depredation unless of a magnitude to cause lynx population decline (Herfindal et al. 2005). Lethal control of gray wolves in the western United States could have such unintended consequences as shifting depredation from cattle to sheep (by mesopredator release of coyotes) and increasing mortality of pronghorn (*Antilocapra americana*) fawns (Berger et al. 2008; Bergstrom et al. 2014). Lethal control of gray wolves in the northern Rocky Mountains, causing total mortality of up to 25% of the estimated population, was found actually to increase depredation on livestock (Wielgus and Peebles 2014; but see Bradley et al. 2015). There are 3 reasons that predator removal is likely to have no long-term effect—or even adverse effects—on depredation of livestock: vacant territories are quickly recolonized (Knowlton et al. 1999; Treves and Naughton-Treves 2005); immigration rate of breeding pairs into the area experiencing lethal control can increase (Sacks et al. 1999); and immigrants are more likely to be subadults, which have a greater propensity for livestock depredation than older adults (Peebles et al. 2013). Simulation results suggest that even moderate nonselective predator control can potentially increase densities of the targeted carnivore species, because nontarget deaths of co-occurring carnivore species decrease competition for the targeted species (Casanovas et al. 2012). Use of nonselective, lethal predator-control methods (e.g., trapping and poison baits) by Wildlife Services has resulted unintentionally in the deaths of individuals of 150 species of vertebrates since 2000 (Knudson 2012) and at least 12 taxa of mammals protected (or candidates for protection) under the Endangered Species Act since 1990 (Bergstrom et al. 2014). Selective local removal of carnivores such as coyotes may eliminate the bycatch problem, but it can still trigger mesopredator release with unintended negative consequences (Mezquida et al. 2006).

The ASM has supported lethal control of large carnivores in certain cases where preservation of critically endangered wildlife species demands it (such as cougar predation on isolated populations of peninsula bighorn sheep, *Ovis canadensis nelsoni*—ASM 2012; Stephenson et al. 2012), but culling apex predators to enhance common game species may be unnecessary at best and harmful at worst. To the latter point, it is well known that wolves preferentially prey on older and diseased individuals (Mech and Peterson 2003; Wright et al. 2006), so natural predation is an important selective agent for the prey. To the former point, recent studies have concluded that gray wolf populations are intrinsically density dependent. That is, rather than being prey-limited, wolf densities are regulated through social interactions, with increasing interpack aggression and mortality at higher densities (Cariappa et al. 2011; Cubaynes et al. 2014). Large mammalian carnivores have been found to limit prey populations, broadly and in specific predator–prey interactions (Binkley et al. 2006; Ripple and Van Valkenburg 2010; Christianson and Creel 2014), but the effect of reduction or removal of predators on densities and dynamics of prey populations in any specific case can be hard to predict. Experiments removing coyotes and cougars in Idaho showed winter weather to be much more important than predation in predicting population trends of mule deer (*O. hemionus*—Hurley et al. 2011). A 7-year effort to remove all mammalian nest predators of ground-nesting birds (coyotes being the largest) from study sites in the southeastern United States concluded that removal of mammalian predators had no net effect on nest predation, primarily because of compensatory increases in predation by snakes (Ellis-Felege et al. 2012). A meta-analysis of 113 predator removal experiments (which was a taxonomically broad sample of animal predators) found that the intended beneficiary prey populations declined in 54 of them (Sih et al. 1985). This illustrates the multiple indirect pathways of potential top-down forcing that may be altered by removal of an apex predator from a complex food web, producing many possible outcomes for prey dynamics. For a mammalian carnivore example, 1 such pathway is through "apparent competition" with an alternate ungulate prey species, mediated through a different predator that increases compensatorily (Serrouya et al. 2015). Another pathway involves release of a mesopredator that preys preferentially on neonates of the same ungulate prey species (Prugh and Arthur 2015).

Effectiveness of Nonlethal Control of Depredation

Use of nonlethal methods (such as guardian animals and livestock protection collars) to prevent livestock depredation by leopards (*Panthera pardus*), caracals (*Caracal caracal*), and jackals (*Canis mesomelas*) in South Africa was found to be less expensive and more effective than lethal predator control (McManus et al. 2014). In this Special Feature, Stone et al. (this issue) document that, over a 7-year pilot project in prime wolf habitat in Idaho, the adaptive use of a suite of nonlethal deterrent strategies reduced sheep depredation by more than

3-fold compared to sheep allotments in Idaho that used lethal controls over the same time period. Presenting results from a large cattle station in Australia, where full implementation of such nonlethal strategies may be prohibitive, Wallach et al. (this issue) argue that simply ending lethal control of dingoes reduced depredation by allowing the social structure of the predator to stabilize, and additionally that cattle mortality can be reduced most effectively by improving husbandry practices. These 2 studies do not meet the "gold standard" of replicated, randomized experimental design (which few predator-control studies do—Treves et al. 2016), because the latter would have been impossible without intentional further killing of important apex predators of great conservation value (in the case of Idaho gray wolves still legally protected for most of the study). Nonetheless, their results are valuable in providing insights into workable alternatives to lethal control for solving wildlife–livestock conflicts. Both of these studies suggest that stable, naturally regulated populations of social carnivores not significantly exploited by humans are the preferred option for both reducing livestock depredation and restoring the functional role of apex predators to ecosystems. These findings for large canids mirror those for cougars, in which excessive harvest replaces adult males with immigrating adolescent males, which are more prone to depredate (Peebles et al. 2013).

Members of ASM Are Acutely Aware of Guidelines on Humane Treatment

There has been much discussion in recent years within the Society about the ethical constraints and obligations pertaining to working with live mammals. While we have striven to ensure that Animal Care and Use regulations imposed on us by extrinsic bodies are not overly onerous and do not prevent us from vigorous pursuit of our science, we nonetheless all feel the obligation to abide by a set of rules for humane treatment of our mammalian study subjects. Not a paper is published in this journal presenting original results from live animal subjects that does not state that the study adhered to these ASM-adopted guidelines (Sikes et al. 2016). Ironically, ASM's guidelines were developed in large part in response to oversight by United States Department of Agriculture-monitored institutional Animal Care and Use committees at universities where many of us work, yet the agencies in the United States Department of Agriculture, including Wildlife Services, are not obligated to abide by the guidelines that their agency helped produce. Although they follow guidelines of the American Veterinary Medical Association on euthanasia, Wildlife Services claims their "management and operational programs are exempt from Animal Welfare Act (1966, 7 U.S.C. 2131, 9CFR) compliance" (Clay 2012:8).

In this Special Feature, Slagle et al. (this issue) show that, while the United States public accepts that predators may need to be controlled, there is low and declining acceptance of lethal predator-control methods, which are regarded as inhumane. Governments at the federal, state, and local levels are tasked with serving broad constituencies, and in the case of native wildlife, which are a public trust asset (Bruskotter et al. 2011; Treves et al. 2015), they should be responsive to these public attitudes. In practice, some government resource agencies or the appointed government boards that rule them, or both, have traditionally favored narrower constituencies within the public. State wildlife or game agencies have elected to provide hunting opportunities for certain species, including large carnivores, even if citizens opposed to hunting a particular species of large carnivore greatly outnumber those wishing to hunt it. A case in point is the state of Michigan recently approving a wolf hunt following removal of federal protection by the Endangered Species Act, and in this Special Feature, Vucetich et al. (this issue) argue that the North American Model of wildlife management, to which the profession is supposedly bound, does not support the hunt. In a society in which lethal control of predators is viewed increasingly negatively and scientific consensus is emerging that social carnivores occupying apex-predator trophic levels function best and depredate least when not lethally exploited, killing native large carnivores is an issue that will become increasingly controversial and should receive increasing scientific scrutiny.

Finally, insofar as most states, probably for the foreseeable future, will continue to include large carnivore hunting among their wildlife management tools, it is important that decision-makers in wildlife agencies have valid data on mortality rates from all mortality sources and on the further effects of anthropogenic mortality on recruitment (which may be negative), so that harvest quotas may not push total mortality beyond a sustainable level (see Creel et al. 2015). To that end, Treves et al. (this issue) show that well over a third of mortality of wolves over the past 3 decades in Wisconsin was due to poaching and another 13% was due to vehicle collision, suggesting that total mortality of the population, which was subsequently exposed to harvest, is higher than the management agency assumes. Setting wildlife management goals at reducing carnivore mortality to at most sustainable levels, and eliminating human-caused mortality wherever possible, is in line with the best current ecological, social, and ethical scholarship, as papers in this Special Feature attest.

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Special Feature Editor was Barbara H. Blake.

Exhibit 6

2005

Demographic and Spatial Responses of Coyotes to Changes in Food and Exploitation

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DEMOGRAPHIC AND SPATIAL RESPONSES OF COYOTES TO CHANGES IN FOOD AND EXPLOITATION

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Abstract: Lethal control for reducing carnivore populations is a contentious issue throughout the world. While computer simulations have been developed modeling the effects of population reduction on coyote (*Canis latrans*) population parameters, testing these hypotheses with empirical data from the field is lacking. We documented the demographic and spatial responses of coyotes to changes in the levels of food resources and human exploitation on the Piñon Canyon Maneuver Site, southeastern Colorado. We captured, radio-collared, and tracked 92 (53 M: 39 F) coyotes from March 1983 to April 1989. Of these, 74 animals were residents from 32 packs, plus 12 transients; 6 animals were captured while making dispersal movements. We collected 14,147 telemetry locations of the radioed coyotes spanning 7 years of study. We compared coyote pack size and density, survival rates, reproduction (litter size, litter sex ratio, % yearlings reproducing), and home range size between years receiving exploitation (1987-88) versus years receiving no exploitation (1983-86) and post-removal (1989), as well as, comparisons of these parameters between removal and non-removal areas within years. Changes in estimates of pack size and coyote density, plus the number of animals removed, indicated the coyote population was reduced 44-61% and 51-75% in the removal area during 1987 and 1988, respectively. As expected, annual survival rates declined significantly for coyotes in the removal area compared to coyotes in the non-removal area. Removals brought about a drastic reduction in pack size and a corresponding decrease in density. However, both pack size and density rebounded to pre-removal levels within 8 months post-removal. Home range size did not change in response to changes in exploitation. Coyotes in the removal area appeared to maintain their normal (i.e., pre-removal) home ranges after coyotes were removed from neighboring territories. Following removals, the population shifted to a younger age structure (i.e., more yearlings). Litter size significantly increased in the removal area 2 years after the beginning of exploitation. However, changes in litter size were confounded by changes in the prey base. Litter size was significantly related to rabbit abundance, while rodent abundance was less of a factor influencing reproductive effort. Accounting for both changes in prey abundance and coyote density, litter size was significantly related to total prey abundance/coyote. With increasing prey and reduced coyote density, mean litter size doubled in the removal area compared to pre-removal levels; females in the non-removal area also increased litter size in response to increased rabbit abundance. Litter sex ratio favored males during years of no exploitation, changing to a preponderance of females during the 2 years of exploitation. Reproduction by yearlings increased from 0 % in years prior to exploitation, to 20% following 2 years of coyote removal.

Key words: *Canis latrans*, coyote, exploitation, litter, home range, prey, reproduction, survival

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INTRODUCTION

Management of predator populations, particularly wild canids, has occurred for centuries. Wolves *(Canis lupus*), coyotes (*C. latrans*), red foxes (*Vulpes vulpes*), dingos (*C. familiaris dingo*), and jackals (*C. mesomelas, C. aureus*) have been controlled by humans for the protection of game species and domestic livestock (Harris and Saunders 1993, Reynolds and Tapper 1996, Knowlton et al. 1999). Most coyote removal operations have focused on reducing coyote predation on domestic animals (Boggess et al. 1978, Andelt and Gipson 1979, Till and Knowlton 1983, Knowlton et al. 1999), or enhancing wild game populations (Beasom 1974, Stout 1982, Smith et al. 1986) by reducing coyote numbers in the area. Lethal control of coyotes remains a contentious and controversial issue among biologists and the general public (Stuby et al. 1979, Kellert 1985, Andelt 1996).

While success or failure of these control programs has generally been focused on the game species or domestic livestock effected, few studies have been conducted documenting the effect of lethal removal on the coyote population itself. Those studies that have been conducted compared parameters between or among separate areas under varying degrees of human exploitation (Knowlton 1972, Davison 1980, Knowlton et al. 1999), but which also varied in coyote density, habitat, prey species, prey density and distribution, and other biological factors important to coyotes (Knowlton et al. 1999). Computer simulations of demographic compensation in coyote populations also have been conducted (Connolly and Longhurst 1975, Connolly 1978, Sterling et al. 1983, Pitt et al. 2001) based upon the current understanding of coyote biology at the time. Many myths have been presented about the possible responses of coyotes to exploitation, but these ideas have remained conjectural and untested. A direct, experimental manipulation of a coyote population in the same study area allowing for comparison of parameters between an area under exploitation versus an area with no exploitation has not been conducted. Equally unknown is the length of time required for a coyote population to respond behaviorally or demographically to changes in the level of exploitation.

We were presented with an opportunity to directly manipulate a lightly exploited coyote population that had been studied for 4 years (Gese et al. 1988, 1989). By removing coyotes from one area of the study area, and not removing coyotes from the other part of the study area, we examined how the coyote population responded both spatially and demographically. Baseline data (1983-1986) showed that both areas were of similar habitat, prey abundance and composition, and coyote abundance. With this manipulation of the coyote population, we addressed the following questions: (i) What level of removal will show a corresponding decline in coyote survival, pack size, and density, and how long will this decline persist? (ii) When coyotes are removed from adjacent territories, do the other coyote packs expand their territories into these vacant areas? (iii) How quickly do coyotes respond to vacancies in adjacent areas and do transient animals move into these vacant areas? (iv) Does the coyote population respond with increased reproduction? (v) If the coyotes increase reproduction, how are these animals incorporated into the population? (vi) How quickly does the coyote population rebound from increased exploitation? (vii) How does prey abundance influence the ability of a coyote population to respond demographically?

STUDY AREA

The 1040-km^2 study area was located on the Piñon Canyon Maneuver Site (PCMS), Las Animas County, Colorado. The climate was classed as mid-latitude semiarid with a mean annual precipitation of 26-38 cm on different parts of the study area. Mean monthly temperatures ranged from -1 C in January to 23 C in July. Elevations ranged from 1,310 to 1,740 m. The PCMS consisted of open plains, river canyons, and limestone breaks (Gese et al. 1988). The two main vegetation types were shortgrass prairie and pinyon pine (*Pinus edulis*) juniper (*Juniperus monosperma*) woodland communities (Costello 1954, Kendeigh 1961, U.S. Department of the Army 1980, Shaw et al. 1989). The PCMS had large-scale cattle ranching prior to purchase by the U.S. Army, thus the coyote population on the PCMS was subjected to human exploitation prior to 1982. In 1982 the U.S. Army acquired the PCMS for mechanized military training. Cattle ranching and coyote exploitation continued on ranches surrounding the study area.

METHODS

From 1983 to 1986 the resident coyote population on the PCMS was not exposed to human exploitation and constituted 4 years of baseline demographics prior to manipulation (Gese et al. 1989). Beginning in 1987 and continuing into 1988, the PCMS was divided into 2 areas of similar habitat and topography (mainly open prairie): coyotes were removed through aerial gunning and trapping on a 340-km^2 area, and were not removed on a 380-km^2 area. Coyotes were removed from the removal area by aerial gunning and trapping in January and May 1987, and March and April 1988 (Knowlton 1972). No coyotes were removed from the adjacent, non-removal area. All coyotes removed were aged by tooth cementum analysis (Linhart and Knowlton 1967) of a lower canine, sexed, weighed, and female reproductive tracts were examined for placental scars or embryos.

Throughout the entire 7-year study period, coyotes were captured with padded leg-hold traps, a hand-held net gun fired from a helicopter (Barrett et al. 1982), manual capture following aerial pursuit (Gese et al. 1987), or manual capture on the ground (Gese and Andersen 1993) in both the removal and non-removal areas. Each captured coyote was sexed, aged by tooth wear (Gier 1968), weighed, ear-tagged, and fitted with a radio collar (Advanced Telemetry Systems, Isanti, MN). Collared coyotes were radio-tracked throughout the study (Gese et al. 1988, 1989) with 3 biological seasons defined (modified from Smith et al. 1981): breeding/gestation (16 Dec – 15 Apr), pup rearing (16 Apr – 15 Aug), and dispersal (16 Aug – 15 Dec). Coyotes were located 3-4 times/week from a vehicle using a portable receiver and an antenna, or via aerial telemetry if the animal was not successfully located from the ground (Mech 1983). We used $\geq$2 compass bearings with an intersecting angle >20^o and <160^o to plot an animal's location. Each location was plotted to the nearest 100-m grid intersection on 1:24,000 U.S. Geological Survey topographic maps using the Universal Transverse Mercator grid system. Triangulation error was determined by reference transmitters to be $\pm$4^o (Gese et al. 1988). We used a minimum of >35 night locations to determine seasonal home-range size (Gese et al. 1990). Adequate sample size for each coyote during each season was determined from area-observation curves (Odum and Kuenzler 1955). We measured home-range size with the 95% adaptive kernel estimator (Worton 1989, Shivik and Gese 2000) using the software program CALHOME (Kie et al. 1996). Coyote pack size was documented by visual observations of radioed coyotes and pack associates sharing a common territory (Bowen 1982, Gese et al. 1989). Density was measured as mean pack size divided by mean home range size for each biological season (Mech 1973, 1977, Van Ballenberghe et al. 1975, Gese et al. 1989). We measured the amount of reduction in the coyote population by documenting changes in pack size and density. Coyote population density estimates were made from radio-collared coyotes (Gese et al. 1989) as previously described. Subtracting the number of coyotes killed provided an estimate of the percent reduction in coyote numbers immediately following the removal.

We calculated annual survival rates using the computer program MICROMORT (Heisey and Fuller 1985). Survival rates were a mean of 2 rates: one rate included all animals of known fate, and the second rate included animals of known and unknown fate (loss of radio contact). This second rate was a mean of 2 rates: the first rate assumed all missing animals were dead, and the second assumed they were alive (Gese et al. 1989).

We determined reproductive output from active dens, fetuses, and placental scars. Reproductive output during 1983-86 (Gese et al. 1989) was used as a baseline to compare changes in litter size and sex ratio during years before and after exploitation. Mean placental scar counts (3.4 scars/females, n = 10) were not different from mean litter size counts (3.2 pups/litter, n = 16) during baseline years (Gese et al. 1989), thus these 2 estimates were combined to determine reproductive output. Yearling reproduction was determined from coyotes removed during the aerial gunning in 1987-88 and was compared to baseline data gathered in 1983-86 (Gese et al. 1989).

Indices of relative prey abundance were determined by 2 methods. Relative abundance of lagomorphs was estimated using spotlight surveys (Chapman and Willner 1986, Schauster et al. 2002) conducted over 4 consecutive nights during the summer months. We drove a truck along established routes at 10-15 km/hr. Two observers used spotlights of 250,000 candlepower to scan both sides of the route. We recorded the number of black-tailed jackrabbits (*Lepus californicus*) and desert cottontail rabbits (*Sylvilagus auduboni*). The average number of observed rabbits/km was used as an index of abundance.

To estimate the relative abundance of small mammals, annual scent-post surveys (Linhart and Knowlton 1975, Roughton and Sweeny 1982, Schauster et al. 2002) were used over 4 consecutive nights each summer. Four scent-station lines of 10 stations each were placed >3 km apart in both the removal and non-removal areas. Each station, placed 0.5 km apart, consisted of a 1-m diameter circle of sifted dirt with a synthetic fermented egg extract tablet (Roughton and Sweeny 1982, Bullard et al. 1983) at the center. Tracks were recorded as presence/absence and cleared each morning. The visitation rate of rodents to the scent-posts were used as a passive index of abundance.

Survival rates were determined using the individual coyote as the sample unit. For home-range size, pack size, and coyote density estimates and analyses, the sample unit was the coyote pack. Litter size information was based upon the breeding female and sex ratio was based upon the litter as the sample unit. Regression analyses used the mean of the parameter for each area each year. All statistical tests were performed using the software program SYSTAT (Wilkinson et al. 1992).

RESULTS

We captured, radio-collared, and tracked 92 (53 M: 39 F) coyotes from March 1983 to April 1989. Of these, 74 animals were residents from 32 packs, plus 12 transients; 6 animals were captured while making dispersal movements. We collected 14,147 telemetry locations of the radioed coyotes spanning 7 years of study.

A total of 25 (12 M, 13 F) and 29 (14 M, 15F) coyotes were shot or trapped in the removal area during the winter and spring of 1987 and 1988, respectively. Aerial gunning and trapping accounted for 89% and 11% of the coyotes removed, respectively. Both the removal (0.167 coyotes/km^2) and non-removal (0.182 coyotes/km^2) areas had similar coyote densities prior to exploitation. Extrapolation of resident home-range size and group size in different habitats, and the number of transients resulted in an estimate of 57 coyotes occupying the removal area. Thus, the 25 coyotes removed in January-April 1987 resulted in a 44% reduction in the coyote population in the removal area. In 1988 we estimated a reduction of 51% (i.e., removed 29 coyotes) of the coyote population in the removal area.

The age structure of the resident coyote population changed following removals. Prior to removals, 34% of the age structure consisted of yearlings with 16% of the animals over 5 years of age (Figure 1). Following population reduction, within the removal area the yearling cohort increased to 60% of the population with only 6% of the animals exceeding 5 years of age.

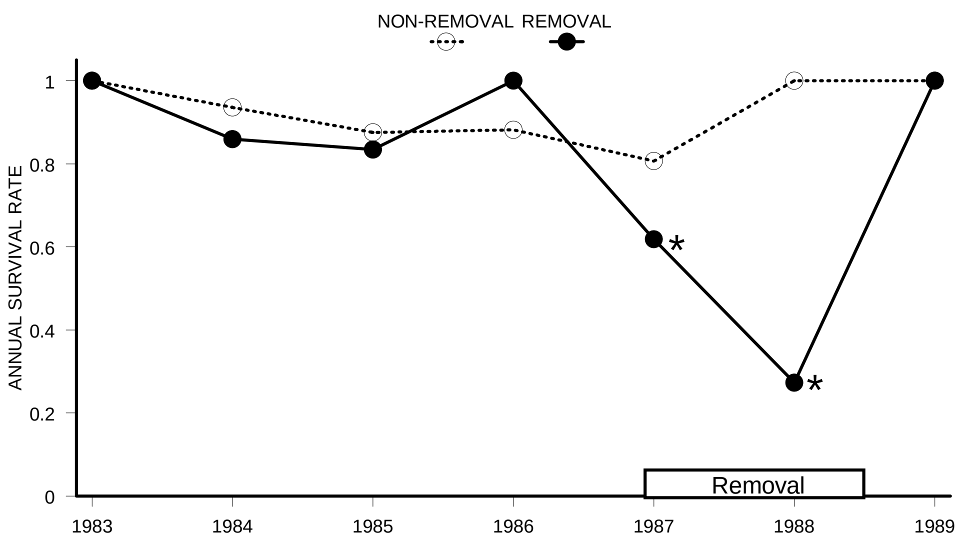

Figure 1. Age structure of resident coyotes before and after 2 years of population reductions, Pinon Canyon Maneuver Site, Colorado, 1983-1989.

Annual Survival Rates

Prior to any population reduction, annual survival of coyotes between the removal and non-removal areas were similar (Figure 2). For all years prior to removals (1983-1986), mean annual survival was 0.922 and 0.925 in the removal and non-removal areas, respectively (all *z*-tests for annual rates had $P > 0.20$). As could be expected, annual survival of coyotes in the removal area declined significantly during the 2 years of removal (1987-1988) compared to survival in the non-removal area (Figure 2; all *z*-tests had $P < 0.05$). Following cessation of population reduction, coyotes in both areas had annual survival rates of 1.0 in 1989.

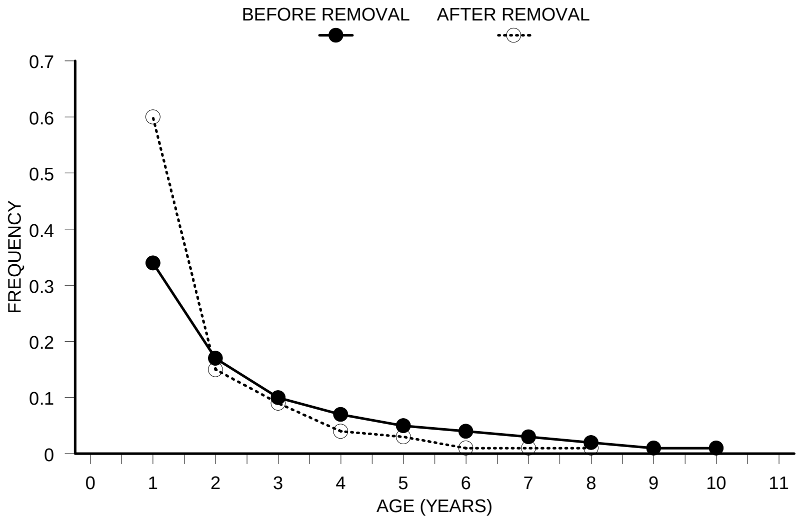

Figure 2. Annual survival rates of resident coyotes in removal and non-removal areas before, during, and after population reduction, Pinon Canyon Maneuver Site, Colorado, 1983-1989. Asterisk denotes significant difference in annual survival rates between removal and non-removal areas for that year (*z*-test, *P* < 0.05).

Home Range Size

A total of 14,147 telemetry locations were collected on the radioed coyotes across the study area from March 1983 to April 1989. Seasonal home-range size was not correlated with relocation sample size (r = 0.08, F = 1.318, df = 1, 199, P = 0.252). A multi-way ANOVA of the influence of area, season, and year on home-range size had an R^2 of 0.102 and showed that home-range size of the coyotes in the non-removal and removal areas did not differ significantly among years and seasons (Table 1, Figure 3A). While the area effect was close to significance (P = 0.086), this value was mainly driven by the increase in home-range size in the non-removal area in the winter of 1987. Independent Tukey's tests found no significant differences between the two areas on a seasonal basis (all P-values >0.20).

We observed movement of one radioed coyote from the non-removal area into a vacant territory in the removal area. In 1987 a 3-year old, female coyote in the non-removal area was classified as a transient due to her large home range (80.4 km^2), solitary behavior, and lack of affinity for one resident area (Gese et al. 1988). In February 1988, she moved 22 km west into the removal area, established a resident home range (11.4 km^2) in an area where a group of 4 coyotes had been removed in 1987, paired with another coyote, and was pregnant with 4 pups when removed in April 1988. None of the resident radioed coyotes in the non-removal area moved into the removal area, nor did any resident pack expand their territory in the removal area even when entire packs were removed from adjacent territories.

Table 1. Multi-way analysis of variance with all interaction terms examining the influence of area, season, and year on home-range size, pack size, and density of coyotes, Pinon Canyon Maneuver Site, Colorado, 1983-1989.

Source	*df*	Home range size *F*	*P*	Pack size *F*	*P*	Density *F*	*P*
Area (A)	1	3.658	0.086	17.287	<0.001	9.289	0.003
Season (S)	2	0.758	0.470	101.082	<0.001	34.381	<0.001
Year (Y)	4	1.244	0.293	15.685	<0.001	9.116	<0.001
A x Y	4	1.568	0.184	7.964	<0.001	1.661	0.160
A x S	2	0.416	0.660	16.543	<0.001	5.012	0.007
S x Y	8	0.438	0.897	5.968	<0.001	2.685	0.008
A x S x Y	8	0.306	0.963	7.379	<0.001	1.948	0.055
Error	211						

Area: removal, non-removal
Season: breeding, pup rearing, dispersal
Year: 1984, 1985, 1986, 1987, 1988

Pack Size and Density

Mean pack size of resident coyotes changed in response to seasons, years, and areas (Figure 3B). A multi-way ANOVA examining the influence of area, season, and year on mean pack size showed that 72% of the variance in mean pack size was explained by the 3 variables ($R^2 = 0.720$, Table 1). During the years prior to population reduction (1983-1986), pack sizes in the removal and non-removal areas were not significantly different (all Tukey's tests had *P*-values >0.10). Following the removals, mean pack size in the removal area significantly decreased during the breeding and pup-rearing seasons of 1987 and 1988 (Fig. 3B; Tukey's tests had $P < 0.05$). Immediately following removals, mean pack size in the removal area declined 61% and 73% in 1987 and 1988, respectively. By comparison, mean pack size in the non-removal area showed no decline during the same time period. Within 8 months, mean pack size in the removal area had returned to pre-removal levels and was similar to pack size in the non-removal area.

With the decline in mean pack size of coyotes in the removal area during population reduction, there was a corresponding decrease in resident coyote density following removals (Figure 3C). A multi-way ANOVA examining the influence of area, season, and year on resident coyote density found that 49% of the variation in density was explained by the 3 variables ($R^2 = 0.491$, Table 1). Coyote density was similar between the 2 areas prior to removal, with a decrease in density following the removals in 1987 and 1988 (Fig. 3C). Following the removal sessions, resident coyote density declined 60% and 75% in 1987 and 1988, respectively. By the winter of 1987, coyote density was similar in both areas 8 months after removal as pack sizes rebounded (Figure 3B). By dispersal season in 1988, coyote density in the removal area had not yet reached pre-removal levels (Figure 3C) even though mean pack size was the same (Figure 3B); this difference was due mainly to changes in home-range size (Figure 3A).

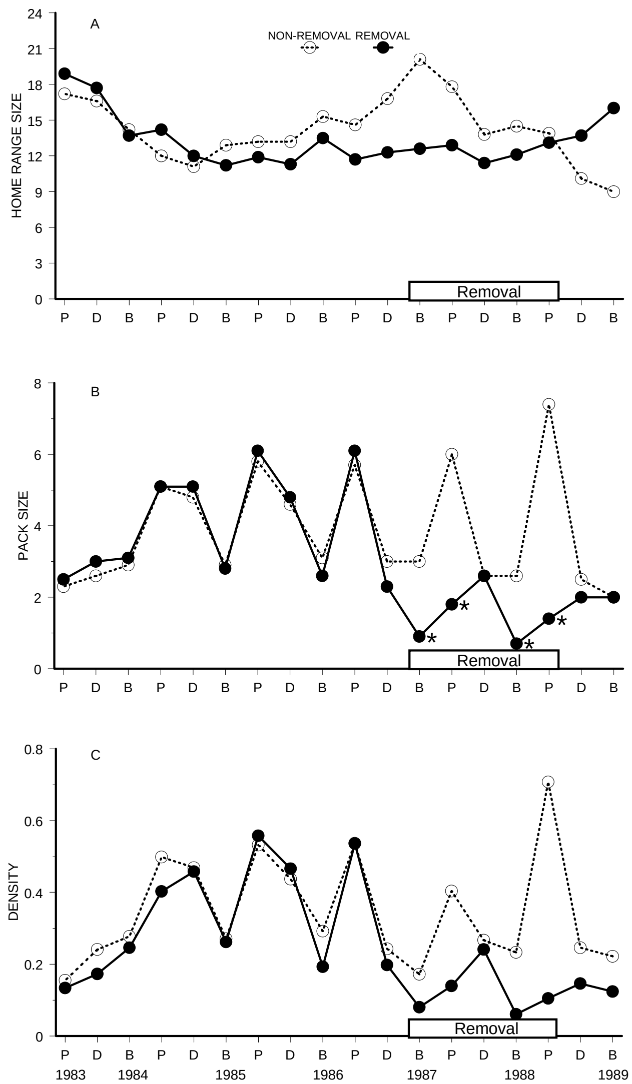

Figure 3. Changes in (A) home-range size, (B) pack size, and (C) density, of resident coyotes in removal and non-removal areas before, during, and after population reduction, Pinon Canyon Maneuver Site, Colorado, 1983-1989. Asterisk denotes significant differences (Tukey's test, *P* < 0.05).

Reproduction

Mean litter size of breeding female coyotes in the removal ($\bar{x}$ = 3.3 pups/litter, *n* = 17 litters) and non-removal ($\bar{x}$ = 3.0, *n* = 8 litters) areas did not differ prior to exploitation (*t* = 0.63, *P* = 0.53). After the first year of removals, mean litter size remained unchanged between the removal ($\bar{x}$ = 3.7) and non-removal ($\bar{x}$ = 3.0) areas. However, mean litter size of breeding females significantly increased in the removal area in 1988 ($\bar{x}$ = 6.3, *n* = 7), 2 years after the removal program began (Figure 4A; $F = 6.72$, $df = 2, 29$, $P < 0.005$). Among individual females, one 4-year-old female that had 3 pups in 1987, produced 9 pups in 1988. Another 5-year-old female that had 3 pups in 1986, whelped 8 pups in 1988. Mean litter size in the non-removal area increased in 1988 as well ($\bar{x}$ = 4.6, *n* = 6), but was not significantly different than pre-removal litter size ($F = 2.48$, $df = 2, 13$, $P > 0.10$). When we examined the influence of coyote population reduction, we found that mean litter size was correlated to the density of coyotes entering the breeding season ($r = 0.717$, $F = 9.496$, $df = 1,9$, $P = 0.013$). As the coyote density coming into the breeding season declined, mean litter size increased.

Sex ratio of the litters changed in the removal area following coyote removal. Litter sex ratio in the removal area favored males (67% male, *n* = 56 pups) during years of no exploitation, changing to a ratio favoring females (59% female, *n* = 44 pups) following 2 years of exploitation ($x^2 = 6.303$, $df = 1$, $P = 0.012$). Litter sex ratio in the non-removal area remained near 50:50 during years of no exploitation (50% male, *n* = 24 pups) and 2 years after exploitation (54% male, *n* = 28 pups) ($x^2 = 0.066$, $df = 1$, $P = 0.797$). The percent of yearling female coyotes reproducing increased from 0% (*n* = 11) during years of no exploitation (Gese et al. 1989) to 20% (*n* = 10) during the 2 years following coyote removal, but was not a significant difference ($x^2 = 2.43$, $df = 1$, $P = 0.119$).

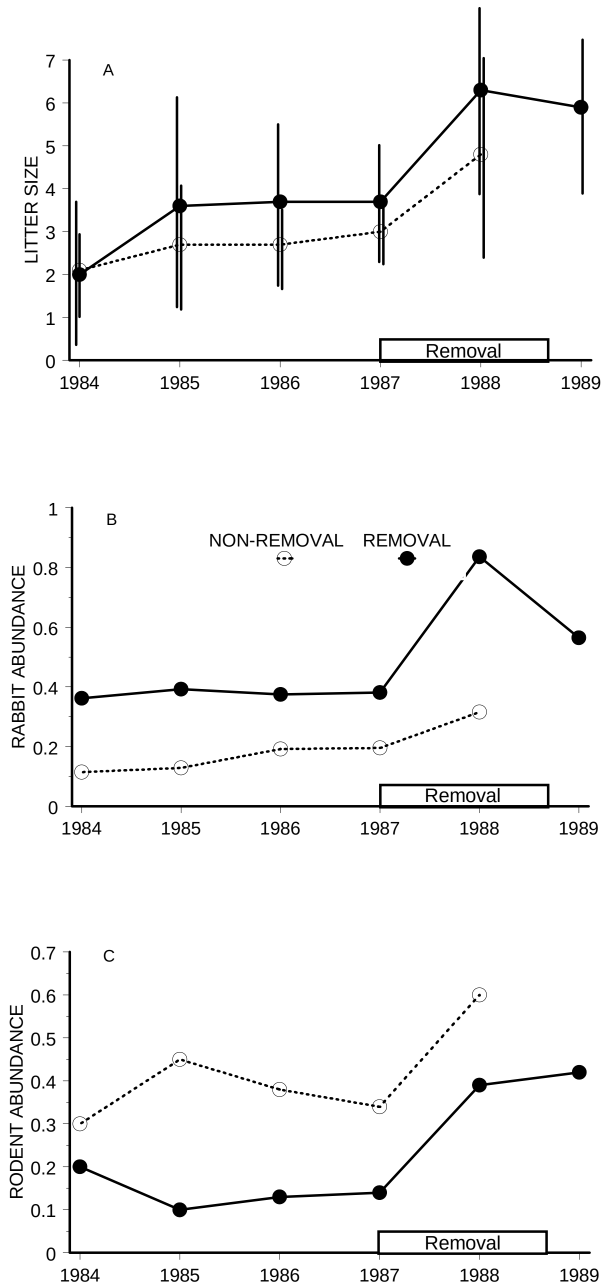

Figure 4. Changes in (A) coyote litter size ($\pm$ SD), (B) rabbit abundance, and (C) rodent abundance, in the removal and non-removal areas before, during, and after coyote population reduction, Pinon Canyon Maneuver Site, Colorado, 1983-1989.

Changes in the Prey Base and Effects on Reproduction

Surveys of lagomorphs and small mammals indicated that the relative abundance of these food resources changed over the course of the study. Both lagomorphs and rodent abundance were relatively unchanged during the first 3 years of the study in both the removal and non-removal areas (Figure 4B and 4C). After the first removal session, prey abundance remained unchanged. However, 2 years after the removals began, prey abundance increased in both areas. It is unlikely the increases in prey were due to coyote population reduction, but that these cyclic prey populations were entering the initial part of a population increase and were coincidental to the removal of coyotes. However, whether there was top-down or bottom-up regulation of prey by coyotes was unknown, but the increase in prey in the non-removal area indicated the removal of coyotes was not the mechanism for the increase.

We previously found that as coyote density declined due to population reduction, mean litter size increased in response. However, the increase in prey abundance confounded the effects of population reduction and the observed increase in litter size. Examining the influence of prey abundance on coyote litter size showed that mean litter size was significantly related to rabbit abundance the previous summer (r = 0.840, F = 21.528, df = 1,9, P = 0.001). As rabbit abundance increased, mean litter size the following spring in both areas increased accordingly (Figure 5A). Mean litter size and rodent abundance the previous summer were not significantly correlated (Figure 5B; r = 0.338, F = 1.160, df = 1,9, P = 0.309). To examine the combined effects of increased food resources and reduced coyote density on mean litter size, we combined the rabbit and rodent indices for a total prey index, then divided that index by the estimate of coyote density entering the breeding season to acquire an estimate of total prey/coyote. Regression analysis showed a significant correlation between total prey/coyote and mean litter size across all years and areas (r = 0.869, F = 27.858, df = 1,9, P = 0.001). As more prey per coyote increased, mean litter size increased in response (Figure 5C).

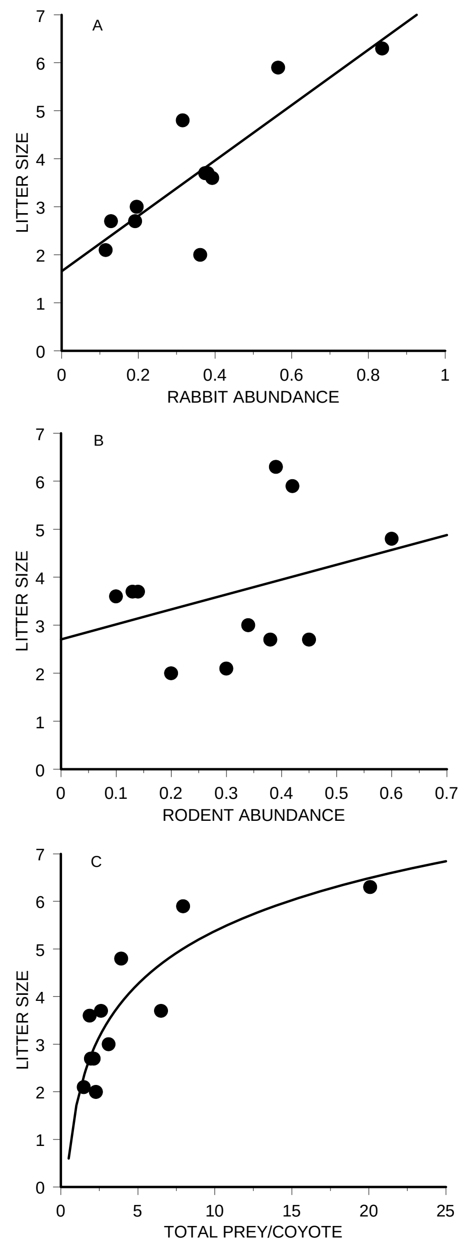

Figure 5. Relationships between coyote litter size and indices of (A) rabbit abundance, (B) rodent abundance, and (C) total prey abundance/coyote, Pinon Canyon Maneuver Site, Colorado, 1983-1989.

Stepwise regression showed that total prey abundance and coyote density prior to the breeding season were the most influential factors on mean litter size (r = 0.924, F = 23.444, df = 2,8, P <0.001).

DISCUSSION

The spatial response of the resident coyotes in the removal area following population reduction was negligible. With entire territories vacant in adjacent areas, the resident coyotes remained within their own exclusive territories. The coyotes that immigrated into the removal area were probably transients and dispersing animals from the non-removal area and areas surrounding the PCMS as these areas were generally exposed to low levels of exploitation (Gese et al. 1989). The observation of a radio-collared transient moving west into the removal area from the non-removal area supports this hypothesis. In addition, offspring from the packs in the removal area likely colonized vacant territories during the dispersal season as evidenced by the younger age structure in the removal area 2 years after removals began.

As predicted, following population reduction, coyote pack size and density both declined substantially. Removals were effective in reducing pack size and consequently resident population density by as much as 60-70%. With this reduction in density, vacancies apparently were found and filled quickly by transient and dispersing coyotes so that within 8 months the density within the removal area had recovered. This level of population reduction appeared to be sustainable for 2 years. Removals exceeding this level or lasting longer would likely cause a more prolonged decline in overall coyote density. Pitt et al. (2001) modeled that population recovery through reproductive compensation may take 2-3 years if removal exceeded 60%.

Changes in litter size and sex ratio, and yearling reproduction has been reported in studies of different areas under various degrees of exploitation (Knowlton 1972, Davison 1980, Knowlton et al. 1999). Knowlton (1972) reported litter sizes averaged 4.3 pups in south Texas in areas under light exploitation. In areas of heavy exploitation, litter size averaged 6.9 pups. Davison (1980) concluded that recruitment was directly related to hunting mortality rates. Connolly and Longhurst (1975), through simulation modeling, suggested an average litter size of 4.5 in an uncontrolled population, increasing to 9 pups/litter as the coyote population was reduced to half the pre-control density. Direct manipulation of a previously unexploited resident coyote population, however, has not been reported. We found that litter size in the removal area nearly doubled when we reduced the population to over half the pre-removal density, similar to the model proposed by Connolly and Longhurst (1975). Similarily, a reduction of a red fox (*Vulpes vulpes*) population in South Dakota resulted in a 63% increase in litter size during years of fox removal compared to years of no removal (Trautman et al. 1974).

However, we caution that the increase in prey abundance also contributed to the change in litter size observed and that the combination of population reduction and food brought about the increase in mean litter size. Coyote litter size is usually related to food abundance. Todd and Keith (1983) reported that coyote pregnancy rate and litter size declined when snowshoe hare (*Lepus americanus*) populations declined in Alberta. Gier (1968) noted that 65% of the yearlings conceived during years of rodent abundance, whereas no yearlings bred during years of rodent scarcity. Clark (1972) reported that more yearlings bred and litter sizes were larger during years of jackrabbit (*L. californicus*) abundance. We suggest that the lower density of coyotes in the removal area and the increased prey availability to the surviving female coyotes, brought about an increase in their reproductive capabilities (Knowlton 1972, Henderson 1972, Connolly and Longhurst 1975). The mechanism by which this occurs is unknown, but may be a consequence of the breeding females acquiring more food due to more prey and reduced competition, entering estrus in better physiological condition, shedding more ova entering estrus, and producing more offspring.

While it has been suggested that human exploitation brings about more coyotes due to increased litter size, we point out that the observed increase in litter size during this study did not increase overall coyote density, but simply replaced the removed cohort. Increased reproduction must be considered in the context of a reduced population, and the upper threshold of coyote density is still dictated by food abundance as mediated by social tolerance (Knowlton et al. 1999). In addition, some coyote populations with abundant food resources and no human exploitation are already at the maximum reproductive output (e.g., Gese et al. 1996) and the breeding females would not be physically capable of increasing litter size.

Litter sex ratio in the removal area changed from a preponderance of males during years of no exploitation to a ratio favoring females during the 2 years of exploitation. Changes in litter sex ratios have been inferred from observed adult sex ratios. Areas under light exploitation favored males (Gier 1968, Hawthorne 1971, Mathwig 1973), while areas with heavy exploitation favored females (Wetmore et al. 1970, Knowlton 1972).

Yearling pregnancy rate increased from 0% to 20% in 2 years after the initial removal began. Gier (1968) and Knowlton (1972) believed that yearling pregnancy rates increased with increased levels of exploitation. Connolly and Longhurst (1975) suggested that 10% of yearlings breed in areas of no exploitation, increasing to 70% in areas where the population is reduced to half the pre-control density. Yearling reproduction on our study area did not increase to the magnitude proposed by Connolly and Longhurst (1975), but we measured the reproductive rate only 2 years after exploitation started. A higher yearling pregnancy rate could occur with continued exploitation.

Biologists generally agree that coyote control can induce increased birth and natural survival rates in a coyote population (Knowlton et al. 1999). However, the magnitude at which these rates change at various control intensities has not been well documented (Connolly and Longhurst 1975). We concluded that with an estimated 60-70% reduction in the coyote population on our study area, resident coyotes did not increase their home ranges in response to vacant space adjacent to their home range. Immigration of coyotes from the surrounding areas into the removal area probably resulted. The coyote population in the removal area responded to exploitation in 2 years through increased litter size, a litter sex ratio favoring females, and a slight increase in yearling reproduction. We emphasize that results from this study may not be universally applicable to other coyote populations. Prior to population reduction, the coyote population in this study was already at very low density, had small pack sizes, and whelped small litters due to low food abundance. Populations at high density and reproductive output due to high food availability would not be capable of similar demographic responses as they would already be at or near upper limits. Also, our control lasted for 2 years only. Prolonged control actions could have more lasting impacts on coyote population size, persistence, and recovery.

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Exhibit 7

POLICY PERSPECTIVE

License to Kill: Reforming Federal Wildlife Control to Restore Biodiversity and Ecosystem Function

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Apex predators; ecosystem resilience; endangered species; keystone species; lethal control; livestock depredation; trophic cascades; Wildlife Services.

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Abstract

For more than 100 years, the US government has conducted lethal control of native wildlife, to benefit livestock producers and to enhance game populations, especially in the western states. Since 2000, Wildlife Services (WS), an agency of the US Department of Agriculture, has killed 2 million native mammals, predominantly 20 species of carnivores, beavers, and several species of ground-dwelling squirrels, but also many nontarget species. Many are important species in their native ecosystems (e.g., ecosystem engineers such as prairie dogs and beavers, and apex predators such as gray wolves). Reducing their populations, locally or globally, risks cascading negative consequences including impoverishment of biodiversity, loss of resilience to biotic invasions, destabilization of populations at lower trophic levels, and loss of many ecosystem services that benefit human society directly and indirectly. Lethal predator control is not effective at reducing depredation in the long term. Instead, we recommend that WS and its government partners involved in wildlife conflict management emphasize training livestock producers in methods of nonlethal control, with sparing use of lethal control by methods that are species-specific, and cease all lethal control in federal wilderness areas and for the purpose of enhancing populations of common game species.

Introduction

Utilitarian valuation of wildlife—including large carnivores—in Western societies increasingly is being replaced with noncommodity valuation (Schwartz *et al.* 2003; Treves & Karanth 2003; Loomis 2012). In the United States, this has led to growing public support for preservation of our diverse native fauna and naturally functioning native ecosystems, particularly in the larger landscapes of western public lands (Bengtson *et al.* 1999). More than 70 million Americans spend $55 billion and generate over $100 billion in total economic activity on nonconsumptive uses of wildlife in native habitats, especially on federal public lands (Leonard 2008; USFWS 2012a).

At the same time, leading ecologists have concluded that many of the world's pandemics, irruptions of undesirable species and collapses of desirable ones, and destabilization of ecosystems, resulting in lost ecosystem services, have been caused by the loss of apex predators (Estes *et al.* 2011) and of important small native herbivores (Delibes-Mateos *et al.* 2011). Still, the US government spends tens of millions of dollars annually killing predators and other mammals and birds that private agribusiness regards as pests (WS 2012a).

Table 1 Federally threatened (T), endangered (E), and ESA petitioned (P)[a] mammals killed by Wildlife Services (1990–2011)

Species	States Where Killed	Year (# Killed)	TOTAL
NRM gray wolf (*Canis lupus*) (E)[b]	ID, MT, WY	1996 (6), 1997 (10), 1998 (15), 1999 (16), 2000 (25), 2001 (13), 2002 (42), 2003 (49), 2004 (75), 2005 (77), 2006 (129), 2007 (178), 2008 (210), 2009 (255), 2010 (262), 2011 (154)	**1,516**
Western Great Lakes gray wolf (*Canis lupus*) (T)[c]	MI, MN, WI, ND	1990 (94), 1991 (70), 1992 (114), 1993 (141), 1994 (165), 1995 (85), 1996 (134), 1997 (212), 1998 (168), 1999 (157), 2000 (149), 2001 (105), 2002 (152), 2003 (138), 2004 (115), 2005 (175), 2006 (149), 2007 (162), 2008 (186), 2009 (223), 2010 (190), 2011 (211)	**3,295**
Mexican gray wolf (*C. lupus baileyi*) (E)	AZ, NM	2004 (1), 2005 (1), 2006(3), 2007 (4)	**9**
Island gray fox (*Urocyon littoralis*) (E)[d,e]	CA	1990 (2), 1998 (2), 1999 (13)	**17**
San Joaquin kit fox (*Vulpes macrotis mutica*) (E)[f]	CA	1990 (1)	**1**
Louisiana black bear (*Ursus americanus luteolus*) (T)	LA	1990 (2), 1995 (1), 1999 (2), 2002 (1)	**6**
Grizzly bear (*Ursus arctos horribilis*) (T)	MT, WY	1990 (9), 1997 (1), 1999 (2), 2000 (1), 2001 (1), 2002 (2), 2003 (3), 2005 (2), 2010 (2)	**23**
Canada lynx (*Lynx canadensis*) (T)	UT	1990 (1)	**1**
Wolverine (*Gulo gulo*) (P)	ID	2010 (1)	**1**
Black-tailed prairie dog (P) (*Cynomys ludovicianus*)	CO, KS, ND, NE, NM, MT, OK, TX, WY	1990 (54), 1991 (354), 1992 (408), 1993 (220), 1994 (256), 1995 (391), 1996 (1,302), 1997 (696), 1998 (833), 1999 (321), 2000 (43), 2001 (19), 2002 (337), 2003 (52), 2004 (53), 2005 (88), 2006 (961), 2007 (1,132), 2008 (3,537), 2009 (10,533), 2010 (20,515), 2011 (16,277)	**58,382**
Black-tailed prairie dog- Burrow/Den[g] (P) (*Cynomys ludovicianus*)	CO, NE, OK, WY	2007 (18), 2008 (12), 2009 (13,252), 2010 (24,204), 2011(15,821)	**53,307**
Gunnison's prairie dog (P) (*Cynomys gunnisoni*)	AZ[h], CO, NM	1996 (57), 1997 (16), 1998 (108), 1999 (101), 2000 (755), 2001 (58), 2005 (30), 2006 (259), 2007 (11), 2008 (72), 2009 (387), 2010 (394), 2011 (808)	**3,056**
Gunnison's prairie dog- Burrow/Den[g] (P) (*Cynomys gunnisoni*)	CO	2009 (625), 2010 (5,918), 2011 (4,775)	**11,318**
White-tailed prairie dog (P) (*Cynomys leucurus*)	CO, NM, UT, WY	1996 (4), 1997 (120), 1999 (72), 2001 (1), 2004 (2022), 2005 (3), 2006 (317), 2007 (94) 2008 (116), 2009 (1,694), 2010 (1), 2011 (4)	**4,448**
White-tailed prairie dog- Burrow/Den[g] (P) (*Cynomys leucurus*)	CO	2009 (1,950), 2010 (59), 2011 (4)	**2,013**

[a]Four species were candidates for ESA listing as either T or E at some time during the period, following citizen petitions to the US Fish and Wildlife Service (USFWS); of these, wolverine in its entire range and Gunnison's prairie dog in parts of CO and NM were found by USFWS to be warranted for listing but precluded by higher priority species; subsequently and as of this writing USFWS, under court order, is reevaluating the entire Gunnison's prairie dog species for listing; black-tailed prairie dog and white-tailed prairie dog were found not warranted for listing in 2009 and 2010, respectively; [b]NRM gray wolf was reintroduced in 1995 and 1996 and then designated under the ESA as a nonessential experimental population; listed as T in ID and MT, and E in WY; the ID and MT wolves were delisted in 2011; [c]Western Great Lakes gray wolf was listed as T in MN and E in MI and WI; delisted in Mar 2007, reversed in Sept 2008, delisted again in Jan 2012; [d]four of six subspecies listed as Endangered under the ESA; IUCN lists entire species as critically endangered; increased take in 1999 partly due to depredation on endangered shrike *Lanius ludovicianus anthonyi;* [e]lumped into "gray foxes" by WS since 2000; [f]lumped into "kit foxes" by WS since 2000; [g]listed as "Removed/Destroyed" by WS; [h]listed as "Prairie-Dog, z-(Other)" by Wildlife Services, included in Gunnison's category here based on geographic range of *Cynomys* in Arizona.

With 10 name changes and several department transfers during its 126-year legacy of animal control, the stated purpose of Wildlife Services (WS, an agency of the US Department of Agriculture's [USDA] Animal and Plant Health Inspection Services [APHIS]) is "to provide Federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist" and more specifically to "apply the integrated wildlife damage management (WDM) approach to provide technical assistance and direct management operations" (WS 2012a). Yet, since 2000, WS has killed—intentionally and unintentionally—2 million native mammals (WS 2012a), including 12 taxa of federally endangered, threatened or "candidate" mammals (Table 1), numerous state-protected mammals (Table 2), and 15 million native birds including—unintentionally—protected golden eagles (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*) (Knudson 2012a; WS 2012a; WS unpubl. data); WS unintentionally killed an endangered California condor (*Gymnogyps californianus*) in 1983 (US Congress

Table 2 State-listed threatened (T), endangered (E), and special concern (SC) mammals killed by Wildlife Services (1996–2011)[a]

Species	State	Status	Year (# taken)	TOTAL
Swift fox (*Vulpes velox*)	CO	SC	1998 (6)[b], 2001 (1), 2003 (4), 2005 (2), 2006 (6), 2010 (3)	**22**
	NE	E	2008 (2)	**2**
	WY	SC	1999(1), 2001 (1), 2002 (2), 2004 (6), 2005 (2)[c], 2006 (3), 2007 (6), 2008 (12), 2009 (5), 2010 (8), 2011 (8)	**54**
Kit fox (*Vulpes macrotis*)	UT	SC	1996 (5)[b], 1997 (4)[b], 1998 (3)[b], 1999 (4), 2000 (4), 2001 (1), 2003 (14), 2004 (3), 2005 (29), 2007 (2)	**69**
River otter (*Lontra canadensis*)	CO	T	2003 (1)	**1**
	IL	T[d]	2002 (1), 2005 (3), 2006 (4), 2007 (6)	**14**
	NE	T	2009 (1)	**1**
Black-tailed prairie dog[c] (*Cynomys ludovicianus*)	CO	SC	2000 (1), 2005 (4), 2006 (918), 2007 (1,108), 2008 (3,520), 2009 (6,042), 2010 (14,029), 2011 (8,906)	**34,258**
	MT	SC	2002 (200), 2003 (5), 2004 (3), 2009 (20), 2010 (29)	**257**
White-tailed prairie dog[c] (*Cynomys leucurus*)	UT	SC	1996 (4)[b], 1997 (120)[b], 1999 (72), 2005 (1), 2006 (317), 2007 (94), 2008 (100), 2009 (1,625)	**2,333**

[a]Reported take by WS was unintentional (nontarget) unless otherwise indicated; [b]intention of take unknown; [c]take was intentional; [d]delisted in September 2004.

1992). Vertebrates of 150 species have been killed unintentionally by WS since 2000 (Knudson 2012a; WS 2012a) by nonselective control methods including snares, leghold traps, poison-laced bait, baited explosive cyanide cartridges (M44s), and gassing of burrows and dens (Knudson 2012a; WS 2012a).

WS's National Wildlife Research Center (NWRC) conducts important research in nonlethal control, but those methods NWRC concludes are effective rarely are adopted by WS field operations, particularly on livestock grazing allotments in the West, which are heavily biased toward lethal control (GAO 1995; Niemeyer 2010); WS claims it *cannot* determine what proportion of its WDM expenditures go toward nonlethal methods (WS 2012b).

WS conducts little or no population monitoring of lethally controlled mammals nor of their alternate natural prey, no studies of whether WS control is additive with other causes of mortality, and no studies of how control affects populations of nontarget species that are unintentionally killed. Moreover, WS operations have never been the subject of an independent cost-benefit analysis, and their internal economic analyses do not adhere to guidelines used by most federal agencies, nor do they consider lost ecological or economic values of the predators themselves (Loomis 2012). In this policy perspective, we argue that the federal government's ongoing and century-old program of widespread lethal control of western predators, and of other keystone species such as prairie dogs (*Cynomys* spp.), requires cost-benefit analysis-driven reform in order to represent broader societal interests, restore biodiversity and ecosystem function, and align with current scientific knowledge on wildlife control.

The western United States possesses numerous large national parks, roughly 300 million acres of national forests and grasslands and federal public range lands, and 50 million acres of designated wilderness (Vincent 2004). Presettlement biodiversity and trophic relationships still can be represented on these significant land areas (Bailey *et al.* 1928; USDI BLM 1997). Unfortunately, many of these lands are overgrazed by livestock and by native ungulates whose predators have been depleted (Beschta *et al.* 2013). Simultaneously restoring apex predators and retiring livestock grazing on these lands hold promise for restoring western ecosystems and mitigating the likely effects of climate change (Beschta *et al.* 2013), but such restoration is inhibited in part by a legacy of predator and rodent control on these lands (GAO 1995; Estes *et al.* 2011; Davidson *et al.* 2012).

Evolution and environmental legacy of a federal wildlife control agency

Coincident with 3 million European families settling the western United States from 1865 to 1890 (Turner 1935), tens of millions of bison (*Bison bison*), mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and pronghorn (*Antilocapra americana*) that had populated the region were dramatically depleted by unregulated hunting, with bison nearly driven to extinction and largely replaced by domestic livestock (Isenberg 2000). Yet, mammalian carnivore populations retained much of their presettlement abundance (Kay 2007). Wolf and coyote (*C. latrans*) populations briefly thrived on bison carcasses littering the Plains; then, following the decline in their prey, these predators increasingly targeted domestic livestock, which elicited a campaign of large-scale predator extermination (Isenberg 2000; Robinson 2005).

After state and private bounties on predators became unreliable around 1900, livestock interests lobbied successfully for direct federal involvement in predator eradication, which began as a collaboration between USDA's Forest Service and Bureau of the Biological Survey (BBS) in the early 1900s and received direct congressional funding in 1915 (Hawthorne *et al.* 1999). Federal control of nuisance rodents soon followed, and, by 1939, government and western livestock interests cooperatively funded the Division of Predatory Animal and Rodent Control (PARC) under BBS at >$1 million (Cain *et al*. 1972; McIntyre 1982 *in* Feldman 2007).

Mass extermination of wolves and coyotes across the western United States began in the early 1900s; by the 1920s, overpopulation of rabbits induced their mass culling (600,000 rabbits were killed in 1 year in Idaho by government hunters; Hawthorne *et al.* 1999). Such lethal control mentality failed to recognize herbivore irruptions as consequences of predator release (Henke & Bryant 1999), or "trophic downgrading" (Estes *et al.* 2011). Extermination of prairie dogs—perceived as competitors with domestic livestock—also began in the early 1900s. New deal relief agencies greatly bolstered BBS/PARC's control programs; by 1936, the Civilian Conservation Corps alone had poisoned 21.5 million acres of prairie dog colonies across the western United States (Robinson 2005).

Controversial from the start: historical critiques of federal wildlife control

Early 20th century conservationists criticized federal government predator-eradication programs, after the successful extirpation of grizzly bears (*Ursus arctos horribilis*) from most of their range in the western United States, and the ongoing campaign against wolves (Robinson 2005). As early critics warned, extirpation of gray wolves from the western United States by 1930 caused interruption of natural trophic cascades, which became evident following their reintroduction to Northern Rocky Mountain (NRM) ecosystems in 1995 (Bergstrom *et al.* 2009).

Poisoning of prairie dog colonies by PARC and its successor agency Animal Damage Control (ADC, under the US Department of the Interior (USDI)) was implicated in the near extinction of the black-footed ferret (*Mustela nigripes*; Cain *et al.* 1972). The American Society of Mammalogists, repeatedly from 1924 to 2012 criticized federal wildlife control programs as overly reliant on lethal measures, driven by special interests rather than science, and causing excessive mortality of nontarget species. Over many decades, prominent conservationists, three study committees appointed by USDI, and several Government Accounting Office (GAO) reports echoed these concerns (see Supporting Information). The 1931 ADC Act (7 U.S.C. § 426) remains WS's primary enabling legislation (Robinson 2005); its provision for private cooperator funding of federal wildlife control programs creates a conflict of interest in setting WS management policy (Ketcham 2008).

Lethal control and its unintended consequences continue

Despite severe population reductions and extirpation of prairie dogs across 92–98% of their original range (Miller *et al.* 2007), there has been a resurgence of lethal control by WS, with 50,613 prairie dogs killed in 2009–2011, compared to 9960 in 2000–2008 (not counting Burrow/Den; Table 1; WS 2012a). Yet, it is questionable whether livestock directly benefit from extermination of prairie dogs, whose colonies have been shown to increase nutritional content and digestibility of forage plants, and increase live-plant to dead-plant ratio, for both bison and cattle (*Bos taurus;* Davidson *et al.* 2012). The loss of most large colony complexes of prairie dogs, partly due to continued government-funded extermination programs, has had cascading effects throughout North America's central grasslands, including declines of many other animal species that depend on prairie dogs as prey and for the unique habitats they create (Davidson *et al.* 2012; Figure 1), and the invasion of shrubs into those grasslands (Weltzin *et al.* 1997; Jones 2000). The US Fish and Wildlife Service (USFWS) program to recover endangered black-footed ferrets, almost solely dependent on prairie dogs as prey, currently is hindered by lack of reintroduction sites (Davidson *et al.* 2012).

Numbers of WS's primary mammalian targets of lethal control and certain other carnivores killed annually since 2000 has remained remarkably constant (Figure 2); data in Berger (2006) indicate a similar pattern from 1939 to 1998. Without monitoring of these populations, we do not know whether this represents a constant proportional annual mortality, but it at least implies that predator control has not effected any long-term solution to the perceived problem, and it shows there is no downward trend in lethal control, despite GAO (1995) admonishments. WS officials recently admitted that relatively few ranching operations, on an estimated 5–10% of native coyote range in the West, account for a large percentage of their annual coyote kills (Clay 2012;

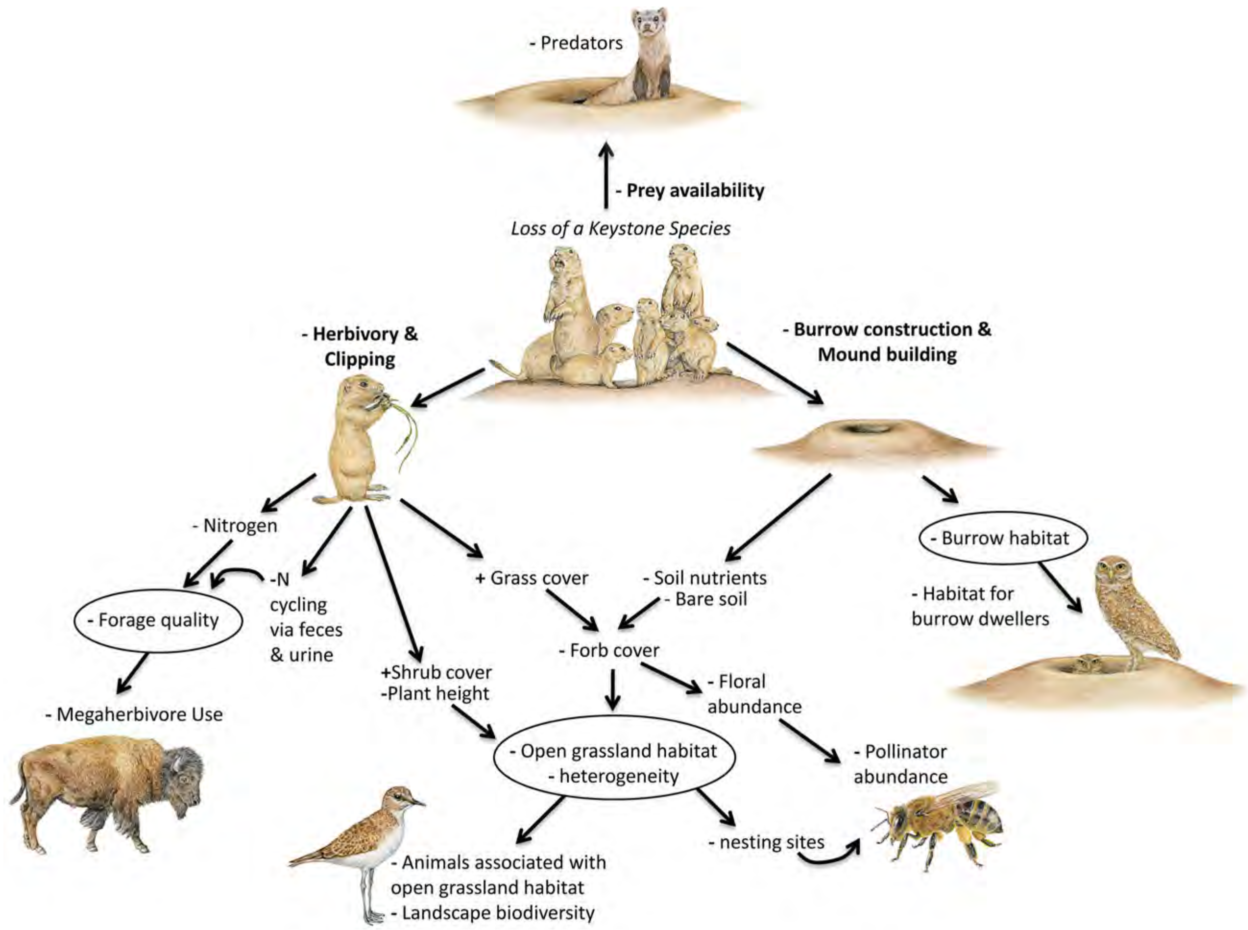

Figure 1 Conceptual diagram illustrating how the loss of a keystone species cascades throughout an ecosystem, using the black-tailed prairie dog (*Cynomys ludovicianus*) in North America's central grasslands as an example. Declines in prairie dogs result in the loss of their trophic (herbivory, prey) and ecosystem engineering (clipping, burrow construction, and mound building) effects on the grassland, with consequent declines in predators [e.g., black-footed ferrets (*Mustela nigripes*), raptors, swift and kit foxes (*Vulpes velox, V. macrotis*), coyotes (*Canis latrans*), badgers (*Taxidea taxus*)], megaherbivore activity [e.g., Bison (*Bison bison*)], invertebrate pollinators, and species that associate with the open habitats and burrows that they create [e.g., burrowing owls, (*Athene cunicularia*), mountain plovers (*Charadrius montanus*), pronghorn (*Antilocapra americana*), swift and kit foxes, cottontail rabbits (*Sylvilagus* spp.), rodents, and many species of herpetofauna and invertebrates]. Black arrows depict the effects of prairie dogs. Plus signs indicate an increase in an ecosystem property as a result of the loss of prairie dogs; minus signs indicate a decrease. Drawings are by Sharyn N. Davidson.

Knudson 2012c). State and federal managers removed 23.2% of the estimated coyote population of Wyoming in 1994–1995 (Taylor 2009). WS will not reveal exactly where coyote control occurs (WS 2012b), suggesting that localized population effects are a potential conservation concern. We acknowledge that range-wide effects likely are negligible, because coyotes have greatly expanded their range east and west during the period of WS control (Kays *et al.* 2010). Coyote removal at a local scale, however, can destabilize small-mammal communities, causing irruptions and reduced diversity (Wagner & Stoddart 1972; Henke & Bryant 1999).

Despite abundant evidence of top-down restoration of NRM ecosystems by reintroduced gray wolves (reviewed in Bergstrom *et al.* 2009), the number of wolves killed by WS has increased substantially since 2000, peaking at 480 in FY2009 (WS 2012a). Additionally, NRM wolves are now hunted in three states. Idaho and Montana killed 525 wolves—or 32% of their total population—by licensed hunting and WS control actions in 1 year, from 2009 to 2010 (Bergstrom 2011; USFWS 2012b). WS has not assessed whether their continued management kills of wolves is additive with hunting mortality and thus jeopardizes wolf recovery as a cumulative effect. Simulation modeling of NRM wolf populations indicates that this level of mortality is unsustainable, and with a likely increase in human offtake, NRM wolf populations will decline substantially (Creel & Rotella 2010).

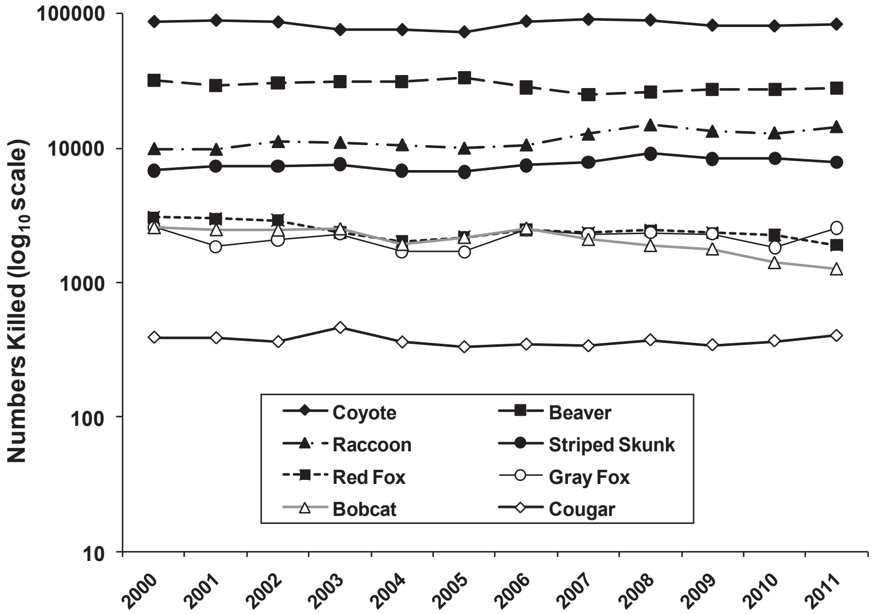

Figure 2 Numbers of the top seven species of native carnivores, plus beavers (*Castor canadensis*), killed annually by USDA-APHIS Wildlife Services from 2000 through 2011 (WS 2012a). Note: coyote (*Canis latrans*), beaver, raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*), in descending order, were the top four mammal species reported killed during the period by WS; fifth and sixth ranks, respectively, were "ground squirrels" and "prairie dogs," but several species are combined in each of those two categories.

Conversely, unmanaged populations of gray wolves in the Yellowstone ecosystem preferentially prey on old and diseased elk (Wright *et al.* 2006), so allowing wolves to establish and maintain natural pack structure could theoretically aid disease prevention in ungulate populations (Roy & Holt 2008). Reducing wolf populations increases coyote populations through "mesopredator release" and can have other unintended consequences on native ungulate populations (Berger *et al.* 2008; Prugh *et al.* 2009). For example, pronghorn fawn survival in areas with wolves was four times higher than in areas without wolves, because wolves suppressed coyotes and consequently fawn depredation (Berger *et al.* 2008). Predator control may, at least locally, decrease ecosystem resilience and lead to state shifts where invasive species become dominant (Wallach *et al.* 2010), which only increases the need for invasive control while decreasing its likelihood of success.

The legacy and legislative history of federal wildlife control reveal agriculture as its primary beneficiary, and lethal control of top carnivores and burrowing mammals such as prairie dogs particularly benefits western ranchers (see WS 2011). A relatively few influential western ranchers and major agribusiness lobbying groups, such as the American Farm Bureau, have prevented Congress from reforming WS in the past (Robinson 2005; Ketcham 2008). Nearly half of WS's annual \$57 million federal allocation directly benefits already heavily taxpayer-subsidized agriculture (FY2010; WS 2012a; Ketcham 2012). This subsidy supports merely 7 million head of livestock, primarily cattle, which graze 268 million acres (>1 million km^2) of leased federal land, or 70% of the land area of 11 western states, including active allotments within 35% of the nation's wilderness areas (Fleischner 1994; 7 million head represented only 6.3% of the nation's total cattle, sheep and goats in 1994 [USDA 1999a, 1999b]). This subsidy contravenes other federal expenditures; e.g., USDI has spent over \$43 million since 1974 reintroducing and conserving the gray wolf (USFWS 2011).

Cattle losses to all predators account for 5.5% of total mortality in the United States (USDA 2011) and even in the NRM wolf recovery zone, wolf predation accounts for a fraction of total predator losses (USFWS 2012b). Yet, WS increased control kills of wolves in recent years in the Wyoming recovery area, even though confirmed wolf depredations of cattle and number of packs depredating have declined steadily since 2006, while the wolf population has increased by 31% (USFWS 2012b).

In addition to increasing human-wildlife conflict, overstocking public rangelands with livestock reduces forage and habitat for small mammals (Bock *et al.* 1984; Heske & Campbell 1991) and other vertebrates (reviewed in Beschta *et al.* 2013) that are important prey of carnivores.

Ohmart & Anderson (1986) concluded livestock grazing likely was the major factor negatively affecting wildlife populations in 11 western states. Sacks & Neal (2007) found a significant negative association between wild prey biomass and sheep predation by coyotes, suggesting that healthy and productive native small-mammal habitats act as buffers against livestock depredation by coyotes. With a declining natural prey base, predators may switch to more abundant domestic stock, prompting greater demand for lethal predator control (Knowlton *et al.* 1999). Heavy cattle grazing has significantly depressed black-tailed jackrabbit (*Lepus californicus*) density (Flinders & Hansen 1975), and when black-tailed jackrabbit populations became severely depressed, ewe and lamb depredation by coyotes increased dramatically (Stoddart *et al.* 2001).

As long as private livestock producers can externalize the costs of predator losses via government-subsidized predator control, they will have little incentive for responsible animal husbandry techniques, i.e., reduce stocking levels, clear carcasses and after-births quickly, confine herds at night or during calving/lambing, install fencing and fladry, or adopt numerous other nonlethal preventive methods to avoid depredation (Shivik *et al.* 2003). The easiest and most obvious places to reduce human-wildlife conflict are wilderness areas. As long as the practice of lethally controlling "problem animals" persists wherever livestock graze (see Linnell *et al.* 1999), livestock-free wilderness areas and national parks may provide the only refuges and source populations for most rare and endangered North American large carnivores.

Lethal wildlife control for livestock: ineffective and wasteful

In 1887, Albert Fisher, C. Hart Merriam's assistant at BBS, examined stomach contents of hawks and owls shot for $90,000 in bounties in Pennsylvania, estimating the lost value of rodent and insect control by removing these predators at $3.9 million; the direct savings in chickens was $1,875 (Robinson 2005; the federal government long ago ceased targeting avian predators for lethal control but has not altered its approach to mammalian predators). Cole (1970) estimated a 5:1 cost-benefit ratio of WS killing Arizona coyotes for livestock depredation, adding lost forage due to compensatory increases in jackrabbits to taxpayer costs for lethal control (see Wagner & Stoddart 1972; Henke & Bryant 1999).

Eradication of predators ended livestock depredation, but lethal control measures, short of eradication, appear no more effective in the long term than no lethal control at all. Three gray wolf removal studies in different decades in different areas of North America indicate that effects are short-lived, because remaining individuals and recolonizing packs just as often depredate as those removed (Treves & Naughton-Treves 2005). Coyote control usually has involved population reduction rather than selective killing (Mitchell *et al.* 2004); this can create temporary local extirpations, soon attracting immigrants that experience dramatically higher reproductive output, resulting in no long-term effect on depredation (Connolly 1978; Knowlton *et al.* 1999). Removing more than the territorial breeding pair of coyotes (which commit most depredations of sheep) from a wider zone around a depredation site may even *increase* the overall problem by allowing more breeding pairs to immigrate (Sacks *et al.* 1999). Despite considerable effort by WS at lethal coyote control in the western United States, evaluation of a 60-year data set indicated that the decline of the sheep industry in both eastern and western United States could be attributed to market trends and production costs, and that predator control (lacking in the East) did not have a significant impact on the decline (Berger 2006).

Lethal control often proceeds without certain knowledge that targeted individuals are responsible or that a depredation has occurred (as in "preventive" culling of coyotes; GAO 1990; Knudson 2012c). But the compensatory aspect of depredation control described above suggests that even highly specific lethal control methods such as poison collars (Connolly *et al.* 1978) would not be a long-term solution. Preventive, nonlethal methods, such as fencing, guard dogs, and taste aversion conditioning hold more promise for long-term reduction of depredation (Green *et al.* 1984; Gustavson & Nicholas 1987; Treves & Karanth 2003; Knudson 2012b). That the unmanaged wolf population of Yellowstone National Park has declined 40% since its peak density in 2006 and appears to have stabilized at ≤100 animals (Figure 3) suggests that simply ending lethal control elsewhere in the NRM could lead to, at worst, a stable rate of depredation (<5%; Bergstrom *et al.* 2009; USDA 2011), which could be decreased by aggressive application of nonlethal methods. The latest annual report for the NRM projects a declining growth rate for the wolf population as it stabilizes at a lower equilibrium in line with natural carrying capacity (USFWS 2012b). Affirming what generally is hypothesized for a territorial mammal, WS/NWRC's own research indicates that gray wolf populations are not prey-limited but rather are intrinsically density-dependent, i.e., self-regulating (Cariappa *et al.* 2011).

Even assuming scientifically supportable benefits of targeted killing of mammals by WS, 2000–2011 kill data reveal several striking examples of waste of nontarget species. Badgers are targeted in most states where they

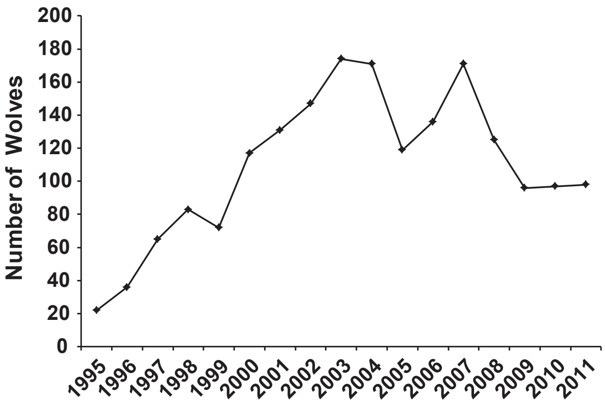

Figure 3 Annual numbers of wolves in Yellowstone National Park from initial reintroduction in 1995 and 1996 through 2011 (winter counts; data from NPS 2011; USFWS 2012b).

occur, but fully a third (>180 per year) of those killed were killed unintentionally (WS 2012a). (Hall 1930 also reported excessive nontarget killing of badgers by PARC agents). Virtually all kit foxes (*Vulpes macrotis*) and swift foxes (*V. velox*) killed (95% of 339 and 99.5% of 225, respectively) were killed unintentionally by neck snares, leghold traps, or M44s set for coyotes (WS 2012a). Ironically, swift foxes were extirpated in many areas by the 1930s as a result of nontarget mortality from federal coyote and wolf control programs (Stephens & Anderson 2005). Swift foxes were identified as the one predator ADC may have killed in FY1989 over a significant portion of its range and therefore put at risk of extinction (GAO 1990). Eighty-six percent of 82 ringtails (*Bassariscus astutus*) killed from 2000 to 2011 were killed unintentionally, as were 97.3% of 2,413 collared peccaries (*Pecari tajacu*; WS 2012a). An average of >400 river otters (*Lontra canadensis*) annually were killed unintentionally by WS, after considerable efforts by at least 21 states to reintroduce the species (Raesly 2001). Unfortunately, eyewitness accounts suggest that not all protected species unintentionally killed are being reported by WS field agents (Niemeyer 2010).

The other reason for lethal predator control

Increasing participation of WS in what was identified in its 2001 Research Needs Assessment as "the growing and expanding negative impact of predators (for example, coyotes, foxes, wolves, and raccoons) on wildlife resources (for example, deer and antelope)" highlights renewed emphasis on WS's role as promoter of particular wildlife species over others (Bruggers *et al*. 2002). This emphasis contradicts the evidence that, where apex predators have been reduced or extirpated, native ungulate populations exceed carrying capacity and are causing increasing habitat deterioration (Beschta *et al.* 2013). In its collaboration with states, WS controls wolves and other predators by aerial gunning in remote areas to reduce predation on elk (Robbins 2011; WS 2012b), especially in Idaho, despite the fact that in 2009, 26 of 29 management units in that state had elk populations at or above state management objectives (Bergstrom *et al.* 2009). Despite wolf recovery and while its aggressive wolf-reduction plan was awaiting federal approval, Wyoming had a record elk harvest in 2010 (WGFD 2013). The political power of western ranching has long been a primary determinant of WS's mammalian predator control (Robinson 2005), but conducting it for the ostensible benefit of common native game species specifically favors certain segments of the US population over others. The Wildlife Society (TWS), in its recent technical review of carnivore management, states "Although the Public Trust Doctrine for Wildlife Management clearly articulates that federal and state agencies manage wildlife for the benefit of all citizens, often the opinions of nonconsumptive users are ignored. Unbalanced information that supports the perceptions of some stakeholders over others can increase conflicts (Peek *et al.* 2012)." This seems to us to be the case when state or federal agencies conduct predator control on wilderness areas (see WS 2012b) and/or implement predator control to promote certain game species over other native wildlife. The latter arguably benefits 11.6 million people in the United States who hunt big game to the detriment of 22.5 million active wildlife watchers, whose direct expenditures are three times that of big-game hunters (USFWS 2012a). TWS goes on to say "In places where human presence and impact is minimized, wildlife populations of all species should be allowed to fluctuate with as little anthropogenic interference as possible (Peek *et al.* 2012)."

Even if enhancing wild ungulate populations were a justifiable goal, predator control is an unproven instrument for achieving it. A meta-analysis of predator-removal experiments in 113 systems found prey populations subsequently *declined* in 54 of them (Sih *et al.* 1985). In Idaho, wolf predation on elk is <10% of total elk mortality and mostly replaceable (IDFG 2007; see Wright *et al.* 2006). In a long-term, large-scale manipulative study of coyote and cougar (*Puma concolor*) removal in Idaho, the effects on mule deer abundance were marginal and short term; winter severity in the current and previous winters was the best predictor of deer population trends (Hurley *et al.* 2011). Three years of elk-calf mortality data from northern Yellowstone indicated wolves did not meet an important criterion of ability to control elk populations, as they were not the dominant predator on all stages of the life cycle of the prey (NRC 1997), accounting for only 14–17% of calf mortality (Barber-Meyer *et al.* 2008).

Conclusion

The continuing heavy reliance of the federal government on lethal control of native mammals is a vestige of the outmoded mentality of western expansionism, in which the goal was to "tame" the wilderness, replacing the ecosystem's primary-consumer trophic level entirely with domesticated herbivores and a few favored game species and all higher trophic levels with humans (Robinson 2005). Its survival into the 21st century defies the consensus among ecologists that significant reductions in local populations of native primary consumers and apex predators has had far-reaching consequences on primary production, nutrient flows, disease incidence, and biodiversity at all levels and at all spatial scales (Delibes-Mateos *et al.* 2011; Estes *et al.* 2011; Davidson *et al*. 2012).

Both to restore ecosystems and to serve broader societal interests in conservation, we recommend that all federal management agencies that deal with human-wildlife conflict collaborate with all stakeholders in adopting a more holistic and ecosystem-based management approach resulting in reduced reliance by WS on lethal control methods, especially on western public lands. An independent cost-benefit analysis of WS operations that includes full economic valuation of native wildlife subject to lethal control (possibly including a contingent valuation method study of public willingness to pay for predators; Loomis 2012) must be undertaken. This could include participatory intervention planning (PIP; Treves *et al.* 2009), which analyzes management options in light of cost effectiveness, sociopolitical acceptability, and species-specific efficacy. It will also necessitate that WS field operations move beyond promotion to actual implementation of "integrated WDM," in which lethal control is a last, not a first, resort. Specific measures to reduce the negative impacts of, and need for, lethal wildlife control in the western United States include: 1) retiring grazing leases on remote federal lands, especially those that are overgrazed or in wilderness areas; 2) requiring federal grazing permittees, under penalty of revocation, to employ best animal-husbandry practices fully; 3) prioritizing use of, and research and outreach on, nonlethal, preventive methods of depredation control; 4) ceasing lethal control methods that are not highly selective of the individual (and species) being targeted; 5) ending misguided efforts to enhance populations of common game species by predator control; 6) preparing an updated, peer-reviewed environmental impact statement on all WS lethal control programs, which analyzes potential direct, indirect, and cumulative effects of lethal control on populations and ecosystems in light of current science; and 7) making details of WS funding sources and budget expenditures transparent and readily available to the public.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web site:

Brief History of Expert Criticism of Federal Wildlife Control Programs

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Exhibit 8

Predator control should not be a shot in the dark

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Livestock owners traditionally use various non-lethal and lethal methods to protect their domestic animals from wild predators. However, many of these methods are implemented without first considering experimental evidence of their effectiveness in mitigating predation-related threats or avoiding ecological degradation. To inform future policy and research on predators, we systematically evaluated evidence for interventions against carnivore (canid, felid, and ursid) predation on livestock in North American and European farms. We also reviewed a selection of tests from other continents to help assess the global generality of our findings. Twelve published tests – representing five non-lethal methods and 7 lethal methods – met the accepted standard of scientific inference (random assignment or quasi-experimental case-control) without bias in sampling, treatment, measurement, or reporting. Of those twelve, prevention of livestock predation was demonstrated in six tests (four non-lethal and two lethal), whereas counterintuitive increases in predation were shown in two tests (zero non-lethal and two lethal); the remaining four (one non-lethal and three lethal) showed no effect on predation. Only two non-lethal methods (one associated with livestock-guarding dogs and the other with a visual deterrent termed "fladry") assigned treatments randomly, provided reliable inference, and demonstrated preventive effects. We recommend that policy makers suspend predator control efforts that lack evidence for functional effectiveness and that scientists focus on stringent standards of evidence in tests of predator control.

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Substantial numbers of vertebrate predators have been intentionally killed by government agencies and by private citizens acting legally or illegally (Wirsing and Ripple 2010; Ripple *et al.* 2014). More recently, however, killing top predators – such as wolves (*Canis lupus*) and leopards (*Panthera pardus*), which occasionally prey on livestock – has prompted concerns associated with ethical issues (Vucetich and Nelson 2014), effectiveness, and ecological impacts. Depletion of apex consumers, which include most large-bodied predators, has led to the degradation of ecosystems and disruption of vital ecological processes worldwide (Estes *et al.* 2011; Ripple *et al.* 2014). As a result, traditional non-lethal methods have been reinstated and new approaches are being developed (Treves *et al.* 2009).

Questions about functional effectiveness center on whether intervening will protect property owners from future losses ("effectiveness" hereafter). The question remains unresolved for many cases but is particularly unclear for killing predators (Mitchell *et al.* 2004; Treves and Naughton-Treves 2005; Woodroffe and Redpath 2015). Although it seems obvious that killing a carnivore about to take a lamb should ensure the latter's short-term survival, most lethal methods are applied indirectly in wholly different situations. Lethal intervention is usually implemented after carnivores are observed near livestock or days after a predation event has occurred, sometimes far from where the attack occurred (eg Treves *et al.* 2002). Historically, eradication campaigns have been aimed at reducing predation by exterminating species. However, national and global concerns about biodiversity loss have largely discouraged this, when applied to native predators (Treves and

In a nutshell:

- Predator control methods to prevent livestock loss have rarely been subject to rigorous tests using the "gold standard" for scientific inference (random assignment to control and treatment groups with experimental designs that avoid biases in sampling, treatment, measurement, or reporting)
- Across the controlled experiments that we systematically examined, higher standards of evidence were generally applied in tests of non-lethal methods than in tests of lethal methods for predator control
- Non-lethal methods were more effective than lethal methods in preventing carnivore predation on livestock generally; at least two lethal methods (government culling or regulated public hunting) were followed by increases in predation on livestock; zero tests of non-lethal methods had counterproductive effects
- All flawed tests came from North America; 10 of 12 flawed tests were published in three journals, compared to four of 12 tests with strong inference in those same journals
- We recommend suspending lethal predator control methods that do not currently have rigorous evidence for functional effectiveness in preventing livestock loss until gold-standard tests are completed

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Karanth 2003; Chapron *et al.* 2014). Furthermore, over time, numerous observers have noted that killing predators could fragment predator social groups or create vacancies in the ecological community, to be filled by more numerous, smaller species of predators that in turn might prey on livestock (Young and Dobyas 1945; Newby and Brown 1958; Haber 1996; Knowlton *et al.* 1999; Prugh *et al.* 2009). Indiscriminate killing was also often ineffective in removing probable culprits (Knowlton *et al.* 1999). Finally, for both lethal and non-lethal interventions, little information was available about the behavioral and population dynamic responses of survivors or any ripple effects, whereby neighboring livestock owners suffer higher costs after predator control was implemented on a nearby property. For example, in response to moderate rates of human-induced mortality, coyotes (*Canis latrans*) frequently showed compensatory reproduction, resulting in higher population growth rates and population densities during subsequent years (Knowlton *et al.* 1999). Controversy and uncertainty about predator control generally persisted for decades in the absence of convincing evidence. Resolving this controversy will help to restore populations of predators and other species in largely undisturbed ecosystems as well as in more developed landscapes with people and domestic animals (Fischer *et al.* 2008).

Prior studies of predator control reviewed evidence for one carnivore species (eg coyotes; Mitchell *et al.* 2004) or a single type of control method (Linnell *et al.* 1997; Mason *et al.* 2001), but general conclusions were elusive because standards of evidence varied or unreliable inferences arose from uncontrolled tests. As the field matured, so did its standards of evidence. Experiments with Australian sheep (*Ovis aries*), for instance, suggested that intense and frequently repeated killing of introduced red foxes (*Vulpes vulpes*) and dingoes (*Canis lupus dingo*) produced only minimal, inconsistent protection for lambs (Greentree *et al.* 2000; Allen and Sparkes 2001). Controlled experiments on three management techniques for European badger (*Meles meles*) – a mustelid – showed that lethal interventions significantly exacerbated disease transmission from badgers to livestock (Vial and Donnelly 2012). Nevertheless, predator control methods have not been subject to comprehensive "clinical trials", in which interventions that appear effective in "laboratory trials" are tested experimentally on real subjects, to borrow terminology and lessons from the biomedical sciences (Mukherjee 2010). Here we apply uniform criteria and an established standard of evidence to evaluate the effectiveness of various interventions used to prevent predation on livestock by carnivores (ie terrestrial members of Carnivora >5 kg, such as coyotes, wolves, bears, or big cats). We adopted the scientific framework for strong inference first articulated by Platt (1964) to review both the experimental design and the evidence for effectiveness of various, widely used lethal and non-lethal methods.

Strong inference demands the careful avoidance of bias at several stages, primarily through the use of an experimental control with random assignment of treatments, followed by unbiased measurement and reporting subjected to rigorous, anonymous peer review, with disclosure of potential conflicts of interest. For ease of discussion, we refer to random assignment of treatments as the "gold standard" for scientific inference – but we also examine whether study designs included other steps to avoid bias in sampling, measurement, or reporting. We use the scientific terms "bias" and "flawed design" without any suggestion of intentional bias or incompetence. Often well-intentioned and highly competent researchers encounter flaws in research design because of inescapable challenges presented by field conditions. Nevertheless, the gold standard of scientific inference has been embraced by practitioners within the clinical biomedical sciences because of a long history of unreliable inferences from tests that had one or more biases in the sampling of subjects, treatments, measurements, or reporting (Mukherjee 2010). Unlike scholars in the paleosciences (Gould 1980; Biondi 2014) who have made cogent arguments for a lesser standard because studies of the past can never be replicated exactly to the specifications required by scientific experimentation, ecologists have long advocated for controlled experiments in ecological research (Hairston 1989). We therefore hold our subdiscipline to the gold standard. However, the shortage of tests meeting the gold standard (see below) led us to examine an alternative "silver standard" of non-random assignment of treatments, as long as we discerned – from a close reading of the peer-reviewed, published methods – no other biases that might weaken inference. The silver standard included quasi-experimental tests with haphazard assignment of treatments (case-control or Before–After Control–Impact [BACI] designs).

Methods

Methods of review

We performed repeated searches of the peer-reviewed literature using Google Scholar, followed by a snowball method using the reference lists of >100 articles identified in the search. We searched with the following keywords: (control, damage, depredation, lethal, non-lethal, removal, or livestock) AND (predat* or carnivor*). For our quantitative summary of results, we included only peer-reviewed, published tests in our native languages (English and Slovenian) that (1) used experimental or quasi-experimental control with a design that allowed strong inference, (2) occurred on working livestock operations with free-ranging, native carnivores of North America or Europe, and (3) verified livestock losses.

Table 1. Tests of interventions to prevent carnivore predation on livestock that met review criteria

	Observed changes (if any) in livestock predation		
	Decrease	*No difference*	*Increase*
Lethal methods	Quasi-experimental tests of culling gray wolves (1) and culling, hunting, and poaching Eurasian lynx (2)	Quasi-experimental tests of hunting black bears (3*), hunting and culling brown bears (4), and culling and hunting gray wolves (5)	Quasi-experimental tests of culling coyotes (6) and hunting cougars (7**)
Non-lethal methods	Random assignment test of fladry on gray wolves (8), random assignment test of LGDs on gray wolves and coyotes (9), quasi-experimental tests of LGDs and night enclosures on gray wolves (10), and fladry on gray wolves (11)	Random assignment test of fladry on coyotes (8), quasi-experimental tests of diversionary feeding on brown bears (12)	

Notes: *Some complaints related to livestock predation but some related to property damage. **A quasi-experimental two-county comparison was reported in Peebles *et al.* (2013), based partly on the work of Cooley *et al.* (2009a,b). Sources of evidence are listed by number: 1 = Bradley *et al.* (2015); 2 = Herfindal *et al.* (2005); 3 = Obbard *et al.* (2014) see their Table S1 for use of moving averages; 4 = Sagør *et al.* (1997); 5 = Krofel *et al.* (2011) reanalyzed as after–before measures of livestock losses (WebPanel 1); 6 = Conner *et al.* (1998); 7 = Peebles *et al.* (2013) and Cooley *et al.* (2009a,b) treated as a single test for the two-county comparison, not the state-wide analysis; 8 = Davidson-Nelson and Gehring (2010); 9 = Gehring *et al.* (2010a,b); 10 = Espuno *et al.* (2004); 11 = Musiani *et al.* (2003); 12 = Kavčič *et al.* (2013). LGDs = livestock-guarding dogs. We excluded two studies that used time lags but not BACI designs to infer changes in livestock losses over time (eg Wielgus and Peebles 2014; Fernández-Gil *et al.* 2016).

Regarding criterion (1), we explicitly describe the reasons any test was deemed unreliable based on selection, treatment, measurement, or reporting biases in WebPanel 1. We excluded analyses that were purely correlational, those based only on unverified estimates of livestock loss, and analyses in which $n \leq 4$ subjects (farms or livestock herds) completed the test. Several studies we mention in the footnote to Table 1 came close to the silver standard by calculating time lags in livestock loss following treatments but we omitted them because they failed to estimate change in livestock loss (after–before). We believe several of these might qualify if the data were reanalyzed.

Regarding criterion (2), we defined a working livestock operation as one in which livestock, land, and predators were managed in ways characteristic of a private livestock producer. That criterion excluded tests with captive predators (Jaeger 2004). We did not review qualifying tests from continents other than North America and Europe for two reasons. First, we excluded Australia because dingoes and red foxes are non-native species and their predation on livestock today may have been shaped by domestication and captivity, respectively, as a result of human-associated artificial selection for traits in these canids. Second, by excluding other continents, we avoided biased representation of tests published in languages that we (the authors) could not understand well enough to evaluate the research design. As WebPanel 1 and our descriptions below reveal, careful reading is necessary to understand research design.

Regarding criterion (3), we excluded studies measuring self-reported livestock losses or perceptions of effectiveness from Table 1. Although livestock owners' perceptions of interventions are important for the adoption of effective techniques, the functional effectiveness of candidate solutions should be established first. This exclusion reduced the number of allegedly effective non-lethal methods in particular.

Methods of analysis

Our quantitative summary was limited to counting tests in various categories. We did not attempt to perform a quantitative meta-analysis of effects, because there is no standard for consistent application of treatments and because the variety of methods used even within one category (eg different types of traps, or breeds of livestock-guarding dogs [LGDs]) would introduce uncontrollable variation. Furthermore, tests using the silver standard offer weaker inference than those using the gold standard but to an unknown degree.

We use the terms "culling" to refer to any variety of killing of wild predators by agents of the government and "hunting" to refer to regulated killing by private citizens.

Geographic and taxonomic distribution

The geographic distribution of tests in Europe and North America has been patchy, and the taxonomic distribution has concentrated on canids (n = 7), ursids (n = 3), and felids (n = 2) (Figure 1). The few tests involving wild felids and ursids do not suggest marked differences between taxonomic groups, as detailed below.

Results

Flawed tests

The earliest scientific studies had design flaws and a total of 12 tests (one published as recently as 2008) were excluded despite otherwise meeting our criteria (WebPanel 1); the earliest test with reliable inference was published in 1997 (Sagør *et al.* 1997). Our review of flawed tests revealed two important patterns. First, early investigations with design flaws have been cited uncritically, even after flaws were identified in peer-reviewed, published articles (eg Mitchell *et al.* 2004). Second, seven tests of lethal methods and four (or five if one counts sterilization) tests of non-lethal methods had design flaws. All flawed tests were conducted in North America.

Lethal methods

Reliable inference was detected in only 7 tests of lethal methods that met the silver standard (those with quasi-experimental designs); tests of lethal methods that might have qualified for the gold standard were flawed (WebPanel 1). Of those 7 tests, only two were shown to reduce livestock losses from predation; in the remaining five, predation on livestock was unaffected in three tests and increased in two tests.

Using a quasi-experimental design to compare Eurasian lynx (*Lynx lynx*) predation on sheep across sites varying in the number of lynx killed over a 6-year period, Herfindal *et al.* (2005) reported that a lethal method (killing by various means) prevented sheep losses but only to a minor degree; prevention differed by site and its duration was short term. The test indicated that for every male and female lynx that were killed, 13 lambs and 2 lambs were saved, respectively. Because the range of each lynx encompassed multiple sheep flocks, the benefits to individual livestock owners averaged <1 lamb saved per lynx killed and were deemed to be "of little practical benefit" (Herfindal *et al.* 2005). Given that individual lynx differed substantially in their tendencies to prey on sheep, benefits were also geographically variable (Herfindal *et al.* 2005).

In three separate investigations of lethal control measures applied to bears, predation on livestock was unaffected or increased. For example, culling Norwegian brown bears (*Ursus arctos*) did not reduce predation on sheep (Sagør *et al.* 1997). Likewise, results from a study of American black bears (*Ursus americanus*) across Ontario, Canada, suggested that neither the number of black bears killed by hunters using various methods, nor bear population size, predicted future bear-related damage; rather, bear food availability was the best predictor (Obbard *et al.* 2014). A similar study in Wisconsin (Treves *et al.* 2010) did not include sufficient numbers of livestock losses among the incidents involving black bears for us to include in Table 1 but the results for agricultural damages of all sorts were similar when the data were reanalyzed as a BACI design.

Most quasi-experimental tests of lethal methods showed no effects or counterproductive effects on livestock loss. Slovenia's nationwide culling of 51 wolves, averaging 4.6 wolves or ~25% of the population annually, was distributed among local management units proportional to the current wolf densities. In an 11-year study in Slovenia, Krofel *et al.* (2011) detected no effect of wolf culling on subsequent livestock losses, even when

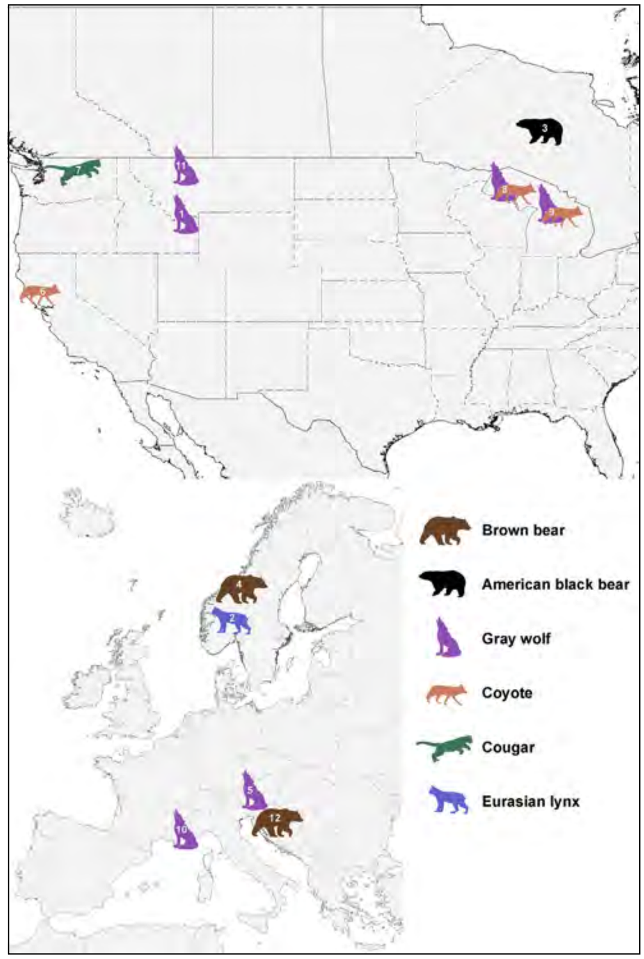

Figure 1. *The geographic distribution of tests of lethal and non-lethal methods providing reliable inference about functional effectiveness in preventing carnivore predation on livestock from North American and European livestock farms. Numbers correspond to those in Table 1.*

only the years with the most extreme killing rates were compared. The data for this test were reanalyzed in a BACI design to meet the silver standard (WebPanel 1). In 1998, researchers at the University of California's Hopland Research and Extension Center (HREC) investigated preventive effects of coyote killing (Conner *et al.* 1998) conducted using various methods (Figure 2). Conner *et al.* (1998) performed numerous analyses on the same data to test the effect of routine, non-selective coyote killing in preventing sheep predation. We focused only on those analyses that employed BACI designs (comparing lamb losses across consecutive seasons and those with time lags) and these reported counterproductive effects of killing more coyotes (Table 1).

Each of the quasi-experimental tests of lethal methods (Table 1) included unmeasured or uncontrolled variables, which may confound analyses and thereby weaken inference (see below for wolf culling and also WebPanel 1). However, one correlational study we would have excluded (Peebles *et al.* 2013) achieved silver standard when we

Figure 2. *M-44 explosive poison (sodium cyanide) delivery device for killing wildlife (Factsheet May 2010, US Department of Agriculture Wildlife Services; http://1.usa.gov/28Iv69N).*

considered it in combination with another study to qualify as a BACI design. Cooley *et al.*'s (2009 a,b) study of cougars (*Puma concolor*) strengthened the inference in Peebles *et al.* (2013) when looking only at the two-county comparison in the latter paper. Specifically, Cooley *et al.* (2009 a,b) documented that hunting cougars led to demographic changes in a heavily hunted county and not in another county with much lower rates of cougar hunting (also see White *et al.* 2011). Later, Peebles *et al.* (2013) showed that livestock losses rose annually in correlation with the number of cougars taken by hunters but only in the county that experienced changes in cougar demography. We therefore judged that the two studies together provided the causal mechanism and the BACI design needed to identify it as a silver standard test in Table 1.

Potential confounding variables in two wolf culling studies illustrate how weak inferences from tests using the silver standard impede scientific consensus. Two teams (Wielgus and Peebles 2014; Bradley *et al.* 2015) came to opposite conclusions when analyzing the same data from the northern Rocky Mountain (NRM) wolf population. Although Wielgus and Peebles (2014) found that killing more wolves was followed by more livestock losses during the following year, it did not adequately account for the time series underlying livestock exposure and lethal interventions. We therefore excluded it from Table 1, pending reanalysis. The time series is critical to BACI designs in the silver standard. Namely, as the wolf population increased in size, it also spread geographically, thereby exposing more livestock to wolf predation. Because wolf killing increased over time as recolonizing wolves left strictly protected areas and as policy changes introduced more and more wolf-killing (Bradley and Pletscher 2005; Bradley *et al.* 2008, 2015), one would therefore expect the predictors (wolf killing, livestock exposed, and wolf distribution) to rise over time. This would create a positive correlation with the observed rise in livestock losses over time. Statistical control for encounters between wolves and livestock would require a measure of geographic spread of wolves, not just wolf and livestock abundance regionally (Wielgus and Peebles 2014). In contrast, Bradley *et al.* (2015) incorporated spatial information in their BACI design but limited their investigation in a critical way: restricting the spatial extent to pack territories.

Bradley *et al.* (2015) reported a reduction in livestock losses subsequent to culling within a wolf pack territory. The reductions were significant after an entire pack was killed, but insignificant when a few wolves were removed; when wolves were neither killed nor removed, no reduction in livestock losses was observed. The analysis was restricted to the affected wolf pack territory, despite the researchers' own work documenting how partial removal of wolves could scatter survivors beyond their original pack range or prompt take-over by a neighboring wolf pack (Bradley 2004; Bradley *et al.* 2008). The analysis should have examined neighboring areas and beyond, including ripple effects, whereby livestock losses recurred up to 16 km from sites of wolf culling (Treves *et al.* 2013). We recommend use of the gold standard for scientific inference to resolve the NRM wolf culling controversy. In sum, we find only weak inference for lethal methods and unconvincing evidence of preventive effects (Table 1).

Non-lethal methods

Non-lethal methods have long been examined but fewer of these studies met our criteria (five tests on six species; Table 1), because the measures of effect often came from livestock owners' perceptions rather than field verification. Of these five tests, four showed preventive effects; one test found preventive effects for wolves but not coyotes and one showed no effect. The latter – a BACI comparison in Slovenia that provided brown bears with livestock carcasses to deter or distract them from attacking sheep – revealed no change in livestock predation regionally (Kavčič *et al.* 2013). A large-scale, long-term study in France evaluated the effectiveness of 0–8 LGDs per pasture, and of mobile electric fences to confine sheep at night, against predation by wolves (Espuno *et al.* 2004). We include their study for the secondary analysis that tested sheep herds and pastures in relation to changes in the number of LGDs over time, not for their primary correlational model, which did not meet our criteria. From that secondary quasi-experimental test, Espuno *et al.* (2004) inferred that a combination of at least five LGDs and night enclosures (but neither in isolation) would prevent virtually all wolf predation on sheep (Figure 3a and b). In addition, two tests of non-lethal methods met the gold standard and showed preventive effects. One conducted on LGDs reported no livestock predation for control or treatment groups but detected an effect of preventing carnivore incursions into fenced pastures (Gehring *et al.* 2010a, 2010b). We considered prevention of carnivore incursions into livestock pastures to be a relevant measure of effect because incursions are an essential precursor to predation on livestock. Likewise, the technique known as fladry (in which flagging is mounted on fences or ropes as a visual deterrent to predators; Figure 4) also demonstrated preventive effects, in the best random-assignment test that we found (Davidson-Nelson and Gehring 2010). A similar test of fladry used a BACI design (Musiani *et al.* 2003). Fladry was found to be effective against wolves but not coyotes or black bears in the former test and in another random-assignment experiment that we excluded because it did not involve livestock (Shivik *et al.* 2003).

Peer review

Rigorous peer review is a component of the gold standard for scientific inference, but we could not assess the rigor of review in the published tests. Three journals published 10 of the 12 (83%) articles with flawed designs (WebPanel 1), and only four of 12 (33%) tests that were reliable (Table 1). The same society publishes two of the journals, one of which also published a strong critique of several of the flawed tests (Mitchell *et al.* 2004). Yet the three journals continued to publish articles citing the flawed tests as evidence without citing Mitchell *et al.* (2004). Indeed, the latter paper appears to have been cited only once in any of those three journals (http://bit.ly/28Joqto, accessed 22 Jan 2016; Web of Science and Science Reports indicated no citations in these journals).

Conclusions

Effectiveness

Tests of effectiveness of interventions to prevent carnivore predation on livestock were consistent across regions. Among 12 North American and European tests that met "gold" or "silver" standards for reliable inference, we found a greater proportion of non-lethal methods were effective in preventing carnivore predation on livestock than lethal methods (80% versus 29%). Quasi-experimental tests of culling and hunting revealed positive, negative, and no effects (Table 1). None of the tests of lethal methods met the gold standard. Indeed, many combined several different methods of killing predators, including unregulated killing that would introduce uncontrolled variables. Culling and hunting appear risky for livestock owners because effects were slight or uncertain and five of seven tests produced no effect or a counterproductive effect (Table 1). This conclusion stands even without the inclusion of four studies that found counterproductive effects of killing wolves, bears, or cougars (Treves *et al.* 2010; Peebles *et al.* 2013; Wielgus and Peebles 2014; Fernández-Gil *et al.* 2016). The non-lethal methods that have been tested (LGD, fladry, night enclosures) were not associated with similar negative results.

Figure 3. *Livestock-guarding dog (a) protecting sheep and (b) charging the approaching photographer.*

Two studies – one relying on LGDs (Gehring *et al.* 2010 a,b) and the other on fladry (Davidson-Nelson and Gehring 2010) – provide both strong inference and evidence of effectiveness in preventing predation on livestock. Although fladry may be limited to deterring wolves, LGDs have a long history and detailed technical information on appropriate breeds, husbandry, and deployment.

Our findings for selected sites in North America and Europe are consistent with tests conducted for Asiatic black bears (*Ursus thibetanus*) in Japan (Huygens *et al.* 2004), cougars in Mexico (Zarco-González and Monroy-Vilchis 2014), and canids and felids in South Africa (McManus *et al.* 2015). Using a pseudo-control, case-control design similar to BACI, the latter team found livestock losses and related costs declined for two consecutive years after implementing non-lethal methods (LGDs, alpacas [*Vicugna pacos*], and livestock protective steel collars) as compared with lethal methods (various kill-traps and shooting) in the first year of their study on the same livestock farms. Although the data on livestock losses were self-reported by livestock owners, the research-

Figure 4. An experimental plot containing a road-killed deer carcass surrounded by a treatment of fladry – a flagging method used to deter wolves (Shivik et al. *2003).*

ers trained the owners in verification techniques and issued field kits to improve verification (McManus *et al.* 2015).

Strength of inference

We found few random-assignment experiments 50 years after its importance for strong inference was first explained (Platt 1964). Of the tests that met our inclusion criteria (Table 1), 83% were quasi-experimental tests using BACI comparisons. We considered that only two tests (17%) both allowed reliable inference and approached the gold standard for experimental design. Other studies were excluded from our quantitative summary because of small sample sizes or unreliable inference (WebPanel 1). The gap between recommended experimental designs (Platt 1964; Hairston 1989) may partly reflect the difficulty of randomizing treatments around working livestock operations. However, the above-mentioned examples of gold standard tests of non-lethal methods emphasize the importance of developing more robust experimental designs for the future.

We recommend an independent scientific panel of experts be convened to conduct a large-scale experiment on predator control, as was done in the UK for badger culling (Vial and Donnelly 2012). Indeed, we suggest that this experiment be subject to an even higher "platinum standard", which would include "double blinds", where those measuring effects are unaware of the treatment and where analysts compare results without knowing which data were from treatment or control groups (Mukherjee 2010).

Law, ethics, and ecological side effects

Sound policy should be consistent with law, scientific evidence, and ethical standards of society. The EU Habitats Directive and various US federal policies and laws (including the Endangered Species Act) require the use of evidence and in some cases specify the best available science (Treves *et al.* 2015). When two or more interventions to control predators are lawful, we recommend that farmers, managers, policy makers, and courts first consider functional effectiveness (will the intervention prevent future threats to human interests?) and the strength of inference for that effect. If two candidate interventions perform equally by those criteria, then we recommend that two additional criteria be considered before implementing predator control: public acceptance (will the intervention be supported by both the complainants and the general public?) and ecological consequences (will the intervention deplete biodiversity or ecosystem services?). We recommend continuing education requirements for wildlife managers to keep up-to-date with the best available science. We also suggest that decision makers should suspend predator control programs that do not meet standards of strong inference about effectiveness, especially if those have legal, ethical, or ecological drawbacks. The burden of proof should rest heaviest on the interventions that have the most serious negative effects on biodiversity, people, and livestock.

Comparisons between non-lethal and lethal methods (such as culling and hunting) reveal how multiple criteria support the use of non-lethal methods. Livestock-guarding dogs and fladry outperformed lethal methods in functional effectiveness and were superior in strength of inference (Table 1). Lethal methods have additional limitations for managing predators and face a legal burden of proof in North America and Europe because of public trust principles or explicit protections (Epstein and Darpö 2013; Treves *et al.* 2015). The Habitats Directive 92/43/EEC, for example, restricts lethal controls to situations with an "absence of a satisfactory alternative" (Article 16, 2). Furthermore, recent court decisions in the US have restricted the use of predator control in several situations (Treves *et al.* 2015; http://bit.ly/28J2mkq). Ethical decisions should also consider the values of society at large and the intrinsic worth of all of the individual animals involved (Vucetich and Nelson 2014). For instance, two large-scale studies in the US suggested lower public acceptance of lethal methods than of non-lethal methods and that humaneness was important to the public (Reiter *et al.* 1999; Slagle *et al.* in press). Finally, the negative ecological effects of killing carnivores have recently been documented in many regions (Ripple *et al.* 2014; Krofel *et al.* 2015). In many ecosystems, both terrestrial and aquatic, predators appear to play a disproportionate role not only in preventing excessive herbivory, which may result in long-term depletion of vegetation and its associated biodiversity, but also in enhancing species diversity. Regardless of whether predators directly regulate the numerical abundance of their prey or indirectly keep the survivors fearful, human-induced mortality, translocation, or sterilization methods for predator control may alter predator ecology and ecosystem dynamics with far-reaching effects.

In conclusion, we believe the science of predator control lacks rigor generally – the resulting uncertainty about the functional effectiveness of killing predators should guide evidence-based policy to non-lethal methods until gold standard tests are completed.

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Supporting Information

Additional, web-only material may be found in the online version of this article at http://onlinelibrary.wiley.com/doi/10.1002/fee.1312/suppinfo

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A Treves *et al*. – Supporting information

WebPanel 1. Tests we excluded because the design precluded reliable inference
We use the scientific terms "'bias" and "flawed design" without any suggestion of intention or incompetence. Indeed, the flaws we discuss often result from inescapable challenges of running experiments under complex field conditions over many months or years. Several tests were excluded because they were not peer-reviewed, published descriptions of all methods and results. Not all tests conducted at the Hopland Research and Extension Center (HREC) were peer reviewed (HREC 2003), including proceedings of conferences that do not publish the editorial policy on anonymous peer review (eg Proceedings of the Vertebrate Pest Conference; http://bit.ly/1UycGeA). Below and in the quotations that follow, we inserted square brackets to identify biases, which we discuss after the quote.

Tests of lethal methods that had flawed designs that precluded strong inference
We found seven tests published since 1978 – each described in the following paragraphs – that evaluated the effectiveness of lethal methods of predator control that fit our criteria but had biases in design that precluded strong inference.

Guthery and Beasom (1978) reported a 17% and 0% decline in predation on goat kids and nanny-goats, respectively, after comparing an untreated pasture to a pasture treated with intense mechanical and explosive trapping (Figure 2), snaring, and shooting. After the test, the authors discovered a decline in native prey species that was twice as large at the untreated pasture as compared with the treated pasture, which unfortunately produced selection bias. Furthermore, it was unclear whether the two pastures received the same level of human stimuli (visits, noise, material left behind, etc), leading to a possible treatment bias.

A test of two lethal methods by Till and Knowlton (1983) came closest to the gold standard in our view. Their experimental design had great potential but because the description of methods and results were flawed, we recommend replicating the test with state-of-the-art reporting. The authors recorded sheep losses 7 days before and 7 days after two treatments and a control. The treatments consisted of one or more technicians back-tracking coyotes to their dens and then either killing only the pups by fumigation (treatment 1) or killing the pups and adults by fumigation and shooting, respectively (treatment 2). In describing this method, Till and Knowlton (1983) cited a manual (Young and Dobyas 1945) that included several alternative treatments. However, Till and Knowlton (1983) did not provide sufficient detail; for instance, back-tracking coyotes is an expert skill but the authors failed to adequately describe who performed the back-tracking, what training they had received, and what actions were taken in various scenarios (eg if technicians lost the coyote trail to the den, if a den was unoccupied, or if adult coyotes did not return to the den). We also noted a discrepancy in their results that confirms that key aspects of the methods were not described: 30 dens should have been destroyed but Till and Knowlton (1983) reported that 40 were destroyed. Till and Knowlton (1983) did not clarify whether dogs were used, as the 1945 methods paper suggested. The study is therefore impossible to replicate, due in part to these shortcomings, and because the control may have been a pseudo-control (eg no den found), because of ambiguous references to "other control methods" being in place, and because the treatments may have differed from the control in multiple ways. We also detected several types of reporting bias. First, the interval after treatments (7 days) may be too short to represent an unbiased comparison of treatments. The authors' conclusion – that, during the 7-day period, greater losses of sheep were associated with controls than with treatments – may be correct but was confounded by unclear statistics and by insufficient details, not only regarding the number and reproductive status of adults killed but also on observed pack sizes (hence the numbers of survivors). Finally, although Till and Knowlton (1983) relied on sheep herders to report lamb kills, their paper did not include data on overall losses or losses to other causes. Without data on sheep flock sizes before and after, one cannot determine if disappearances increased or other causes of death confound the results.

O'Gara *et al*. (1983) compared coyote killing on a single property by conducting a before-and-after test, where the researchers initially habituated coyotes for observation and later switched to various lethal methods when funds ran out. A lack of replication and the presence of a pseudo-control (manipulations during the "before" period differed in more than the lethal intervention) preclude reliable inference.

Using a before-and-after test in Alberta, Canada, Bjorge and Gunson (1985) compared 2 years of use of strychnine-laced baits to 4 years pre-poison. Over the course of 2 years, 26 out of 40 wolves were poisoned by researchers and an additional 11 wolves left the study area or died from other causes (in total 93% mortality), resulting in a decline in wolf predation on cattle from 0.7% to 0.3%. The authors warned of non-target mortality (29 non-target animals representing five species also died) and the potential movement of livestock predators when surviving wolves dispersed (Bjorge and Gunson 1985). However, the first two pre-treatment years showed losses that were statistically equivalent to the two treatment years, and the third and fourth pre-treatment years experienced an important change in management, leading to lower cattle density, associated with substantially higher levels of predation in the 2 years before treatment. We are unsure if the control was appropriate or whether it represented a pseudo-control, given that the sample size was one study site over 6 years. Indeed, it is not clear how one should measure the effect of the treatment to avoid pseudo-replication (number of cattle lost, number lost per wolf present, percent of cattle, or years with higher than median losses). Depending on which measure was used, the effect might have been an increase, a decrease, or no change in wolf predation on cattle. Therefore, we find the test inadequate to support reliable inference.

Wagner and Conover (1999) treated several mountain pastures during summer months with mechanical and explosive trapping (Figure 2), snaring, and shooting; subsequently, flocks on those pastures experienced 7.3% verified predation by coyotes. These losses were compared to sheep flocks on another set of pastures treated with those same lethal methods as well as with aerial gunning during winter. The authors claimed a decline to 2.7% losses. The study had five design flaws, some of which were noted by Mitchell *et al*. (2004): (1) control pastures started with 40% higher sheep densities, which has been shown to increase vulnerability to predation by

North American canids (Robel *et al*. 1981; Mech *et al*. 2000; Wydeven *et al*. 2004) and implies a treatment bias; (2) pre-treatment sheep losses were 186% higher in untreated than treated pastures, suggesting selection bias; (3) untreated pastures were subject to twice the lethal effort (excluding aerial-gunning), again suggesting treatment bias; (4) livestock-guarding dogs (LGDs) were apparently matched between treated and untreated pastures but those data were not presented, implying reporting bias; and (5) the authors made an unsupported assumption in their analyses that the ratio of known to unknown losses was constant across treatments and years (measurement bias).

Blejwas *et al*. (2002) tested poison-filled collars on sheep at the HREC. Note the word "control" referred to killing coyotes and other wildlife, not experimental treatments, in the quote that follows:

> "Coyote Control. The HREC employed three different control strategies during the course of the study: no control, nonselective control, and selective control…During the no-control periods, animals on the periphery of HREC were still subject to control on adjacent ranches. During nonselective control, the local Wildlife Services specialist attempted to remove as many coyotes as possible from HREC [pseudo-control]. These activities were carried out independently of the ongoing coyote research and without benefit of radiotelemetry locations. During selective control, HREC personnel used [Livestock Protection Collars, LPC] to target depredating coyotes. Once a pattern of coyote predation was established [treatment bias 1], all sheep were removed from the pasture except for a small target flock of 10–30 lambs or yearlings with LPC [treatment bias 2]. Collared lambs were accompanied by uncollared ewes. [An LPC] consists of a pair of toxicant-filled rubber bladders attached to a Velcro collar and placed around the neck of a lamb or small ewe…in some cases, use of the LPC was impractical or unsuccessful, and HREC or Wildlife Services personnel used radiotelemetry to remove these depredating breeders by shooting [treatment bias 3 and reporting bias]" (square brackets added; Blejwas *et al*. 2002).

First, non-selective coyote killing during experiments represents a pseudo-control – allowing only an inference about the addition of LPC to an unmeasured, background level of nonselective coyote killing. The first treatment bias arose from the timing of intervention: "once a pattern of coyote predation was established" (which was undefined). Thus, treated flocks were neither randomly assigned nor selected haphazardly (independent of outcomes), but rather selected based on past vulnerability. In biomedical clinical trials, that step would be analogous to treating patients only when disease symptoms had appeared – and it was not clear how control flocks were managed when a pattern of coyote predation was established. The second treatment bias compounded the latter issue because the vulnerable sheep flock was replaced with a treated one, thereby conflating vulnerability, treatment, and a massive manipulation of the flock. True experimental controls and non-LPC periods should have also had simultaneous flock replacement with lambs wearing dummy collars lacking poison. Finally, the decision to add coyote shooting when LPC was impractical or unsuccessful was the third treatment bias. Because the latter step was neither quantified nor fully explained, we also find reporting bias.

In a Minnesota study, Harper *et al*. (2008) analyzed the effects on livestock predation in three scenarios: when traps were set and wolves were trapped, when traps were set and no wolves were trapped, and when no traps were set; the authors concluded that the effects of removing wolves by trapping did not differ from trapping without removing wolves. The authors reported exceptions for small effects on sheep farms and when male wolves were removed. However, the test represents a pseudo-control because decisions whether or not to set traps apparently reflected subjective judgments by government trappers, implying possible treatment bias. Also, the authors discarded data points for numerous reasons without citing evidence or by justifying the removal of data post hoc based on results, implying measurement and reporting biases. For example, they excluded farms where trapping was unsuccessful but where dispersing wolves might have been present, which the authors did to "decrease apparent effectiveness of unsuccessful trapping" (Harper *et al*. 2008). Given the Minnesota wolf population size exceeded 1000 individuals, and the very small proportion of marked wolves (www.dnr.state.mn.us/mammals/wolves/mgmt.html), the guesswork required to make such judgments implies possible measurement bias.

We could not draw reliable inference from three or four tests of non-lethal predator control methods (if one counts sterilization as non-lethal).

Tests of sterilization

Bromley and Gese (2009) conducted a well-designed random-assignment experiment to capture what they believed were entire packs of coyotes and surgically sterilize some or conduct sham treatments that were identical except for sterilization. However, we identified a measurement and a reporting bias in this study, which precluded strong inference. First, the position, size, and overlap of territories of the treated, control, and uncaptured packs were potentially important confounding variables. The authors were transparent about the uncaptured coyotes when writing, "In 4 packs, no members were captured or radiocollared, but pack members were observed and the home range boundary was estimated based on the spatial arrangement of adjacent radiocollared packs…many [sheep] kills were located in areas of overlap between territories" (Bromley and Gese 2009). Across both years of the study, the authors reported six sheep kills in core pack areas and 20 on the edge of territories. In 1999 (the year with the best radio-telemetry data), sheep kills were significantly disproportionately on the edge of territories, when accounting for sheep distributions. Therefore, assignment of a sheep kill to a particular coyote pack must have included some uncertainty. Furthermore, that uncertainty was not a random effect because subsequent work showed that the home ranges and core areas of sterilized coyote packs overlapped territories of neighbors significantly more than those of intact coyote packs during the breeding season, when virtually all sheep predation occurred (Seidler and Gese 2012). Thus, assigning sheep kills to a certain pack may have introduced measurement bias to a majority of sheep kills on the edge of territories. Error in classifying even a single sheep kill might alter their results, as evidenced by the slight difference between treatment and control:

"weekly survival rate tended to be higher for sheep in sterile coyote territories (mean = 0.998) than in intact coyote territories (mean = 0.989)" (Bromley and Gese 2009). The authors presented no justification regarding why such a small difference in weekly survival rate was biologically significant, or exceeded the measurement error given uncertainty in assignments described above. Nor did the authors justify why weekly survival was better than other measures. For example, the authors did not emphasize in the abstract or conclusions that they found a counter-productive effect. Namely, they reported that 5 of 9 (56%) sterile packs and 9 of 14 (64%) intact packs were not assigned as having killed sheep. We conclude that strong inference cannot be drawn in either direction, despite the excellent random-assignment of treatment in this study.

Tests of non-lethal methods that had flawed designs that preclude strong inference

We excluded a substantial number of studies of non-lethal methods because they relied on livestock owners to report losses without providing training in verification (Coppinger *et al*. 1988; Meadows and Knowlton 2000). Three additional tests met our criteria except for flaws in research design. Bourne and Dorrance (1982) tested baits laced with an aversive chemical (lithium chloride, LiCl) to deter coyotes and other animals from sheep. This study seemed to present reporting bias: "It seemed improbable that the LiCl baits affected predation in southwestern Alberta because the rate of bait disappearance was so low. Therefore data from the 8 farms in southwestern Alberta were excluded from subsequent analyses of bait disappearance and predation losses" (Bourne and Dorrance 1982). A greater concern was raised by apparent selection bias: "flock size differed markedly between farms treated with placebo and LiCl baits [placebos averaged 123 lambs, LiCl averaged 231 lambs]" (Bourne and Dorrance 1982). Finally, the authors apparently used a pseudo-control that hinders interpretation of the results because lethal controls were implemented throughout the study until depredations stopped, on both treatment and control farms.

Between 1979 and 1992, Linhart *et al*. tested several non-lethal methods. Some of these tests were not peer reviewed and thus did not meet our criteria for inclusion; other tests met our criteria but were flawed. For example, Linhart *et al*. (1984, 1992) tested sound and light devices to prevent coyote predation on sheep. We agree with Mitchell *et al*.'s (2004) reasoning that the BACI design Linhart *et al*. used may have triggered a measurement bias by comparing early losses without treatment to late losses with treatment, within the same year. As time passes, lambs may outgrow the size most coyotes would attack and coyote pups may no longer need the provisioning that seems to prompt alpha breeders to prey on sheep (Knowlton *et al.* 1999). Also Linhart *et al*. (1979) summarized several tests of LGDs on sheep in working farms but relied on various methods that we view as having one or more of the following flaws: pseudo-control, before-and-after comparison with the above-mentioned measurement bias in the timing of comparisons, or small sample size.

Finally, Palmer *et al*. (2010) tested the effects of sheep herders quasi-experimentally. We could not draw strong inference: (a) lethal methods were ongoing in the background against coyotes and cougars; (b) the control (no herder) and treatment (herder or herder and dog) selected by the owners and treatment flocks were larger than control flocks; (c) bands or flocks of sheep which were the subunits of herds varied in treatment within the same herds, but the analyses were conducted at the level of herds; and (d) although the researchers attended carefully to scavengers (Palmer *et al*. 2010), the quantitative effect of scavengers in relation to different treatments was not adequately described.

Reanalysis

In the main text, we argued that several studies might qualify as "silver" standard tests by our criteria if they re-analyzed data using a BACI design; namely estimating livestock losses minus losses before the treatment. These include those studies listed in a footnote to Table 1. We conducted such a re-analysis of the data presented in Figure 1 in Krofel *et al.* (2011) to illustrate the point. When we recalculated livestock losses each year as a net change in livestock losses over 2 years, we found no effect of wolf culling and hunting, as in Table 1 (Spearman *rho*=0.47, p=0.09. Indeed, there was a trend toward a counterproductive effect that killing more wolves led to more livestock losses the following year).

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Exhibit 9

PLOS | BIOLOGY

PERSPECTIVE

Carnivore conservation needs evidence-based livestock protection

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Abstract

Carnivore predation on livestock often leads people to retaliate. Persecution by humans has contributed strongly to global endangerment of carnivores. Preventing livestock losses would help to achieve three goals common to many human societies: preserve nature, protect animal welfare, and safeguard human livelihoods. Between 2016 and 2018, four independent reviews evaluated >40 years of research on lethal and nonlethal interventions for reducing predation on livestock. From 114 studies, we find a striking conclusion: scarce quantitative comparisons of interventions and scarce comparisons against experimental controls preclude strong inference about the effectiveness of methods. For wise investment of public resources in protecting livestock and carnivores, evidence of effectiveness should be a prerequisite to policy making or large-scale funding of any method or, at a minimum, should be measured during implementation. An appropriate evidence base is needed, and

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we recommend a coalition of scientists and managers be formed to establish and encourage use of consistent standards in future experimental evaluations.

Carnivores, such as lions and wolves, are killed in many regions over real or perceived threats to human interests. Combined with habitat loss and fragmentation, human-induced mortality has contributed to widespread carnivore population declines, along with declines of their important ecosystem functions [1]. Balancing the goals of nature preservation, livelihood protection, and welfare of carnivores and domestic animals depends on policies that foster coexistence between humans and carnivores in multiuse landscapes [2, 3]. Central to this aim is a need for rigorous scientific evidence that interventions are effective in preventing predation on livestock. Such policies should be based on strong inference [4, 5], otherwise, we risk wasting resources on ineffective interventions that might harm all involved.

Between 2016 and 2018, we independently published four reviews examining evidence for the effectiveness of interventions to reduce livestock predation by carnivores [6±9]. Here, we focus on the results for livestock losses or carnivore incursions into livestock enclosures (hereafter, ªfunctional effectivenessº [8]). Since each review offered a unique perspective, we reconcile differences to synthesize three messages common to the reviews. First, despite the immense resources spent globally to protect livestock from carnivores, few peer-reviewed studies have produced strong inference about the functional effectiveness of interventions. Second, there was scant consistency of standards of evidence in our four reviews, hindering scientific consensus, and hence clear recommendations to policy-makers, about the relative functional effectiveness of different interventions. Finally, we identified several interventions that were found consistently effective, which deserve promotion in policy, even if only in the general conditions under which they have already been tested, as well as prioritization for further research under conditions in which evidence is lacking.

We suspect that the striking paucity of rigorous evaluation is due to the tendency for decisions about predator control to depend on factors other than evidence-based evaluation of whether a given intervention effectively protects livestock. These other factorsÐincluding ethics (should one implement the intervention?), feasibility (can one implement the intervention?), and perception (does one believe the intervention will work?)Ðmight be important subsequent considerations in the implementation and decision-making processes. However, objective scientific evidence of an intervention's functional effectiveness must remain a foundational prerequisite on which subjective inquiries later build. The lack of scientific synthesis and consensus about functional effectiveness has allowed more subjective factors to dominate decision-making about predator control and likely wasted time and money on interventions that do not optimally protect livestock. Furthermore, shifting ethics and public values in some communities are enabling the return of carnivores to landscapes worldwide or leading to the increased use of nonlethal predator control interventions. We support these initiatives from the perspective of conserving carnivores but insist that scientific evidence for functional effectiveness be considered first to ensure that interventions intended to protect livestock accomplish that goal. This will prevent the inefficientÐor worse yet, counterproductiveÐuse of limited resources to protect animals long term.

Additionally, although our reviews collectively reveal a need for more evidence, scientists alone cannot fill this gap. Livestock owners, natural resource managers, and decision-makers each have an important role to play in research partnerships to collaboratively guide the testing of predator control interventions. Here, we appeal to these groups by summarizing the advantages of evidence-based effective interventions, the best practices of scientific inference, and the role of policy in promoting effective predator control strategies. We start by synthesizing the results of our four independent reviews to provide scientific consensus on the evaluations of predator control interventions. We urge managers and policy decision-makers to use this discussion as a basis for creating policy that promotes evidence-based, effective strategies for protecting domestic animals from carnivore predation.

Synthesis of the science on functional effectiveness

Our four reviews [6±9] jointly screened >27,000 candidate studies. The four sets of inclusion criteria differed in geographic coverage, carnivore species, and standards of evidence and research design (see S1 Table), which limited overlap in the studies that passed screening (only 19% of studies were included in two or more of the four reviews; no study was included in all four, S1 Fig). The differing inclusion criteria also meant that it was not possible to conduct a quantitative comparison (meta-analysis) combining the data from our four reviews, but we suggest that such an analysis should be conducted in the future as evidence increases. Nonetheless, our reviews came to remarkably similar conclusions, irrespective of methods, suggesting that our conclusions are robust.

Among the 114 studies that passed screening in one or more reviews (S2 Table), representing >40 years of research, we found few that yielded strong inference about functional effectiveness. Surprisingly, many widely used methods have not been evaluated using controlled experiments. Also, few interventions have been compared side by side or tested singly under diverse conditions. These deficiencies in the literature are further compounded by disagreement among scientists, managers, and peer-reviewed journals about standards of evidence, such as which study designs produce strong inference [8]. We acknowledge the challenges of regional experiments amid dynamic, complex ecologies, publics, and jurisdictions. However, a handful of random-assignment experimental studies without bias (ªgold standardº) have proven that the obstacles are surmountable [8, 10, 11, 12].

We summarize our four sets of results by category of intervention in Fig 1. Our reviews agree that several methods have been tested numerous times with high standards of evidence and have been found effective: livestock guardian animals, enclosures for livestock, and a visual deterrent called fladry. Importantly, we should recognize that the effectiveness of different methods will vary under different contexts, and there is currently a bias among research toward certain geographic regions and predator types (Fig 2). Further, we agree that standards of evidence have been higher for nonlethal methods, and there remains a need to ensure data on all interventions are collected appropriately and consistently. As such, building on existing criticism of the lack of appropriate data collection in environmental management [13±16], our reviews collectively highlight the need to improve standards of evidence used in evaluating interventions. We need to develop a comprehensive evidence base that allows us to compare the effectiveness of interventions for reducing carnivore predation on livestock and inform consistent policy in any jurisdiction.

Importance of rigorous experimental design and evaluation

Societal values and, accordingly, policies for human±carnivore coexistence have changed over the millennia. The almost exclusive use of lethal interventions has given way to nonlethal interventions as important supplements to or replacements for prior lethal methods. Immense logistical and financial resources are invested in protecting livestock and carnivores, so the scarcity of rigorous scientific evidence for effectiveness should be a concern. We encourage governments to adopt proven methods from similar systems of carnivores and human

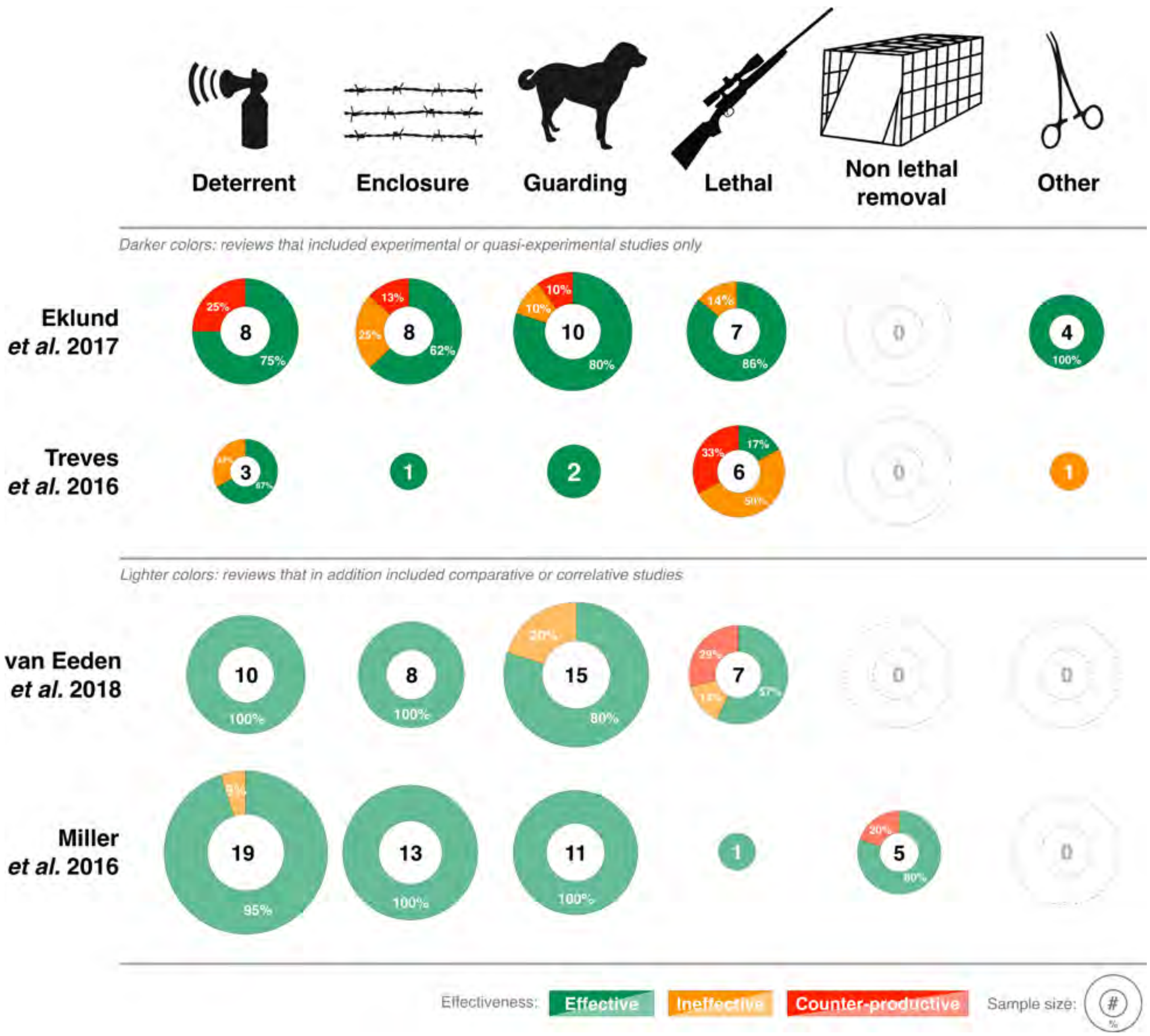

Fig 1. Percent of studies that measured interventions as ªEffective,º ªIneffective,º or ªCounter-productiveº in reducing livestock loss to large carnivores, as measured by four independent reviews in 2016±2018. The sample sizes inside disks represent the number of studies or tests, as some studies reported more than one test of the same or different interventions. Darker colors represent reviews that included experimental or quasiexperimental controls; lighter colors represent reviews that also included comparative or correlative studies (see S1 Table for details). ªDeterrentsº include nonlethal interventions such as audio or visual deterrents, fladry, and livestock protection collars. ªEnclosure/barrierº includes electrified and nonelectrified fencing and corralling. ªGuardingº includes human shepherding and livestock guardian animals. ªLethal removalº includes hunting, poison baiting, and other lethal methods. ªNon-lethal removalº refers to translocation of carnivores. ªOtherº includes carnivore sterilization and diversionary feeding. Eklund and colleagues measured effectiveness using RR and classified Effective as RR < 0.90, Ineffective = 0.90±1.10, and Counterproductive RR > 1.10. Treves and colleagues measured effectiveness as significant change in livestock loss. Note that Treves and colleagues initially contained 12 studies with 14 separate tests using gold or silver standards, but one test was subsequently removed after review of the methods found it impossible to draw strong inference [17]. van Eeden and colleagues measured effectiveness as Hedges' d and classified Effective as $d < -0.05$, Ineffective $-0.05 > d < 0.05$, and Counterproductive $d > 0.05$. Miller and colleagues measured effectiveness as percentage change in livestock loss (or carnivore behavior change) and classified Effective as $d > 0\%$ change, Ineffective = 0%, and Counterproductive $< 0\%$. RR, relative risk.

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interests, with systems in place to review and adapt management actions as new evidence becomes available. When governments contemplate large-scale implementation or funding for interventions, scientific evidence of functional effectiveness deserves priority to avoid wasting

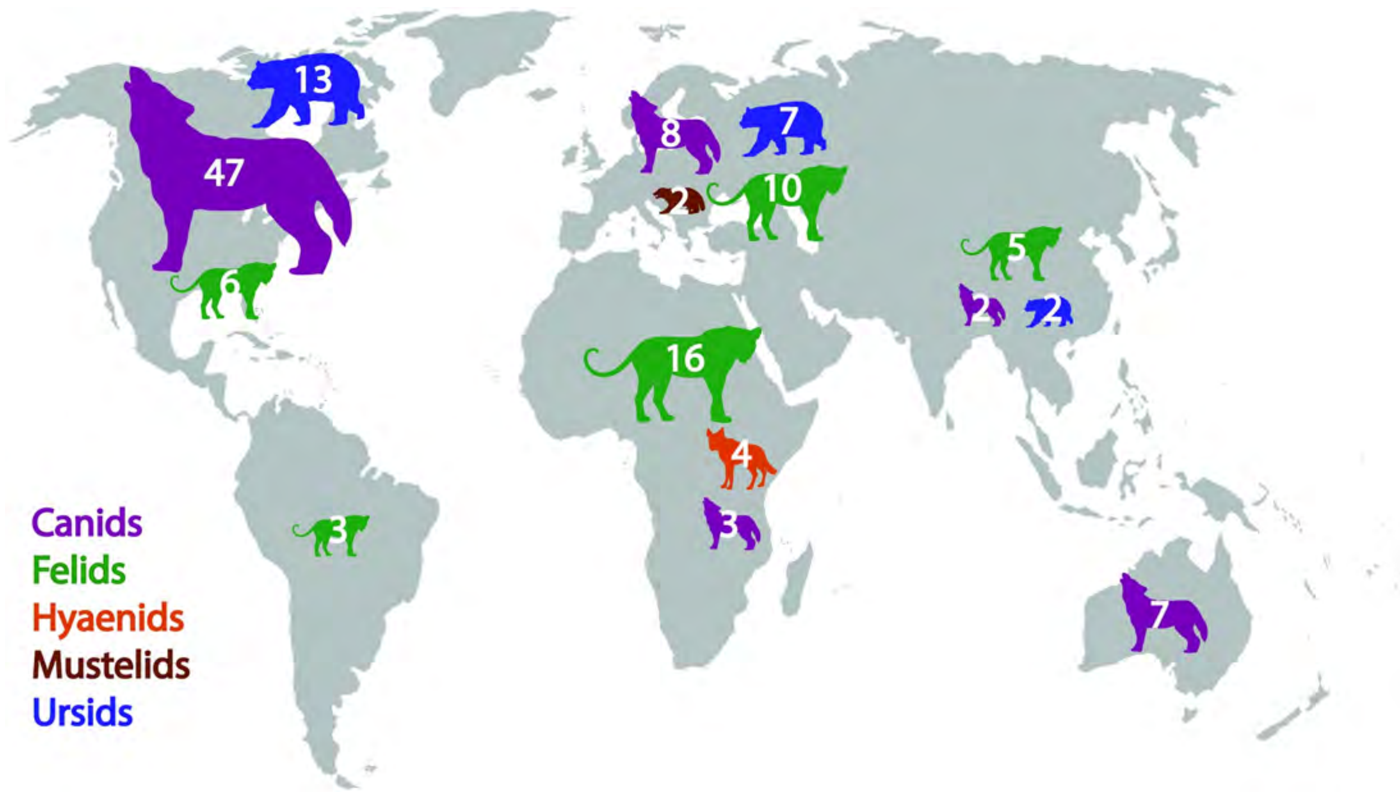

Fig 2. Number of studies included in four independent reviews published in 2016±2018, presented by carnivore family and continent. Canids include gray wolves and subspecies (*Canis lupus*), coyotes (*C. latrans*), dingoes (*C. dingo*), black-backed jackals (*C. mesomelas*), African wild dogs (*Lycaon pictus*), red foxes (*Vulpes vulpes*), and domestic dogs (*C. familiaris*). Felids include Eurasian lynx (*Lynx lynx*), cougars (*Puma concolor*), lions (*Panthera leo*), jaguars (*P. onca*), leopards (*P. pardus*), snow leopards (*P. uncia*), caracals (*Caracal caracal*), and cheetahs (*Acinonyx jubatus*). Hyaenids include spotted hyenas (*Crocuta crocuta*). Mustelids feature wolverines (*Gulo gulo*). Ursids include American black bears (*Ursus americanus*), Asiatic black bears (*U. thibetanus*), brown or grizzly bears (*U. arctos*), and polar bears (*U. maritimus*). Smaller carnivores (e.g., red foxes, hyenas, and caracals) are included in studies that investigated multiple carnivore species of varying sizes.

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resources on ineffective methods, no matter if the latter are ethical or easy to implement. When no proven method is available, scientific evaluation of functional effectiveness should coincide with implementation.

Strong inference in any scientific field demands control over potentially confounding variables and testable claims about functional effectiveness of interventions [8]. In our context, all methods present opposable hypotheses, i.e., method X works or does not work. Several experimental design components are essential to strong inference about that hypothesis, and we focus here on the three of topmost priority for yielding strong inference about livestock protection interventions: controls, randomization, and replication.

The strongest inference results from experiments that achieve the ªgold standardº through ªrandom assignment to control and treatment groups without bias (systematic error) in sampling, treatment, measurement, or reportingº [8]. This requires that an intervention be used to protect a livestock herd (treatment) and that its effectiveness is compared against a livestock herd that is not exposed to the intervention (placebo control). Both treatment and control should be replicated using multiple independent herds of livestock that are distributed so that the effects of treatment on one herd do not confound the effects on another herd, which would eliminate independence. Random assignment of treatments avoids sampling or selection bias that is common in our field [8], as in others [18]. Implementing random assignment for actual livestock herds can be challenging, but several studies have succeeded, such as those conducted by Davidson-Nelson and Gehring [10] and Gehring and colleagues [11]. In the Chilean altiplano, 11 owners of alpacas (*Vicugna pacos*) and llamas (*Lama glama*) joined a randomized reverse treatment (crossover) experiment to evaluate light devices in deterring carnivores [12]. Moreover, if large numbers of replicates are infeasible or replicates are unavoidably heterogeneous, then crossover, reverse treatment designs should help to increase the strength of inference about interventions [8, 12, S2 Table].

ªSilver standardº designs provide weaker inference because of nonrandom assignment to treatment and then repeated measures of the replicate at two or more time points (before-and-after comparison of impact or quasiexperimental designs, also called case control). Both time passing and the treatment might explain changes in replicates, in addition to the extraneous ªnuisanceº variables present in agro-ecosystems at the outset [8].

The weakest standard of evidence is the correlative study, which compares livestock predation among herds that varied haphazardly in past protection or varied systematically if people intervened only where livestock had died. In correlational studies, confounding variables inevitably create selection or sampling bias. Although correlative studies may be useful as an initial exploratory step and help direct further research, confidence in their findings should be low, especially if there is large variation in the results. Correlative studies cannot substitute for the silver or gold standards described above.

Implementation of interventions must be consistent to avoid treatment bias. For example, the functional effectiveness of livestock-guarding dogs might vary with breed, individual, training, and maintenance of the dog. Likewise, tests of lethal methods have never controlled the simultaneous use of several methods of intervention (e.g., pooling shooting and trapping as one treatment), which is inadvisable for strong inference. Consistent maintenance of interventions throughout a study should also minimize treatment bias [18].

Well-designed experiments should incorporate evaluation along multiple dimensions. Was the intervention implemented as planned? Did attacks on livestock diminish? Measurement bias arises from systematic error in documenting implementation or losses in treatment or response variables. As in biomedical research, which sometimes uses patient self-reports as a subjective measure of effectiveness alongside objective measures of health outcomes, there are valid reasons to measure owners' perceptions of effectiveness of interventions. In human± wildlife interactions, people's attitudes can influence the adoption or rejection of interventions independently of scientific evidence [14,19]. Several of the reviews included metrics of perceived effectiveness among livestock owners, yet perception alone is not a reliable measure of functional effectiveness because of widespread placebo effects, whereby patients feel better simply because they have participated. Studies should therefore either ªblindº their participants or use an independent, verifiable measure of effectiveness (i.e., livestock loss).

We recognize that gold or silver standards may be difficult to achieve. Systematic errors can be difficult to eliminate entirely, so we urge careful consideration of methods during the design process, including peer review prior to initiation. Ethical considerations about exposing animals to lethal risks may limit experimental designs. This inherent difficulty for controlled experiments may explain why some published experiments were completed in artificial settings (e.g., using captive carnivores or measuring bait consumption rather than livestock loss). Although most of our reviews omitted experiments for protecting property other than livestock, strong inference from such studies merit tests for livestock protection. Nonetheless, given that several examples of gold standard experiments overcame the complexities of people and wild ecosystems [5, 10, 11, 12], we urge greater effort and recommend government support and accolades for the highest standards of experimentation.

Incorporating science into conflict mitigation and conservation

Many governments have institutionalized support for livestock protection from predators and implemented various interventions at landscape scales. The European Council Directive 98/58/EC, concerning protection of animals kept for farming purposes, states that ªanimals not kept in buildings shall where necessary and possible be given protection from adverse weather conditions, predators and risks to their health.º The Swedish Animal Welfare Act of 1988 mandates care should be given to injured animals as soon as possible. This obligation is in practice relevant subsequent to carnivore attacks. When trained field observers confirm livestock attacks by large carnivores, they also implement rapid response interventions, such as fladry and portable electric fences, to prevent recurrent attacks [20]. In the United States, in 2013 alone, the US Department of Agriculture killed >75,000 coyotes, 320 gray wolves (*Canis lupus*), and 345 cougars (*Puma concolor*) [21]. Similarly, in some Australian states, landowners and managers are required by law to actively control dingoes (*C. dingo*) on their property.

Given the weak state of current evidence about effectiveness, decisions to use interventions are most likely based on subjective factors (e.g., ethics, opinions, or perceptions) or nonscientific (and thus possibly biased) evidence. For example, many people have deeply rooted perceptions that an intervention is effective or not [19]. Therefore, research, promoted by policy, is needed to validate that perceptions align with measurable and scientifically defensible outcomes [14]. This is especially crucial in cases of lethal interventions, which entail multiple drawbacks, including ethical criticisms and the potential to hasten carnivore declines and impede population recoveries.

However, scientists alone cannot transform policies for implementation. The pursuit of science-based management must be truly interdisciplinary and involve carnivore ecologists, animal husbandry scientists, social scientists, natural resource managers, ethicists, and other scholars and practitioners. Political leaders can also play a role to prioritize, coordinate, and fund partnerships across government agencies and nongovernment organizations. Because we anticipate continued debate over the standards of effectiveness, we recommend a coalition be formed to clearly distinguish standards for evaluation and experimental protocols, which would be distinct from coalitions convened to consider local factors that affect decisions. Through collaboration, scientists, managers, and policy leaders can help to protect livestock within healthy ecosystems that include carnivores. Constituents worldwide increasingly support the restoration of carnivore populations and accordingly are calling for human±carnivore coexistence and minimizing conflicts [2]. Enabling coexistence through evidence-based solutions will give the public strong confidence in methods promoted by scientists and governments, particularly when implementation is difficult or the ethics are controversial.

Supporting information

S1 Table. Methods used by authors' reviews. Methods have been simplified for comparison. Refer to the original articles for a full account of methods used and justification for the use of these methods.
(DOCX)

S2 Table. Studies included in the four reviews.
(DOCX)

S1 Fig. Overlap of studies included in each of the four independent reviews that evaluated evidence of functional effectiveness of interventions in reducing carnivore attacks on livestock.
(TIF)

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Exhibit 10

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Trophic cascades in Yellowstone: The first 15 years after wolf reintroduction

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ABSTRACT

The 1995/1996 reintroduction of gray wolves (*Canis lupus*) into Yellowstone National Park after a 70 year absence has allowed for studies of tri-trophic cascades involving wolves, elk (*Cervus elaphus*), and plant species such as aspen (*Populus tremuloides*), cottonwoods (*Populus* spp.), and willows (*Salix* spp.). To investigate the status of this cascade, in September of 2010 we repeated an earlier survey of aspen and measured browsing and heights of young aspen in 97 stands along four streams in the Lamar River catchment of the park's northern winter range. We found that browsing on the five tallest young aspen in each stand decreased from 100% of all measured leaders in 1998 to means of <25% in the uplands and <20% in riparian areas by 2010. Correspondingly, aspen recruitment (i.e., growth of seedlings/sprouts above the browse level of ungulates) increased as browsing decreased over time in these same stands. We repeated earlier inventories of cottonwoods and found that recruitment had also increased in recent years. We also synthesized studies on trophic cascades published during the first 15 years after wolf reintroduction. Synthesis results generally indicate that the reintroduction of wolves restored a trophic cascade with woody browse species growing taller and canopy cover increasing in some, but not all places. After wolf reintroduction, elk populations decreased, but both beaver (*Caster canadensis*) and bison (*Bison bison*) numbers increased, possibly due to the increase in available woody plants and herbaceous forage resulting from less competition with elk. Trophic cascades research during the first 15 years after wolf reintroduction indicated substantial initial effects on both plants and animals, but northern Yellowstone still appears to be in the early stages of ecosystem recovery. In ecosystems where wolves have been displaced or locally extirpated, their reintroduction may represent a particularly effective approach for passive restoration.

1. Introduction

In a system with three trophic levels (tri-trophic) involving predators, prey, and plants, predators can indirectly affect plant communities by influencing prey behavior and density, thus releasing plants from herbivory (Strong and Frank, 2010). In Yellowstone, wolves (*Canis lupus*) were extirpated from the park by the mid-1920s, absent for a period of seven decades, and reintroduced in the winters of 1995/1996. The historical presence, then absence, and now presence of wolves in Yellowstone National Park (YNP) represents a natural experiment through time and an opportunity to study cascading trophic interactions. During the seven-decade wolf-free period, the collapse of a tri-trophic cascade allowed elk (*Cervus elaphus*) to significantly impact wildlife habitat, soils, and woody plants. For example, species such as aspen (*Populus tremuloides*) and willows (*Salix* spp.) were generally unable to successfully recruit young stems into the overstory on Yellowstone's northern winter ranges, except in fenced exclosures (Grimm, 1939; Lovaas, 1970; NRC, 2002; Barmore, 2003).

Recent studies of aspen and cottonwood (*Populus* spp.) age structures, based on assessments of tree rings and diameter classes, have shown that the extirpation of wolves and subsequent increase in elk herbivory was linked to the long-term decline in the recruitment of these deciduous species (Ripple and Larsen, 2000; Beschta, 2005; Halofsky and Ripple, 2008b). With wolves now back on the Yellowstone landscape for 15 years, we ask the question: How has the reintroduction of wolves affected the recruitment of woody browse species? Our objectives were to (1) collect new data on the recruitment status of both aspen and cottonwood in the Lamar River catchment on the northern winter range of YNP, and (2) synthesize the existing body of work on tri-trophic cascades (i.e., wolves, elk, and changes in woody plants) in Yellowstone since wolf reintroduction 15 years ago.

2. Methods

In September of 2010, we repeated an aspen recruitment survey originally conducted in 2006 in the Lamar catchment of YNP's northern range where riparian and adjacent upland aspen stands had been surveyed along four streams; the Lamar River and Slough, Crystal, and Rose Creeks (Ripple and Beschta, 2007b). This pairing

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originally allowed us to compare browsing levels and aspen heights between upland and riparian (stream side) areas. We returned to the same 98 stands measured in 2006 using a global positioning satellite (GPS) system. In order to document any early aspen recruitment, we measured the browsing status and heights of the five tallest young aspen (ramets) in each stand using a methodology similar to that of our original survey (Ripple and Beschta, 2007b). In our 2006 survey, we used plant architecture methods to inspect individual leaders for terminal bud scars and browsing to retrospectively determine annual aspen heights and the percentage of leaders browsed over time (1998–2006). In 2010, we successfully measured 485 young aspen in 97 of our 98 original stands where we recorded aspen height, current annual growth, and current browsing status. One site was excluded because a conifer had been felled by the park service, thus potentially impacting the young aspen. We recorded the presence and absence of downed logs (aspen and conifer >30 cm in diameter) within a 3 m radius of each measured aspen because downed logs represent potential impediments for ungulates [e.g., bison (*Bison bison*)], potentially causing less browsing and more aspen growth (Ripple and Beschta, 2007b; Halofsky and Ripple, 2008a). Our aspen sampling design defined four different site categories: upland and riparian areas and sites with and without logs. We merged our aspen browsing and height data from 2006 with that collected in 2010. Combining these two data sets allowed us to plot browsing and aspen height for the years 1998–2006 and 2010. We photographed each of the 97 sampled aspen stands in 2010.

In September of 2010, we also surveyed cottonwood recruitment in the Lamar and Soda Butte Valleys. We searched for and enumerated all young cottonwood trees $\geqslant$5 cm diameter at breast height (DBH) using the same methods as earlier described by Beschta and Ripple (2010). We plotted the number of young cottonwood trees $\geqslant$5 cm DBH for 2001, 2002, 2003, 2004, and 2006 as reported by Beschta and Ripple (2010) along with the number of cottonwood trees $\geqslant$5 cm DBH that we found during our survey in 2010. Further information on study areas and methods of surveying aspen and cottonwood can be found in Ripple and Beschta (2007b) and Beschta and Ripple (2010), respectively. See Despain (1990) for a detailed description of the vegetation communities.

Two potential bottom-up factors that might influence tree recruitment, snowpack amount and site productivity were considered for this study. In order to analyze trends in snowpacks, we obtained the accumulated daily snow-water equivalent data by year [SWE_{acc}, see Garrott et al. (2003) for methods] from two National Resources Conservation Service SNOTEL sites nearest the northern range (Northeast Entrance Site and Canyon Site). As an index for site productivity, we summarized the current annual growth of all sampled aspen leaders that were unbrowsed in 2010. We used a Student's *t*-test to check for difference in current annual growth between upland and riparian sites. Aspen plant height was also regressed against current annual growth to determine if there was a relationship between this index of productivity and aspen height. A positive relationship would indicate that site productivity differences could be contributing to the variability in aspen height.

We summarized trends in wolf, elk, and bison populations on the northern range. Other ungulate species were present on the northern range [i.e., moose (*Alces alces*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*)], but their densities were considerably lower than elk and bison (see Table 1 in Ripple and Beschta, 2004a) and annual counts were not available for them. We plotted beaver (*Castor canadensis*) population trends because these herbivores could benefit from improving woody plant communities. We did not initiate any new willow surveys, but we included temporal trends in willow stem ring area from Beyer et al. (2007). Stem ring area represents the annual cross-sectional growth of willow stems and can be useful for documenting the timing of willow release (i.e., growing taller), with an increase in annual ring areas indicating more willow growth and a release from browsing suppression.

Finally, for the 15 year period since wolf reintroduction of 1995/1996 through 2010, we searched the literature for tri-trophic cascades studies that attempted to measure vegetation change in Yellowstone. We summarized articles that included data regarding changes in height, cover, or size (i.e., stem diameter or growth ring area) of woody browse species.

3. Results

Between 1995 and 2003, northern range wolf numbers increased from 0 to 98 (Smith et al., 2011). However, since 2003 the population has generally declined, but has fluctuated substantially (Fig. 1A). According to annual elk census data, the northern range elk counts decreased from highs >15,000 individuals during the early 1990s before wolf reintroduction to approximately 6,100 in 2010 (Fig. 1B) (White and Garrott, 2005; unpublished data – Yellowstone National Park).

Based on plant architecture measurements, 100% of aspen leaders were browsed in 1998, but this percentage declined considerably during the next 12 years for all four site categories: (1) uplands without logs, (2) uplands with logs, (3) riparian areas without logs, and (4) riparian areas with logs (Fig. 1C). Browsing intensity diminished at differing rates depending on site category and as of 2006 browsing remained greater in the uplands relative to riparian areas. Between 2006 and 2010, browsing had decreased for all site categories and the percentage of aspen leaders browsed declined from 84% to 24% for uplands without logs, 67% to 20% for uplands with logs, 49% to 18% for riparian sites without logs, and 16% to 4% for riparian sites with logs. As browsing levels decreased, aspen heights increased across all site categories. Average heights of the five tallest young aspen in each stand in 1998 were $\leqslant$40 cm regardless of site category (Fig. 1D). Most of the decrease in browsing and increase in aspen heights happened since 2004. By 2006, average aspen height for riparian areas with logs increased to 230 cm which is above the normal browsing reach of elk. As of 2010, mean aspen heights had increased for all site categories to a mean of 176 cm for uplands without logs, 224 cm for uplands with logs, 237 cm for riparian areas without logs, and 350 cm for riparian areas with logs. In terms of recruitment status of the 485–490 total aspen trees measured in our surveys, we found no aspen taller than 200 cm in 1998 (0%), 171 aspen above 200 cm in 2006 (35%), and 289 aspen above 200 cm in 2010 (60%). Overall, mean height of the five tallest young aspen increased from 154 cm in 2006 (n = 490) to 265 cm (n = 485) in 2010 (p < 0.0001). Photographs of each of the sampled 97 stands resurveyed in 2010, the majority of which show releasing aspen, were archived in ScholarsArchive@OSU for long-term storage and can be viewed at http://hdl.handle.net/1957/20842.

In terms of productivity, there was no significant difference (p = 0.53) in mean current annual growth of aspen in 2010 for upland sites ($\bar{x} = 46.7$ cm, n = 214) versus riparian areas ($\bar{x} = 45.6$ cm, n = 202). Additionally, there was very little correlation between site productivity, as measured by current annual growth, and aspen plant height (r^2 = 0.02).

Using $\geqslant$5 cm diameter at breast height (DBH) as an indication of successful recruitment of young trees into the overstory, recruitment inventories in 2001 and 2003 yielded "zero" cottonwoods that met the $\geqslant$5-cm DBH criteria (Beschta and Ripple, 2010). However, since 2004 cottonwood recruitment has steadily increased, attaining a total of 156 recruiting trees in 2010 for the Soda Butte and Lamar Valleys (Fig. 1E), almost all of these along Soda Butte Creek or the upper Lamar River, above the confluence of the two

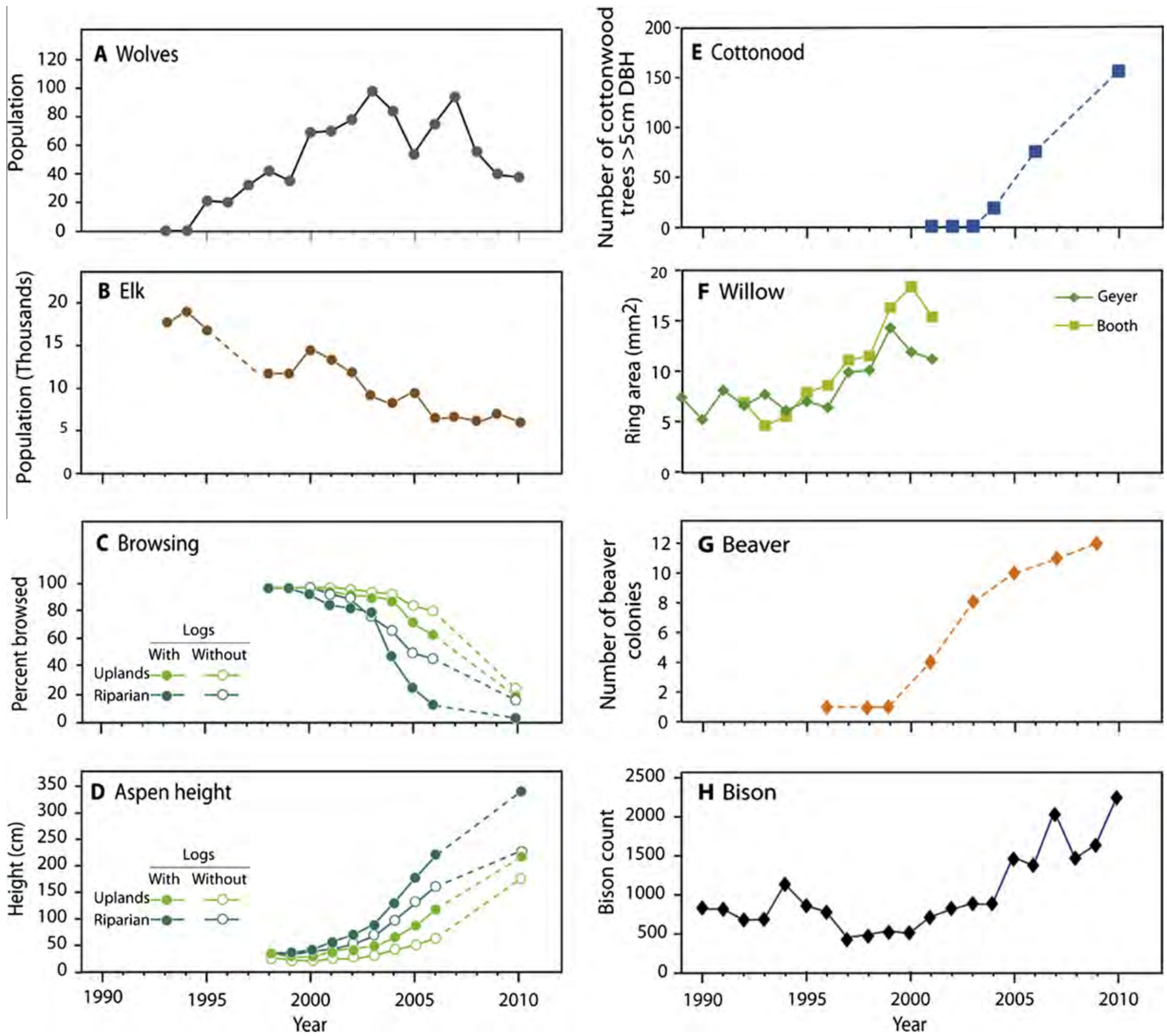

Fig. 1. Trends in (A) wolf populations, (B) minimum elk populations from annual counts, (C) percentage of aspen leaders browsed, (D) mean aspen heights (early springtime heights after winter browsing but before summer growth), (E) cottonwood recruitment, (F) willow ring area, (G) number of beaver colonies, and (H) summer bison counts. Wolf data were obtained from Smith et al. (2011). Elk data for the period 1993–2004 from White and Garrott (2005); 2005–2010 elk data as well bison data unpublished from Yellowstone National Park. The elk count for 2006 is believed to be inaccurate due to poor weather conditions during the count. Animal data presented here are based on reporting year protocol suggested by White and Garrott (2005). Recent changes in the distribution of elk to more use of conifer cover (Mao et al., 2005) indicate that continuing efforts to conduct the traditional complete counts of elk may not be adequate. Willow data from Beyer et al. (2007); beaver data from Smith and Tyers (2008) and Yellowstone National Park. Dashed lines represent time periods with at least 1 year of missing data. Panels A, G, and H represent animal population counts for the northern range in the park; B the entire northern range; and C, D, E, and F from selected plant study areas within the northern range inside the park.

streams. Mean willow stem ring area was as much as two times greater after wolf reintroduction compared to before wolves suggesting a willow release (Fig. 1F). The number of beaver colonies on the northern range increased from 1 in 1996 to 12 in 2009 (Fig. 1G). Summer counts of bison on the northern range have greatly increased since wolf reintroduction. The number of counted bison between 2001 and 2010 ($\bar{x} = 1,385$) averaged nearly two times greater than between 1990 and 2000 ($\bar{x} = 708$) (Fig. 1H).

Mean annual snow water equivalent (SWE_{acc}) was 34.7 m for the period of 1981–2009. During the late 1990s (1995–1999), representing the early years of wolf recovery in Yellowstone NP, annual SWE_{acc} averaged 49.7 m which was more than 40% above the long term mean. During more recent years (2000–2009), the average SWE_{acc} was 30.6 m or approximately 14% below the long term mean.

During the 15 years since wolf reintroduction (1995/1996–2010), we found 13 field studies and 2 remote sensing studies of change in woody browse species in Yellowstone (Table 1). Twelve of 13 field studies reported taller plants over time. For example, some valley-bottom willows showed evidence of release from high browsing pressure by about 1997 on the northern range (Beyer et al., 2007) and by about 1999 on the Gallatin winter range (Ripple and Beschta, 2004b). Two remote sensing studies of willow cover also showed significant increases in willow canopy cover since wolf reintroduction (Groshong, 2004; Baril, 2009). Cottonwoods on the northern range showed evidence of a release at just a few sites in 2002 (Ripple and Beschta, 2003), had increased by 2006, and increased further by 2010 (Fig. 1E). Evidence for a release of riparian aspen appeared at some sites by 2004 (Ripple and Beschta, 2007b) and by 2010, even upland aspen were at early stages of a release (Fig. 1D).

When documenting recruitment, authors consistently reported (1) that plant height increases were inversely related to browsing levels and (2) increased growth/recruitment was "spatially patchy" and only found at some sites and not others. Most authors attributed these plant responses, at least partially, to spatial variation in perceived predation risk; relatively risky sites received less browsing and experienced more plant growth. Perceived predation risk relates to prey antipredator behavior (Lima and Dill, 1990) and can be inferred from foraging patterns (browsing) and space use by

Table 1
Synthesis of trophic cascades studies in Yellowstone National Park for the 15 year period from when wolves were first reintroduced in 1995/1996 to the end of 2010. Only trophic cascades studies that included an analysis of potential plant changes over time are included.

Field date	Species	Location	Metric	Synthesis comment	Citation
1995–1999	Mostly willow	Soda Butte Creek	% cover	Between 1995 and 1999, a 279% increase in deciduous woody vegetation cover	Groshong (2004)
2001	Willow	Northern range	Growth rings	Twofold increase in willow stem growth rings following wolf reintroduction. Willows started releasing in 1997	Beyer et al. (2007)
2002	Cottonwood	Lamar and Soda Butte Valleys	Height	Cottonwood started releasing in 2002 at three sites to maximum heights of 200–400 cm	Ripple and Beschta (2003)
2003	Willow	Gallatin Range	Height	Between 1998 and 2002, heights of tallest willows increased from 75 cm to 200 cm. Willows started releasing in 1999	Ripple and Beschta (2004b)
2004	Willow	Northern and Gallatin Range	Height	Between 1999 and 2003, mean heights of tallest willow increased <150 cm to more than 300 cm	Ripple and Beschta (2006)
2004	Willow	Blacktail Creek	Height % cover	Between 1997 and 2003, tallest willows increased from <50 cm to >250 cm, canopy cover over streams increased from 5% to 14–73%	Beschta and Ripple (2007a)
2004	Aspen	NW Yellowstone	Height	Between 1995 and 2004, mean aspen heights increased from <100 cm to >300 cm in 1988 burn area	Halofsky et al. (2008)
2002–2005	Willow	Northern range	Height	Between 2001 and 2005 willows increased in height, but continued to be suppressed at <100 cm	Bilyeu et al. (2008)
1991–2006	Mostly willow	Northern range	% cover	Between 1991 and 2006, tall deciduous woody vegetation cover increased 170%	Baril (2009)
2002–2006	Cottonwood	Lamar and Soda Butte Valleys	Height	Between 2002 and 2006, median heights for tallest cottonwoods increased from 100 to 300 cm	Beschta and Ripple (2010)
2003–2006	Willow	Gallatin Range	Height	Between 2003 and 2006, median heights for tallest willows increased from approximately 125 cm to over 200 cm	Beschta and Ripple (2010)
2006	Aspen	Northern Range	Height	Between 1998 and 2006 mean heights for tallest riparian aspen increased from <50 cm to >200 cm. Riparian aspen started releasing by 2004	Ripple and Beschta (2007b)
2004–2007	Aspen	Northern Range	Height	Between 2004 and 2007, sampled aspen were not releasing. Mean Aspen heights were between 25 and 75 cm	Kauffman et al. (2010)
2010	Aspen	Northern Range	Height	Between 2006 and 2010 mean heights for tallest riparian aspen increased from 164 to 265 cm. Upland aspen started releasing by 2010	This study
2010	Cottonwood	Lamar and Soda Butte Valleys	Diameter	The number of young cottonwoods trees $\geqslant$5 cm DBH increased from 0 in 2001 to 156 in 2010	This study

prey over time. With the exception of one early study with field work conducted in 2001 (Beyer et al., 2007), all of the studies that reported plant recruitment and trophic cascades attributed the woody browse release primarily to a combination of behavioral and density effects of wolves on ungulates. Beyer et al. (2007) concluded that their results were consistent with a behaviorally mediated trophic cascade. One northern range field study of 16 aspen stands did not detect increased plant heights or recruitment over time (Kauffman et al., 2010).

4. Discussion

Since wolf reintroduction, Yellowstone northern ecosystems have responded as predicted by classic ecological theory with alternating biomass levels across adjacent trophic levels (i.e., more wolves, fewer elk with altered behavior, more plant biomass). Over a 13-year period from 1998 to 2010, we found a strong inverse relationship between browsing intensity and heights of young aspen in that as browsing decreased, aspen height increased (Fig. 1C and D). Browsing on aspen has been declining in both uplands and riparian areas and aspen heights increased significantly since our last survey in 2006. One reason that recent browsing percentages were low for our sampled aspen in 2010 is that many of them had grown above the browsing reach of elk (~200 cm). Furthermore, aspen recruitment in 2010 was spatially less variable than

Fig. 2. (A) August 2006 photograph showing a lack of recent aspen recruitment (aspen <1 m tall) in an upland site and (B) September 2010 photograph of recent aspen recruitment (some aspen >2 m tall) in same upland site. The dark, furrowed bark comprising approximately the lower 2 m of aspen boles represents long-term damage due to bark stripping by elk.

in 2006, since recruitment has now started occurring on more upland sites (Fig. 2). It should be noted that because we measured the five tallest young aspen in each stand, our results represent the "leading edge" of aspen recruitment.

We found no evidence that differences in site productivity as indexed by aspen current annual growth was the main cause for the aspen recruitment that we report herein, or in our previous study (Ripple and Beschta, 2007b). Furthermore, we detected no significant difference in our index of site productivity in uplands compared to riparian areas. This lack of difference may have been due to the fact that many of the upland sites were located in relatively moist areas, many with seeps. We also found little correlation between our index of site productivity and aspen height.

While more widespread aspen recruitment would suggest an increasing influence from a density-mediated trophic cascade because elk numbers have trended significantly lower since wolf reintroduction, it is difficult to separate density effects from behavioral effects because predation risk can be temporally dynamic and exist at multiple spatial scales, from a few meters to very large landscapes (Laundré et al., 2001). Sometimes large-scale shifts in behavior due to predation risk may locally appear to be density effects. For example, in recent years elk have reduced their use of the high elevation winter range in and around the Lamar Valley compared to low-elevation winter range both in and out of the park (White et al., 2010, in press). This landscape-scale shift in elk space use was likely caused by higher predator densities, more predation, deeper snow, and increased risk levels in the Lamar Valley compared to low elevation sites (White et al., 2010, in press). For example, elk are more vulnerable to wolf attacks at higher elevations in winter due to relatively deep snowpacks.

Researchers have documented major behavioral effects whereby elk in YNP, under the risk of predation by wolves, have altered their habitat use, movements, group sizes, vigilance, and other traits (Laundré et al., 2001; Childress and Lung, 2003; Wolff and Van Horn, 2003; Ripple and Beschta, 2004a; Creel et al., 2005; Hernández and Laundré, 2005; Fortin et al., 2005; Beyer, 2006; Gude et al., 2006; Halofsky and Ripple, 2008a). At least some of these behavioral effects, in addition to density effects, have likely contributed to a trophic cascade in Yellowstone (Table 1). Early on and before a significant prey population decline, we would conceptually expect any trophic cascade to be dominated by behavioral mediation and, as prey populations decline over time, to become dominated by density mediation (see Fig. 6 in Beschta and Ripple, 2010). Conversely, Kauffman et al. (2010) did not find evidence for a behaviorally mediated trophic cascade on the northern range, but it should be noted they did not document a release of plants at their sample sites (i.e., no trophic cascade was found, thus no behaviorally mediated trophic cascade would be expected). We are uncertain why Kauffman et al. (2010) did not find recruitment of young aspen but it may have been due to methodological differences in measurements of young aspen relative to other studies, increased heights of young aspen were just beginning, or other factors (Beschta and Ripple, 2011a).

Even with the occurrence of increased recruitment within existing aspen stands, full recovery of aspen to historical conditions may not be possible during the next few decades because most stands (approximately 2/3rds) have already died out and were lost due to heavy elk herbivory during the seven-decade period of wolf absence (Renkin and Despain, 1996; NRC, 2002). Furthermore, a recent modeling study has predicted there will be an aspen snag deficit during the second half of the 21st century corresponding to the aspen recruitment gap that was created during the long wolf-free period of the 20th century (Hollenbeck and Ripple, 2008). It should be noted that future aspen restoration is also possible with sexual reproduction now that wolves are again present in the Yellowstone ecosystem. For example, aspen may again regenerate following fire from seed sources rather than from extant clones (Turner et al., 2003).

Aspen, as previously noted, is not the only species of concern in northern Yellowstone and thus it is important to consider whether recent growth patterns of other woody browse species are consistent with or different from that of aspen. An assessment of Booth (*Salix boothii*) and Geyer (*Salix geyeriana*) willow stem diameter growth from 1989 to 2001 in the northern range by Beyer et al. (2007) found that increases in growth occurred relatively soon after the 1995/1996 reintroduction of wolves (Fig. 1F). They also found an inverse relationship between browsing intensity and willow stem growth that suggested reduced browsing was the mechanism for the trophic cascades and that the presence of wolves on the landscape was a significant predictor of willow growth in their highest ranked models. Similarly, decreased browsing and increased willow height growth were found at various other locations in the northern range and the Gallatin winter range, beginning in the late 1990s (Ripple and Beschta, 2004b, 2006; Beschta and Ripple, 2007a, 2010). An example of willow releasing over time on the northern range is shown in Fig. 3.

Scattered groups of black (*Populus trichocarpa*) and narrowleaf (*Populus angustifolia*) cottonwoods, totaling some 700 trees in 2001, provided prominent overstory canopies along the Lamar River and Soda Butte Creek in the northern range (Beschta, 2005). However, contemporary mortality rates indicate half of them may be dead within approximately 25–30 years such that replacement of existing overstory cottonwoods with new recruits represents an increasing ecological concern (Beschta and Ripple, 2007a, 2010). Given these ongoing patterns of mortality, the emerging pattern of increasing cottonwood recruitment in some places in recent years, like that of aspen and willow, appears to represent fundamental change in the dynamics of riparian cottonwood communities following the reintroduction of wolves.

In summary, riparian willow appeared to start recruiting by 1997, riparian cottonwood by 2002, and riparian aspen by 2006. Recruitment of upland aspen has lagged behind that of riparian stands, but data from the current study in the higher elevations of the northern range show that even some upland aspen are now growing taller than 200 cm (~upper browse height of elk). With wolves back in northern range ecosystems, various bottom-up forces may now begin to influence woody plant recruitment. For example, sites with deeper snow may cause a decrease in browsing intensity (Creel and Christianson, 2009) whereas site productivity and water tables might affect plant recruitment levels (e.g., Bilyeu et al., 2008; Tercek et al., 2010).

Willows started recruiting before both cottonwoods and aspen most likely because of a combination of two factors: (1) they are found mainly at high risk sites in valley bottoms and riparian areas (Beyer, 2006) and (2) they can withstand greater browsing pressure due to the multi-stem protective structure of individual willow clumps. Nevertheless, the fact that multiple woody species (aspen, willows, and cottonwoods) with contrasting autecologies have begun recruiting since wolf reintroduction (Table 1), the timing of the increased recruitment, and that decreased browsing has been common where plants have begun to release, provides important evidence that a post-wolf trophic cascade is the main cause for woody browse recruitment, rather than variations in climate or weather, or some other factor. Even so, none of the studies we reviewed indicated recruitment of woody browse species across all potential sites during the first 15 years after wolf reintroduction and it appears Yellowstone may still be in the early stages of ecosystem restoration resulting from a trophic cascade caused by wolves.

From the 1920s to the mid 1960s, when wolves were absent, the park service tried to attain improved recruitment of aspen and other woody browse species with decreased elk densities through culling of elk (NRC, 2002). In retrospect that experiment failed. While recruitment of multiple woody browse species appears to have begun in some areas of Yellowstone National Park in the presence of wolves, we might contemplate what will be required for a more complete and widespread recruitment of upland aspen in the coming years. The combination of behavioral and density effects from wolf presence (press disturbance) with periodic fire (pulse disturbance) may realistically portray how this system functioned historically. Fire reduces the dominance of aspen overstories, promotes the creation of dense young aspen thickets, and increases the occurrence of downed logs within the thickets. Researchers have also documented how elk, while under the risk of predation, skirt the edges of aspen thickets, avoiding their interiors (White et al., 2003). A photograph taken in the summer of 1900, before intensive herbivory from elk had become a problem on the northern range, provides visual evidence for this process

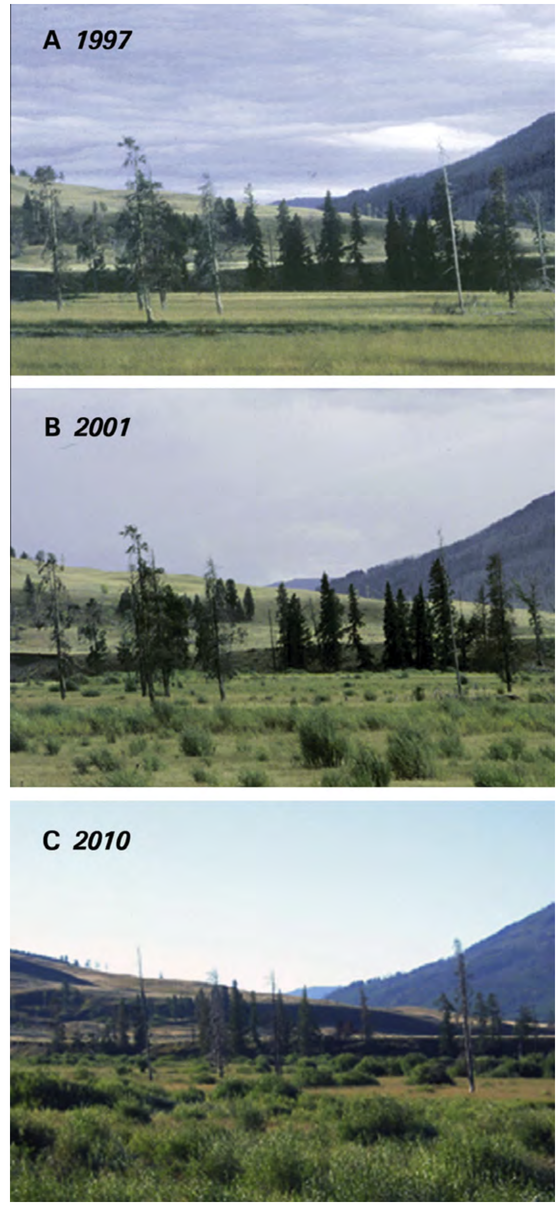

Fig. 3. Comparison photographs taken in 1997, 2001, and 2010 near the confluence of Soda Butte Creek with the Lamar River illustrating the stature of willow plants during suppression (A) from long-term browsing and their release (B and C) following wolf reintroduction in the winters of 1995–1996. As of 2010, both willow height and canopy cover increased compared to the earlier dates.

Fig. 4. Photograph taken in the summer of 1900 near Tower Junction on the northern range of Yellowstone National Park, showing aspen recruitment after wildfire and evidence of elk browsing on the outer stems of a 3- to 5-m-tall aspen thicket in the foreground and multiple recruiting aspen thickets on a distant hillslope. See text for hypothesis on the potential combined effects of wolves and fire on aspen recruitment and why browsing is evident only along the outer edges of the aspen thicket.

(Fig. 4). The photograph, which was taken a few years after wildfire during a time when wolves were present on the northern range, shows elk browsing the outer stems of a 3- to 5-m-tall recruiting aspen thicket. The recoupling of fire disturbance with the behavioral and density effects of wolves on elk could again facilitate upland aspen recruitment that has been missing for many decades. Furthermore, there is recent evidence that this scenario has started to again play out in that the combined effect of fire and a subsequent decrease in elk browsing following wolf reintroduction appears to have facilitated recruitment in aspen thickets for an area in northwestern Yellowstone National Park (Halofsky et al., 2008).

The effects of new recruitment of woody browse species does not stop with plant communities, but continues to ripple through an ecosystem potentially changing abiotic processes, as well as biotic functions such as habitat and food-web support for a host of vertebrates and invertebrates with potential consequences for increased biodiversity (Hebblewhite and Smith, 2010). In an abiotic example, Frank (2008) suggested that a wolf-triggered trophic cascade on elk likely altered net nitrogen mineralization in northern range grasslands. Biotic scenarios are more numerous. For example, the predicted aspen snag deficit described above will likely affect populations of cavity nesting birds on the northern range for decades to come (Hollenbeck and Ripple, 2008). Conversely, small herbivores such as rodents and lagomorphs may already be benefiting from decreases in coyotes (*Canis latrans*) and additional cover and forage due to decreases in elk herbivory and changes to plant communities (Ripple et al., 2011; Miller et al., in press). Any increase in small herbivores could significantly affect the prey base for both avian and mammalian predators [e.g., red foxes (*Vulpes vulpes*), and badgers (*Taxidea taxus*)] that subsist on these smaller mammals. Direct and indirect effects of wolves on other animals in Yellowstone have also been suggested for scavengers such as ravens (*Corvus corax*), bald eagles (*Haliaeetus leucocephalus*), and black-billed magpies (*Pica hudsonia*) due to subsidies from wolf-killed carcasses (Wilmers et al., 2003), and on smaller carnivores due to the killing of coyotes by wolves (Smith et al., 2003; Ripple et al., 2011). Wolves could have a positive effect on the diets of birds and bears thorough a decrease in ungulate browsing on berry-producing shrubs, resulting in higher berry production and more food for these taxa. In turn, birds and bears, can affect berry-producing shrub establishment by dispersing seeds after consuming the berries.

Wolves and bears may provide multiple and linked positive feedback loops in their sympatric predation effects such that wolves provide subsidies to bears through scavenging opportunities on wolf-killed carrion, thus supporting higher bear densities and increased predation by bears on neonatal elk, further lowering elk densities. In recent years, the bear population on the northern range has increased and in 2003–2005 bears killed more elk calves than wolves, coyotes, and cougars combined (Barber-Meyer et al., 2008).

It appears that songbird populations have already been affected by the resurgence of willow on the northern range. Specifically, Baril (2009) found that the increased willow growth on the northern range resulted in more structurally complex habitat that subsequently allowed for greater songbird richness, Shannon-Weiner diversity, and relative abundance for six of seven focal bird species that use willow (Fig. 5). She found greater abundances of common yellowthroat (*Geothlypis trichas*), Lincoln's sparrow (*Melospiza lincolnii*), warbling vireo (*Vireo gilvus*), yellow warbler (*Dendroica petechia*), song sparrow (*Melospiza melodia*), and willow flycatcher (*Empidonax traillii*) in released willows than in suppressed willows.

Beaver have also increased since wolf reintroduction; from one colony in 1996 to 12 in 2009 (Fig. 1G). Although beaver were reintroduced into the national forest just north of the park between 1986 and 1999, the park increase in beaver is likely due, at least in part, to the resurgence of willow communities, because beaver on the northern range have been almost exclusively feeding on the newly released willow (Smith and Tyers, 2008). Increases in beaver populations have tremendous implications for riparian hydrology and biodiversity. Beaver have important roles in the hydrogeomorphic processes of decreasing streambank erosion, increasing sediment retention, raising wetland water tables, modifying nutrient cycling, and ultimately influencing plant, vertebrate, and invertebrate diversity and abundance in riparian ecosystems (Naiman et al., 1988). Wyoming streams with beaver ponds were found to have 75 times more abundant waterfowl than those without beaver ponds (McKinstry et al., 2001). Other species groups likely to be positively affected by an increase in the number of beaver ponds include amphibians, reptiles, and fish. In addition, mammals such as muskrat (*Ondatra zibethicus*), and river otters (*Lontra canadensis*) could benefit from the recovery of willow, beaver, beaver ponds, and wetlands.

Riparian plant communities play an important role in affecting the stability and morphology of stream channels (Kauffman et al., 1997; Beschta and Ripple, 2006). Thus, recovering riparian vegetation can provide increased hydraulic roughness and root strength thereby increasing the stability of formerly eroding streambanks. With improving riparian plant communities, currently eroding channels are likely to stabilize (i.e., less bank erosion and lateral channel movement during periods of high flow), active channel widths decrease, and pool-riffle morphology to become more complex (Beschta and Ripple, 2011b). While plant community recovery

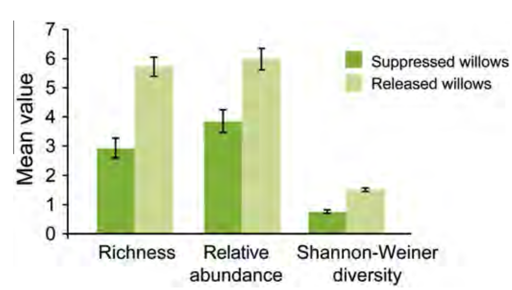

Fig. 5. Bird species richness, relative abundance, and Shannon-Weiner diversity on the northern range in suppressed versus released willows from browsing (Baril, 2009). Error bars represent standard errors.

can often proceed relatively rapidly in riparian ecosystems, channel recovery is likely to require a longer period of time.

Concurrent with the declining elk population, the bison population has been increasing on the northern range (Fig. 1H). Wolves may be allowing the bison population to increase through a decrease of inter-specific competition with lower elk numbers. Increased bison herbivory appears to be impacting young woody plants (e.g. willow, cottonwoods) on the northern range especially in the Lamar Valley where there is a relatively high year-round population (Painter and Ripple, 2012). Increased bison herbivory may explain why most cottonwood recruitment observed in recent studies has been on Soda Butte Creek and the extreme east end of the Lamar Valley, with little recruitment in the rest of the valley (Beschta and Ripple, 2010; Painter and Ripple, 2012). These secondary cascading effects may represent an example by which predators can influence multiple trophic levels through mediating the competitive interaction between the two prey species, elk and bison (Ripple et al., 2010a). Additional research in YNP is needed to examine the potential effects bison may be having on the structure and function of woody plant communities and riparian areas.

In terms of bottom-up influences, winter weather in Yellowstone can influence elk populations and seasonal patterns of herbivory (White and Garrott, 2005). While any changes in snowpacks and growing seasons may affect the release of woody browse plants, we suggest that such effects are of secondary importance relative to that of wolf presence and ungulate browsing. For example, during the seven decades when wolves were absent from northern Yellowstone's winter ranges and regardless of snowpack fluctuations, woody browse species were generally unable to grow above the browse level of elk, except in fenced exclosures. Therefore, snowpack depth, by itself, is unlikely to represent the main triggering mechanism regarding the ongoing release of woody browse species since wolf reintroduction because there has been plant recruitment regardless of snowpack depth, with recruitment occurring during both high snow and low snow periods.

5. Conclusions

Integrating top-down and bottom-up processes is a formidable challenge for ecologists and will require additional research on how potential bottom-up factors interact with top-down forces affect woody plant growth in Yellowstone. Examples of bottom-up factors include snow depth, precipitation (drought), and temperature (climate warming). More studies that sample multiple plant species across space and time are needed especially those that incorporate ungulate browsing levels and measures of site conditions and/or productivity. Additional research is a prerequisite for understanding differences in behavior of elk and bison, especially their patterns of browsing on deciduous woody species. Separating density and behavior effects of apex predators on prey, and subsequently on plant communities, in a dynamic landscape of fear is a continuing research need.

Based on studies of aspen, willow, and cottonwood in recent years, it appears that wolves have initiated a restructuring of northern Yellowstone's ecosystems via passive restoration (e.g., Kauffman et al., 1997). Improving recruitment of woody browse species during the first 15 years following wolf recovery has clearly begun, indicating that a tri-trophic cascade involving wolves-elk-plants has been re-established. Although these studies were conducted in Yellowstone National Park, the occurrence of trophic cascades involving wolves in other areas may have conservation implications for wolf management and ecosystem restoration.

The Yellowstone findings support other studies regarding the role of wolves in trophic cascades in northern Wisconsin (Callan, 2010), as well as Banff (Hebblewhite et al., 2005), Wind Cave (Ripple and Beschta, 2007a), Jasper (Beschta and Ripple, 2007b), and Olympic (Beschta and Ripple, 2008) National Parks. In fact, strong top-down forcing appears to be widespread in boreal and temperate ecosystems throughout the northern hemisphere, and this is the consistent conclusion from prehistoric, historic, and modern evidence from North America, Europe, Asia, and Oceania (Flueck, 2000; Beschta and Ripple, 2009; Ripple and Van Valkenburgh, 2010; Ripple et al., 2010b). Similarly, findings from apex predator research in the southern hemisphere indicate that dingos (*Canis lupus dingo*) appear to be biodiversity regulators (Letnic et al., 2011).

Taken collectively, the evidence provided by recent studies of top-down forcing and tri-trophic cascades caused by large predators with interacting bottom-up forces is becoming increasingly persuasive. Predation and predation risk associated with large predators appear to represent powerful ecological forces capable of affecting the interactions of numerous animals and plants, as well as the structure and function of ecosystems (Soulé et al., 2003; Terborgh and Estes, 2010; Eisenberg, 2010; Estes et al., 2011). Thus, the preservation or recovery of gray wolves may represent an important conservation need for helping to maintain the resiliency of wildland ecosystems, especially with a rapidly changing climate.

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Exhibit 11

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PERSPECTIVE

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A new era of wolf management demands better data and a more inclusive process

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Abstract

Hunting and trapping of gray wolves (*Canis lupus*) has increased dramatically in the "lower 48" states of the United States. We assess the data used to justify the intense hunting pressure on wolves, and find an absence of accessible biological data. We find there is a clear need for more transparent reporting of livestock losses, wolf kills, and especially the numbers and types of nontarget species captured in traps set for wolves. Also lacking is a full accounting of benefits and costs of hunting wolves, with a noteworthy failure to incorporate the ecosystem functions served by wolves. As apex predators, wolves warrant multi-objective management as opposed to management focused largely on livestock interests and concerns.

KEYWORDS

data needs, inclusive decisions, multiple objectives, nonlethal predator control, wolf killing, wolf management, wolf trapping

1 | EVOLVING WOLF MANAGEMENT OBJECTIVES IN THE US

The gray wolf, *Canis lupus*, once was abundant throughout most of the Northern Hemisphere. In the "lower 48" states of the US alone, wolves historically numbered at least 380,000, and likely closer to 2,000,000 (Seton, 1929). In the 1800s to the mid-twentieth century, the US government (Wildlife Services and Animal Damage Control branches of the United States Department of Agriculture, henceforth USDA) nearly exterminated wolves in the lower 48 through a program of shooting, poisoning, and trapping. Wolf numbers may have fallen as low as 300 or 400, as they were extirpated from all of the lower 48 states except Minnesota by 1970 (Musiani & Paquet, 2004).

After receiving protection under the US Endangered Species Act (ESA) in 1974, gray wolf populations underwent a remarkable recovery. The resurgence of wolf numbers to at least 6000 individuals and the successful reintroduction of gray wolves into the Greater Yellowstone area and Idaho are counted among the great conservation wins of the last century (Smith & Bangs, 2009; Wayne & Hedrick, 2011). These positive trends spurred Congress in 2011 to require the Secretary of Interior to remove the protected status of the Northern Rocky Mountain population of gray wolves (H.R.1473 – Department of Defense and Full-Year Continuing

Appropriations Act, 2011). In 2020, gray wolves in the rest of the lower 48 states (with the exception of the Mexican gray wolf of the southwest) were delisted; a decision that was reversed in court in February 2022. USFWS scientists had recommended delisting under the assumption that state wildlife biologists would manage wolf populations responsibly, using the best available science (Ashe, 2021). However, in the 2020–2021 hunting season over 1000 wolves total were killed in Idaho, Montana, Wyoming, and Wisconsin by state-sanctioned hunting (Jones, 2022; Main, 2021; Mills, 2022; Montana Fish, Wildlife, & Parks, 2022), leading to public outcry and calls for reinstating federal protections for all wolves in the lower 48 (McNamee, 2022).

Over the course of the last two centuries, wolf management in the US shifted from the straightforward goal of eliminating all wolves to another straightforward goal of protecting wolves and recovering wolf numbers (Musiani & Paquet, 2004). Today, the heated debate between conservationists and ranchers surrounding wolf control reveals a new challenge. No longer is wolf management about eradicating vermin, and no longer is it about doing everything possible to bring wolves back from the brink of extinction. Now the objectives entail managing wolves for their ecological and intrinsic value, while learning to live with what might be locally abundant wolves and mitigating the damage wolves might do to rancher livelihoods. It is worth noting that the challenge of learning to live with fierce predators, which were once hunted to near extinction but have now bounced back, is an increasingly common phenomenon. In the US alone alligators, grizzly bears, and great white sharks represent other instances of apex predators recovering and thereby exacerbating human-wildlife conflict (Guerra, 2019; Gunther et al., 2004; Langley, 2010).

Here we discuss some of the data that ought to be brought to bear in decisions about wolf protection and management, as states seek to protect ranching livelihoods as well as restore fully-functioning ecosystems that include their top predators. We argue that decision-making about wolf management will be best served by (1) greater transparency and data standardization and (2) a more complete consideration of the costs and benefits of wolves, wolf hunting, and alternative management approaches. This is not to suggest wolf management is simply a matter of data and science. The many stakeholders invested in the fate of wolves represent diverse values, a variety of economic interests, and different cultures. While science and data cannot resolve these differences, they can provide a common platform of evidence about which to debate and negotiate.

2 | LACK OF TRANSPARENCY AND AN ABSENCE OF REAL-TIME DATA ACCESS

Basic biological data that should inform wolf management decisions include, but are not necessarily limited to, estimates of wolf numbers, damage to livestock caused by wolves, number of wolves killed, and nontarget animals unintentionally trapped. Key data often are not easily accessed and, in some cases, are obtainable only through Freedom of Information Act requests.

The primary sources of data are USDA reports on livestock losses, the USDA Wildlife Services reports on wolf hunting and trapping, and each state's individual wildlife reports. USDA livestock losses are reported at most once every 5 years. Meanwhile, state wildlife reports tend to be annual reports. Unfortunately, the data from these annual reports are not curated in any centralized on-line database that the public and researchers could examine. Transparent, publicly available data are especially critical in light of accusations of erroneous data and public pressure on scientists who speak out against existing wolf management (Schontzler, 2010; Wuerthner, 2022).

Below, we delve into two key metrics—livestock losses attributable to wolves and deaths of nontarget animals in traps set to capture wolves.

2.1 | The magnitude of livestock losses due to wolves

Approximately every 5 years the USDA reports estimates of livestock losses, state by state, with losses attributed to non-predator causes (e.g., weather, disease) and predator causes (e.g., wolves, coyotes). Using the most recent USDA reports available (USDA, 2015 for cattle and USDA, 2020 for sheep) we focused on the four lower 48 states that harbor substantial wolf populations and that recently increased hunting and trapping of wolves (Idaho, Wyoming, Montana, and Wisconsin). In these four states, 3% of total cattle inventory and 10% of total sheep inventory were counted as "unwanted losses." Of those unwanted losses, the vast majority of livestock deaths were due to non-predator causes, such as health problems, weather, parasites, and birthing problems (Figure 1). In contrast, the percent of livestock killed by wolves never exceeded 0.21% for sheep and 0.05% for cattle (Figure 1).

These minimal livestock losses attributed to wolves are even more noteworthy because they are likely overestimated. In particular, the USDA combines confirmed cases (kills) and "probable" cases into one "loss" figure,

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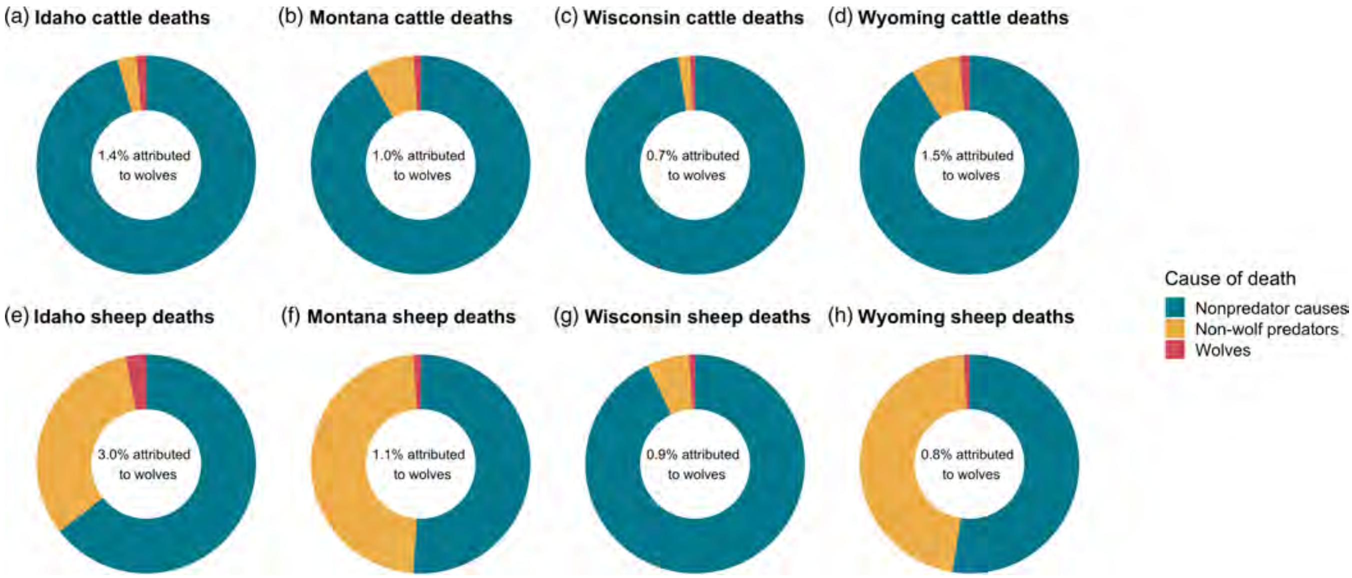

FIGURE 1 Causes of unwanted livestock deaths. (a–d) Causes of unwanted cattle deaths in (a) Idaho, (b) Montana, (c) Wisconsin, and (d) Wyoming. (e–h) Causes of unwanted sheep deaths in (e) Idaho, (f) Montana, (g) Wisconsin, and (h) Wyoming. Data for cattle from USDA (2015); data for sheep from USDA (2020)

which will be biased upward unless every "probable" kill is in fact caused by a wolf. Second, the USDA's livestock loss estimates are based on unverified mailed surveys, which are then extrapolated to a statewide estimate (USDA, 2015). To get a sense of the accuracy of the wolf depredation extrapolations reported by the USDA, we compared these USDA estimates to the number of confirmed wolf-caused kills reported by on-the-ground state wildlife agencies. This exercise revealed greater than a tenfold difference between livestock kills confirmed by state biologists and those extrapolated by the USDA from mailed surveys. For example, in 2015 the USDA reported a total of 2834 cattle losses due to wolves across the three states of Idaho, Montana, and Wyoming. Meanwhile, wildlife agencies across these same three states in the same 2015 calendar year confirmed only 148 total cattle killed by wolves (Coltrane et al., 2015; Idaho Department of Fish and Game, 2015; Wyoming Game and Fish Department et al., 2018). Given the historical vilification of wolves and the discrepancies in available data, there is a clear need for better verification of wolf-caused deaths. Consider, for example, that in Idaho confirmed wolf kills have included livestock with no bite marks or injury under the assumption that "the cattle exert so much energy trying to escape wolves that they later die from the effort" (Ridler, 2018).

Further complicating the attribution of livestock deaths to wolves is the fact that multiple species prey upon livestock in any given region. The cause of death for livestock is not always clear, and if there has been any decomposition before inspection it is much harder to determine. In addition, a whistleblower from the USDA Wildlife Services has publicly charged the Wildlife Services with corrupt practices (Roberts, 2022). This whistleblower, who was the Director of Wildlife Services for the state of New Mexico, remarked, "My guys in the field were going and rubber-stamping anything these people asked them to." While this New Mexico report applies to Mexican gray wolves, a USDA Wildlife Services district supervisor in Montana reports similar corruption in Montana due to the influence of the ranching lobby, stating "we were the hired gun of the livestock industry" (Roberts, 2022).

Despite the negligible wolf damage evident in Figure 1, wolves are being targeted under the guise of livestock protection. For example, Idaho's most recent wolf management progress report (Hayden, 2017), states that the current management approach prioritizes lethal management of wolves, including "public hunting and trapping as a preferred means of managing wolves." However, if reducing unwanted livestock losses were a priority, then one would focus on better livestock husbandry and losses due to health and weather—not on the few cattle killed by wolves (Figure 1). A recent systematic review of 119 gray wolf dietary studies revealed that wolves prefer wild prey over domesticated livestock, and when they do attack livestock, prefer animals that graze freely in small numbers as opposed to larger or fenced herds (Janeiro-Otero et al., 2020). These results suggest that wildlife management that sought to build robust populations of wild prey species for wolves would not only benefit the hunting community, but also could reduce livestock damage. An alternative hypothesis is that livestock losses are rare precisely because wolves are being vigorously hunted and trapped and consequently are sufficiently few that their damage is limited. However, as is discussed below, there is little evidence to support the hypothesis that lethal wolf control is effective at reducing livestock losses.

2.2 | Collateral damage due to wolf harvest

States differ in the methods of wolf hunting that are allowed, as well as requirements for reporting deaths of nontarget wildlife. Methods for killing wolves that have been sanctioned by these states include: baiting, foothold traps, snares, a wide variety of firearms often in combination with night vision scopes or thermal imaging, electronic calls, bow and arrow, hunting from airplanes, hunting with packs of dogs, and hunting from snowmobiles and other off-road vehicles. Much of the wolf hunt entails indiscriminate traps and snares that also capture other species, such as domestic dogs and cats, and nontarget wildlife such as deer and bobcats. In part because of a lack of data transparency, and also because some traps may be lost or are not checked, it is hard to quantify the full extent of nontarget deaths. However, data obtained by a FOIA request in Idaho reveal that in some years the number of nontarget animals caught is similar to, or even exceeds, the number of wolves trapped (Fignure 2). Overall, between 2012 and 2019, nontarget species accounted for nearly half (47%) of the animals caught in Idaho's wolf traps (Figure 2). During this period, traps set for wolves in Idaho caught game species such as deer, elk and moose, as well as mountain lions, domestic dogs, and a smattering of rare species including lynx, eagle, and wolverine (Cole, 2020). Data from Montana indicate a similar composition of species accidentally caught in traps set for wolves (Figure 3).

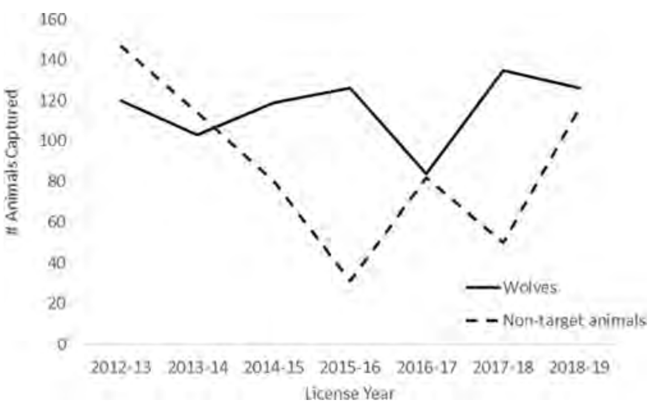

FIGURE 2 Captures of wolves and other animals for wolf traps set in Idaho during the 2012/2013 to 2018/2019 trapping seasons. A total of 813 wolves and 614 nontarget animals were reported captured for this 7-year period. Accidental captures included game species such as deer, elk, and moose, as well as mountain lions, domestic dogs, and a smattering of rare species including lynx, eagle, and wolverine. Data extracted from Cole (2020), who in turn obtained data via a public records request to the Idaho Department of Fish and Game. Reports of nontarget fish ($n = 2$) and wolves ($n = 4$) were omitted

Discussions of trapping and snaring wolves as a wildlife management strategy consistently fail to account for the unintended consequences of collateral damage. Any calculus of the benefits and costs of trapping wolves needs to include the inevitable harm caused to nontarget organisms—harms that include unnecessary suffering of individual animals, as well as potential population consequences. The true magnitude of these nontarget captures is difficult to know given the high likelihood of under-reporting for nontarget casualties.

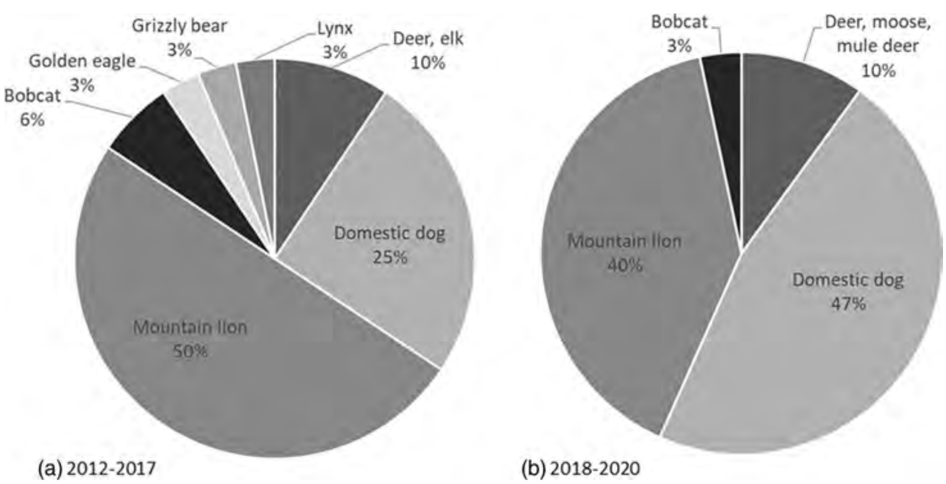

FIGURE 3 Composition of incidental captures reported for wolf traps set in Montana. (a) Thirty-two total reports of nontarget captures in license years 2012–2017. Data from Inman (2018). (b) Thirty total reports of nontarget captures in license years 2018–2020. Data courtesy of trap free Montana public lands, obtained from Montana fish, wildlife and Parks

3 | A FULLER LEDGER OF COSTS AND BENEFITS

As wolf management responds to multiple objectives, tough decisions must weigh damage to livestock against the benefits of wolves, and against the explicit costs and unintended consequences of expansive trapping and hunting programs. Currently, the economic losses experienced by ranchers have been a central focus of wolf management conversations. Ranchers and hunters should continue to have a significant voice, but their objectives must be balanced with a more thorough accounting of the economic costs and benefits of wolves and wolf management strategies, as well as the cultural value of wolves. For example, Raynor et al. (2021) examine the economic damage caused by wolves and find no evidence that wolves are a net economic negative. This is because wolves reduce deer-vehicle collisions by as much as 20% by altering the behavior, as well as the abundance, of their deer prey (Raynor et al., 2021). Wolves are also an important part of the Yellowstone National Park tourist experience, where they are estimated to bring in $82 million annually to the states of Idaho, Montana, and Wyoming (RRC Associates, 2022).

Ecosystem benefits of wolves should also weigh heavily into decision-making. Wolves both directly and indirectly shape their ecosystems, altering productivity and functioning from the top-down (Frank, 2008; Gable et al., 2020). Historically, wolves played a major ecological role in North America as a top carnivore: their predation on elk, deer, and buffalo held these and other herbivores at sufficiently low numbers such that overgrazing rarely occurred (Hermans et al., 2014). For this reason, Treves et al. (2021) argue that wolves should be protected as predators, and ideally managed at a regional level. Some studies find that even at relatively low numbers, wolves can profoundly impact an ecosystem by reducing the intensity of grazing in riparian zones (because they either kill or scare off deer and elk). For example, riparian grazing increases the erosion of sediment into streams, and conversely the reduction of grazing due to wolves can yield less turbid water (Estes et al., 2011; Ripple & Beschta, 2003, 2012).

An additional benefit of wolves is the possibility they enhance the health of their prey populations by targeting sick and weak individuals (Stahler et al., 2006). By picking off sick prey, wolves could in theory cleanse prey populations. This hypothesis is currently being tested in response to the idea that wolves could be used "as first responders against a deadly brain disease" (chronic wasting disease) that threatens to infect Yellowstone's large elk and deer herds (Robbins, 2020). Initial analyses suggest that wolves could substantially reduce the prevalence of chronic wasting disease in deer and elk in Yellowstone (Brandell et al., 2022). Wolves could also impact human health via their interaction with prey that harbor SARS-COV-2. Thus far SARS-COV-2 has been found in deer in 24 states, with evidence of mutation and evolution of the virus within deer populations (Mallapaty, 2022). The concern is that some new variant of the virus could jump back from deer to humans (Kuchipudi et al., 2022). While any link between wolves and reduced disease spillover from deer is speculative, it is an example of the interconnectedness of species in ecosystems and the fallacy of viewing wolves only through the prism of livestock damage.

The challenge, of course, is to balance the ecosystem benefits that wolves provide with the costs of livestock losses attributed to wolves. The solution could come, at least in part, from nonlethal deterrents. Nonlethal solutions can be effective at preventing wolf-livestock conflict (Espuno et al., 2004; Treves et al., 2016). Nonlethal methods are not a silver bullet solution, but the use of fladry, enclosures, electrified fencing, and well-trained livestock guardian dogs can be more effective than lethal control, even at large scales (Bruns et al., 2020; van Eeden et al., 2018, Treves et al., 2016). Even something as simple as fencing cattle as opposed to having them range freely can make a big difference in the magnitude of livestock losses—especially if wild prey are abundant (Janeiro-Otero et al., 2020).

While ranchers may fear that nonlethal methods could be ineffective, it is worth noting that there is little evidence that lethal methods reduce livestock losses. In fact, several studies have documented instances in which lethal methods are ineffective or counterproductive because they worsen conflict (Lennox et al., 2018; Santiago-Avila et al., 2018; Treves et al., 2016; Wielgus & Peebles, 2014). There is some indication that lethal interventions against wolves may simply spread conflict to neighboring livestock owners (Santiago-Avila et al., 2018). In addition, lethal removal of wolves disrupts pack stability which results in pack dissolution, increased dispersal, and could lead to more attacks on livestock by single pack-less wolves (see Haber, 1996; Santiago-Avila et al., 2018; Wielgus & Peebles, 2014). These results may also explain why Wielgus and Peebles (2014) found that lethal wolf removal was associated with increased livestock loss at the population level the following year.

While sheep operations often use nonlethal predator control methods, cattle operations have a lower rate of uptake: only 10.1% of cattle operations in Idaho, 14.5% of cattle operations in Montana, and 14% of cattle operations in Wyoming used nonlethal methods (USDA, 2015). Economic costs likely hinder adoption of these approaches. Maintaining guard dogs and visual deterrents can be a considerable time and financial expense for ranchers compared to shooting or trapping wolves. For example, the lifetime cost of using livestock guardian dogs as a nonlethal depredation tool was estimated at nearly $6000 per dog (Bruno & Saitone, 2019). However, considerable public funds are also spent on lethal control measures. Idaho, for example, budgeted $1 M to kill wolves in 2022 (Ridler, 2022). This single-year $1 M fund could cover the lifetime costs (including purchase, food, training, and veterinary care) of 168 fully-trained livestock guardian dogs. If funds were regularly redirected to support nonlethal methods, livestock losses might be reduced without disruption of key ecosystem services.

4 | WHAT WOULD INCLUSIVE AND EVIDENCE-BASED WOLF MANAGEMENT LOOK LIKE?

Much of the discussion surrounding recent hunting of wolves has been framed in terms of extinction risk and the administration of the ESA. However, wolf management that seeks merely to avoid extirpation is a mistake, because such a framing fails to address the value of larger populations of wolves. Management plans often determine population goals based on existing population sizes, rather than incorporating community dynamics to restore ecological interactions (Soulé et al., 2003). Instead, Soulé et al. (2003) stated that "conservation plans should contain a requirement for ecologically effective population densities; these are densities that maintain critical interactions and help ensure against ecosystem degradation." Apex predators such as wolves can have outsized or "cascading" impacts on ecosystems (Estes et al., 2011), and, because of this, their management demands special consideration. Currently, states are allowing large numbers of wolves to be killed without compelling evidence that the benefits (the presumed prevention of livestock losses) outweigh the costs, including the economic costs of lethal control programs and the ecosystem-level disruptions caused by suppressed wolf populations.

The failure to consider the negative impacts of wolf killing is especially noteworthy in the case of trapping and snaring wolves from Yellowstone National Park (hereafter YNP). In only six months of the 2021–2022 hunting season in Montana, at least 25 wolves from YNP were killed when they wandered outside the park boundary a number that represents one fifth of the YNP wolf population (Partlow, 2022). The Superintendent for YNP asked Montana Governor Gianforte to limit wolf hunts in the northern neighborhood of the park, but his requests were ignored, and the Governor himself trapped and killed a radio-collared wolf from YNP in 2021 (Associated Press, 2022). It is highly unlikely that these Yellowstone wolves represent a threat to livestock, since in the last 3 years there has been only one documented livestock kill attributed to wolves in the county that encompasses the hunting districts bordering YNP (Partlow, 2022). Almost 5 million people visited YNP in 2021–that is more than four times the size of the entire population of Montana. Montana ranchers certainly deserve a voice in wolf management, but so too do the many visitors who come to see YNP's spectacular wildlife.

In recent decisions to kill increasing numbers of wolves, the goal of protecting ranchers from livestock losses has played an outsized role. But wolf management largely takes place on, and certainly has major implications for, public lands. As such, wolf management cannot be beholden to any single special interest group, whether that group is ranchers, hunters, or nature viewers. Decisions about wolf management should inclusively involve all stakeholders, including Native American tribes whose lands overlap with wolf populations. Species do not exist in a vacuum. The public and cultural value of wolves must be balanced in management decisions. It is not surprising that some ranchers resent any restrictions on their ability to kill what they may view as vermin, especially when advocates for wolves are "outsiders". But just as the rancher's perspective warrants consideration, so too do the concerns of the broader public who may view wolves and Yellowstone as a national treasure. A multi-objective and thoughtful decision process could bridge these differences and yield a balanced solution.

Yet even the most inclusive and best-run stakeholder discussions will get nowhere without transparent and up-to-date data that provides all parties with key information. That foundation of data is currently lacking for wolves. Certainly, it is challenging to coordinate and standardize data collection across a variety of state and federal agencies. Yet such standardization has been achieved in other contexts. An example of a complex fish and wildlife management challenge that is well supported by on-line data across state boundaries can be found in the Columbia River Basin DART (Data Access in Real Time—see https://www.cbr.washington.edu/dart/overview). DART includes a glossary, metadata, maps of all data sites, and both annual and monthly real-time data from 47 different sites across three states (https://www.cbr.washington.edu/dart/dartmap). While DART does not resolve conflicting objectives such as tribal harvest, salmon conservation, and irrigation, it does focus the debate around a standardized data set to which everyone has easy access. Given the iconic role of wolves as top predators in North America, we advocate for a concerted effort to collate data on wolf numbers, wolf depredation of livestock, wolf losses to hunting and trapping, collateral damage from indiscriminate trapping, and the costs and impacts of nonlethal methods–in a standard way across states. If coordinating methods across states proves impractical, at least any and all relevant data should be made easily available. Currently, public debate about wolf management is confused and confusing because of an absence of a transparent database around which different viewpoints can assess their merits.

The fundamental question is how best to balance the full ledger of ecological, economic, and social/cultural costs and benefits associated with wolves, wolf hunting, and alternative methods of wolf management. Moving forward, wolf management should be inclusive and embrace a systems approach that takes a broader perspective on the overall costs and benefits.

AUTHOR CONTRIBUTIONS

Desiree Felix and Elishebah Tate-Pulliam scoured state fish and wildlife reports to find salient data on wolf kills and wolf hunting regulations. Madison Miketa took the lead on nonlethal methods and analyzing USDA data on livestock losses. Kim Bean provided information on the conflict between ranchers and wolf advocates. Michelle Marvier and Peter Kareiva wrote the first draft of the manuscript after synthesizing input provided by co-authors. Samantha Atwood edited the manuscript and helped design the research from the very beginning. All authors read, reviewed, and edited the manuscript.

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CONFLICT OF INTEREST

None of the authors have any conflicts of interest or financial interests that are pertinent to this research.

DATA AVAILABILITY STATEMENT

All data are from USDA or State Wildlife Agency reports and websites and are publicly available. These public sources are cited in the text. No original data were collected for the manuscript.

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Exhibit 12

2010

Utility of livestock-protection dogs for deterring wildlife from cattle farms

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Utility of livestock-protection dogs for deterring wildlife from cattle farms

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Abstract

Context. Livestock producers worldwide are negatively affected by livestock losses because of predators and wildlife-transmitted diseases. In the western Great Lakes Region of the United States, this conflict has increased as grey wolf (*Canis lupus*) populations have recovered and white-tailed deer (*Odocoileus virginianus*) have served as a wildlife reservoir for bovine tuberculosis (*Myobacterium bovis*).

Aims. We conducted field experiments on cattle farms to evaluate the effectiveness of livestock-protection dogs (LPDs) for excluding wolves, coyotes (*C. latrans*), white-tailed deer and mesopredators from livestock pastures.

Methods. We integrated LPDs on six cattle farms (treatment) and monitored wildlife use with tracking swaths on these farms, concurrent with three control cattle farms during 2005–2008. The amount of time deer spent in livestock pastures was recorded using direct observation.

Key results. Livestock pastures protected by LPDs had reduced use by these wildlife compared with control pastures not protected by LPDs. White-tailed deer spent less time in livestock pastures protected by LPDs compared with control pastures not protected by LPDs.

Conclusions. Our research supports the theory that LPDs can be an effective management tool for reducing predation and disease transmission. We also demonstrate that LPDs are not limited to being used only with sheep and goats; they can also be used to protect cattle.

Implications. On the basis of our findings, we support the use of LPDs as a proactive management tool that producers can implement to minimise the threat of livestock depredations and transmission of disease from wildlife to livestock. LPDs should be investigated further as a more general conservation tool for protecting valuable wildlife, such as ground-nesting birds, that use livestock pastures and are affected by predators that use these pastures.

Additional keywords: bovine tuberculosis, coyote, grey wolf, livestock protection dog, mesopredators, white-tailed deer, wildlife damage management.

Introduction

Agricultural producers are important stakeholders in wildlife conservation (Kellert 1981; Conover 1998). For example, in the USA there are ~2 million farmers and ranchers, who make up <2% of the country's population but control ~40% of the land (Berg 1986; US Census Bureau 2010). Producers appreciate wildlife (Brown *et al*. 1978) and their support has long been recognised as essential if wildlife conservation is going to occur on private land in concert with farming and ranching (Leopold 1933). However, livestock producers worldwide, particularly smaller-scale operations, are often confronted with the challenge of reducing livestock losses to predators and wildlife-transmitted diseases. In the western Great Lakes Region of the USA, most producers are small- and medium-sized operations, with 45–59% having cattle/calf commodity sales of <US$10 000 per year, 72–85% having cattle/calf commodity sales of <US$100 000 per year, and 71–86% having <100 head of cattle (www.nass.usda.gov, accessed 1 June 2009). This region exemplifies challenges of maintaining agricultural production while conserving valued wildlife. Livestock depredations will likely increase as the grey wolf (*Canis lupus*) population increases and expands its geographic range (Mech 1995; Gehring and Potter 2005; Harper *et al*. 2005). The region has a large population of coyotes (*C. latrans*). Livestock producers in this region have also been affected negatively by livestock losses associated with infectious disease transmitted by wildlife. In Michigan, and more recently Minnesota, free-ranging white-tailed deer (*Odocoileus virginianus*, deer) continually infect cattle with bovine tuberculosis (*Mycobacterium bovis*, TB; Schmitt *et al*. 1997; Palmer *et al*. 2001; O'Brien *et al*. 2002).

Effective, producer-based management tools are needed to assist producers in reducing risk of livestock depredation and transmission of diseases such as TB to livestock (Gehring *et al*. 2006; VerCauteren *et al*. 2008). Efficacious tools that producers can adapt into their normal husbandry practices are needed to

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reduce economic losses. Lethal control, as a management tool, can be effective (Conover 2002). However, livestock depredations commonly recur annually after wolves are removed lethally following a depredation (Fritts *et al*. 1992; Gehring *et al*. 2003), and does not appear to reduce depredations at a regional scale (Musiani *et al*. 2005). Non-lethal management tools are regarded by society as more humane than lethal control (Reynolds and Tapper 1996; Reiter *et al*. 1999). Numerous non-lethal management options exist; however, few have been the subject of a controlled experiment involving free-roaming wildlife (Shivik 2006). Partly, this has been due to the difficulty in conducting large-scale experiments while controlling for confounding variables (Breck 2004; VerCauteren *et al*. 2008; Gehring *et al*. 2010*a*).

Livestock protection (guarding) dogs (LPDs) were developed centuries ago to protect goats and sheep from predators (Coppinger and Coppinger 2001). LPDs are generally regarded as effective in reducing livestock depredations caused by coyotes (Green *et al*. 1984; Andelt 1992; Andelt and Hopper 2000; Smith *et al*. 2000), but their effectiveness against wolves is more tenuous (Gehring *et al*. 2010*a*). VerCauteren *et al*. (2008) and Gingold *et al*. (2009) provided experimental evidence of the ability of LPDs to deter deer from livestock pastures and modify ungulate behaviour, respectively. LPDs may also have value related to the conservation of species of wildlife that are predated by species that LPDs repel. For example, Hansen and Smith (1999) documented that medium-sized mammals were excluded and/or killed by LPDs in livestock pastures, which we propose could allow species such as grassland birds to be more successful. In general, though, there is a dearth of experimental work that has evaluated the effectiveness of LPDs for reducing the use of farms by wildlife (Gehring *et al*. 2010*a*).

Our objective was to determine whether LPDs that were socialised and bonded to cattle could reduce the use of livestock pastures by wildlife, a measure of reduced risk of livestock depredation and transmission of disease to livestock. We predicted that LPDs would reduce the number of wolf, coyote, white-tailed deer and mesopredator visits into livestock pastures, and amount of time deer spent within livestock pastures.

Materials and methods

Study sites

During 2005–2008, we studied LPDs within a study area located in the western Upper Peninsula (UP) of Michigan, including Houghton, Iron, Marquette and Ontonagon counties. The study area consisted of a mixture of northern hardwoods, upland conifers, lowland conifers, agricultural areas, streams and rivers. Agriculture included cattle operations and forage crops. During the study, the UP contained 425–520 wolves within an estimated total of $\geq$87 wolf packs (D. E. Beyer, Michigan Department of Natural Resources & Environment, pers. comm.), as well as coyotes, deer and mesopredators interspersed within the landscape.

We selected nine beef-cattle farms on the basis of their location within the study area, habitat, livestock on pasture and their willingness to participate in the study. Farms contained 19–50 head of cattle on 10–40-ha fenced pastures. During June–September, cattle were located on pasture and confined near or in buildings for the remainder of the year. All farms were surrounded by forest and six farms included wooded areas within a portion of the pasture. All farms had existing electrified livestock fencing ($\geq$three electric wires and a total height of 110 cm) which was used to maintain cattle within pastures. We added one electrified strand of wire ~0.25 m from the ground and additional wires to maintain gaps $\leq$0.33 m at each farm (Gehring *et al*. 2010*b*). The lowest strand of wire served to improve the training of LPDs to remain within pastures on treatment farms (Gehring *et al*. 2010*b*), and control pastures also had this lower strand of wire to reduce variability among the farms as a result of fencing. Fencing on study farms was not designed to serve as predator- or deer-proof fencing and would not effectively prevent access by wolves, coyotes or deer. Dorrance and Bourne (1980) reported that coyotes still penetrated a 7-strand electric fence they used, even though the bottom wire (15-cm above ground level) was electrified. Gates *et al*. (1978) found that 111-cm-high fencing was not effective at preventing coyotes from entering pastures. Only coyote-proof fencing (150–168-cm high with 12 strands) reduced coyote access to pastures (Gates *et al*. 1978; Linhart *et al*. 1982). VerCauteren *et al*. (2006) reported that common livestock-fencing designs (e.g. multi-strand electric wire fence) were not effective for excluding white-tailed deer, even with a lower electrified wire 25 cm from the ground.

We initially used Michigan Department of Natural Resources & Environment (MDNRE) winter track and radio-telemetry data to identify likely study sites where wolves and farms overlapped. These areas were locations where MDNRE had monitored radio-collared wolf packs within 1–2 years of the present study. Annually, we also conducted track and scat surveys along dirt roads and on farms within these areas during late winter to early summer, to confirm the presence of wolves within 5 km of potential study farms. Track surveys were conducted a minimum of three times so as to confirm the presence of wolves (Wydeven *et al*. 1995).

We randomly assigned farms as treatment (LPDs present, $n = 6$) or control (no LPDs present, $n = 3$) farms. In 2007, one treatment farm was dropped from the study after the farmer ceased raising livestock. Treatment and control farms were located within 10 km of each other, to ensure that the wildlife within the area had equal access to both farm types. We assumed that both farm types were equally accessible to wildlife. Further, all farm pastures were confirmed to be used by wolves, coyotes, deer and mesopredators (raccoons (*Procyon lotor*), opossums (*Didelphis virginiana*), red fox (*Vulpes vulpes*) and striped skunks (*Mephitis mephitis*)), on the basis of our track surveys conducted before the experiment began.

Dog training and integration with cattle

In March 2005, we purchased 7–8-week-old Great Pyrenees pups (6 females, 6 males) from a reputable breeder that had an established record of producing working LPDs. Subsequently, we placed a male–female pair of pups at each treatment farm. We provided producers with a document of training guidelines and, with our assistance, they were responsible for the care and training of their pups. Within a livestock barn, pups were housed in a 2 × 4-m pen (LPD pen) located within a livestock pen (8 × 8 m) that contained two $\leq$1-week-old calves. We provided food and water in the LPD pen that only the dogs had access to. Pups could move in and out of the LPD pen to interact and bond with calves (Gehring *et al*. 2010*b*). We limited human contact with pups for a strong bond to develop with cattle and not humans (VerCauteren *et al*. 2008). However, pup interactions with calves were monitored to detect inappropriate behaviours (e.g. biting calves, pulling tails or playing aggressively), and these behaviours were corrected immediately. At 4 months, pups were allowed to interact with adult cattle in barns under direct supervision by producers. If taken outside, pups were on leashes and allowed only in the area they would be guarding as adults. At 6 months, pups were neutered or spayed to reduce the likelihood of hormonal changes from influencing their effectiveness as LPDs, including roaming behaviour (VerCauteren *et al*. 2008).

At 7 months, we began a slow-release program for integrating pups with adult cattle in pastures. During the day, pups were housed with their calves in outdoor pens (5 × 5 m) within pastures and then returned to their livestock barn by dusk. Pups were walked daily on leashes around the inside of pastures to familiarise them with the pasture and to establish the fence as a boundary. Pups were encouraged to interact with the adult cattle while exploring pastures. This slow-release program allowed the pups to become accustomed to living in a new area, while furthering the bonding between the adult cattle and the pups (Gehring *et al*. 2010*b*).

Before pups were released into pastures, we added a strand of 12-gauge electric fence wire to the existing fence at treatment and control farms to maintain a bottom wire 0.25 m from the ground at each farm (Gehring *et al*. 2010*b*). We monitored fencing regularly and maintained it at 7000 V. Throughout the study, if a dog escaped and began roaming, we installed an invisible fencing system (PetSafe Stubborn Dog System, Radio Systems Corporation, Auburn, IN, USA) and put a shock collar on the LPD to ensure it stayed in the pasture (Gehring *et al*. 2010*b*).

Wildlife visitation on farms

We recorded visits by wolves, coyotes, deer and mesopredators at treatment and control farms by using track swaths. We created track swaths by clearing a 1.5 × 4-m area of debris and vegetation and sifting soil over the area. Track swaths were placed at 200-m intervals around the entire perimeter of each pasture, with equal proportions inside and outside the pasture (i.e. straddling the livestock fencing). No attractant was used at track swaths. Surveys of track swaths were conducted biweekly during May to August, with treatment and control farms being monitored concurrently during the 6-day sampling periods. This resulted in a total of 24 sample days each year. During each check of track swaths, tracks were identified and recorded as a single visitation if the track proceeded into the pasture. We identified tracks using shape characteristics and track dimensions (Halfpenny and Bruchac 2001). We used a cut-off point in track size of 9.0 cm in length and 7.0 cm in width to differentiate coyote and wolf tracks. Domestic-dog and wild-canid tracks were differentiated on the basis of size and shape (e.g. length : width ratio) characteristics (Halfpenny and Bruchac 2001). Track swaths were raked smooth after each check to prevent double counting. Annual visitation data were standardised by summing the number of tracks entering the pasture for each farm and dividing by the number of sampling days. This provided an index of species-specific visitation by wildlife to farms, a measure of intensity of use and potential risk.

During 22–25 June 2006, we conducted ground-nesting bird and nest surveys on two treatment and two control farms. We used a drag line to flush birds and walked 20-m-wide transects throughout the herbaceous portions of pastures. Locations of flushed birds were marked with a wire flag and the area was searched to find a nest. The number of flushed birds and nests was recorded and summed for each pasture. Because of a small sample size (i.e. two treatment and two control farms), we did not conduct statistical analyses to compare treatment and control farms for the number of birds flushed or the number of nests.

During June–August 2007 and 2008, we also used direct observation to measure the amount of time deer spent in livestock pastures on four treatment and three control farms. We observed pastures for 2 h at each farm once per week for 7 weeks, from 1 h 40 min before to 20 min after the sunset. We used binoculars and a stop-watch to record observations from a parked vehicle outside the pasture, at positions that allowed the pasture area to be viewed without obstruction. We recorded the time when a deer or group of deers entered the pasture until the time they left the pasture. The total number of minutes deers spent in pastures at each farm was standardised as the number of minutes per 2-h sample period for each farm. Our research was approved by the Institutional Animal Care and Use Committee at Central Michigan University (IACUC #13-04).

Statistical analysis

We used a two-way Friedman's test and repeated-measures ANOVA (Conover and Iman 1981) for wolf, coyote and deer visits to livestock pastures. We blocked by farm type (treatment or control) and time (year). We excluded data from 2005 in our analyses because no LPDs were yet present on farms. We used a Wilcoxon rank-sum test to compare mesopredator visits on treatment and control farms during 2006, the first year LPDs were present. We used a Wilcoxon rank-sum test to compare treatment and control farms relative to deer use (time spent in pastures) during 2007 and 2008. We conducted statistical analyses with SAS statistical software (SAS Institute, Cary, NC, USA). We used a significance level of $\alpha = 0.05$.

Results

We found a group effect (i.e. between-subject effect) for wolf, coyote and deer visitation. Treatment farms had fewer visits by wolves ($F = 28.57$, $P < 0.001$), coyotes ($F = 5.69$, $P = 0.027$), and deer ($F = 4.34$, $P = 0.047$) than did the control farms. We did not find a time effect for wolves ($F = 1.43$, $P = 0.263$), coyotes ($F = 0.87$, $P = 0.435$), or deer ($F = 0.21$, $P = 0.888$). We recorded wolves only ever on treatment farms in 2005, the year before LPDs were present. During 2005, coyote ($S = 15$, $P = 0.560$, Fig. 1), deer ($S = 15.5$, $P = 0.488$, Fig. 2) and mesopredator ($S = 14.5$, $P = 0.548$, Fig. 3) visitation was similar on treatment and control farms. Once LPDs were present, wolf and coyote visitation declined to zero on treatment farms, and increased slightly on control farms (Fig. 1). Further, no

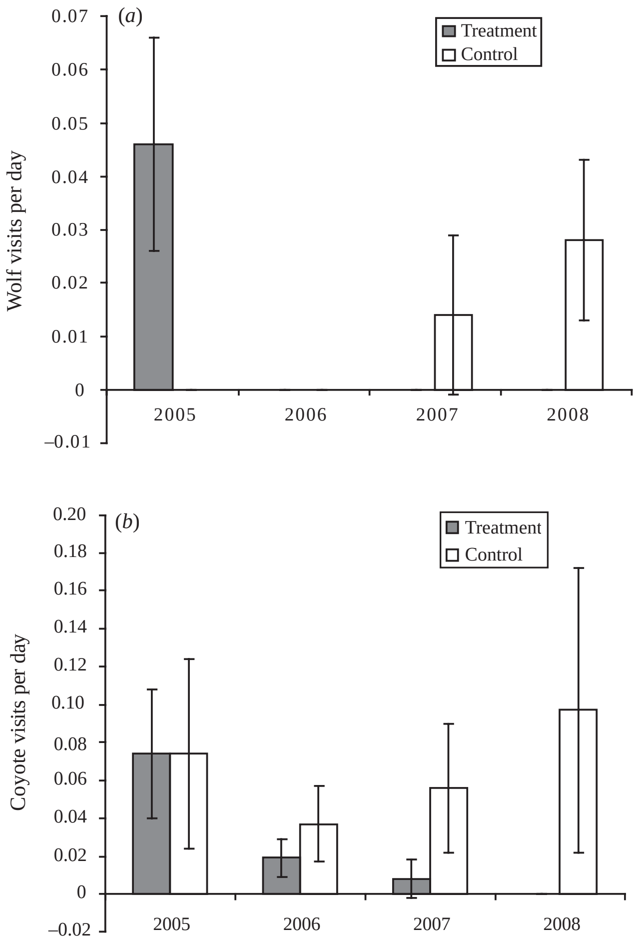

Fig. 1. Mean (± 1 s.e.) number of (*a*) wolf and (*b*) coyote visits per day into livestock pastures on study farms in the western Upper Peninsula of Michigan, May–August 2005–2008. No livestock-protection dogs (LPDs) were present in pastures during 2005. LPDs were present on treatment farms during 2006–2008.

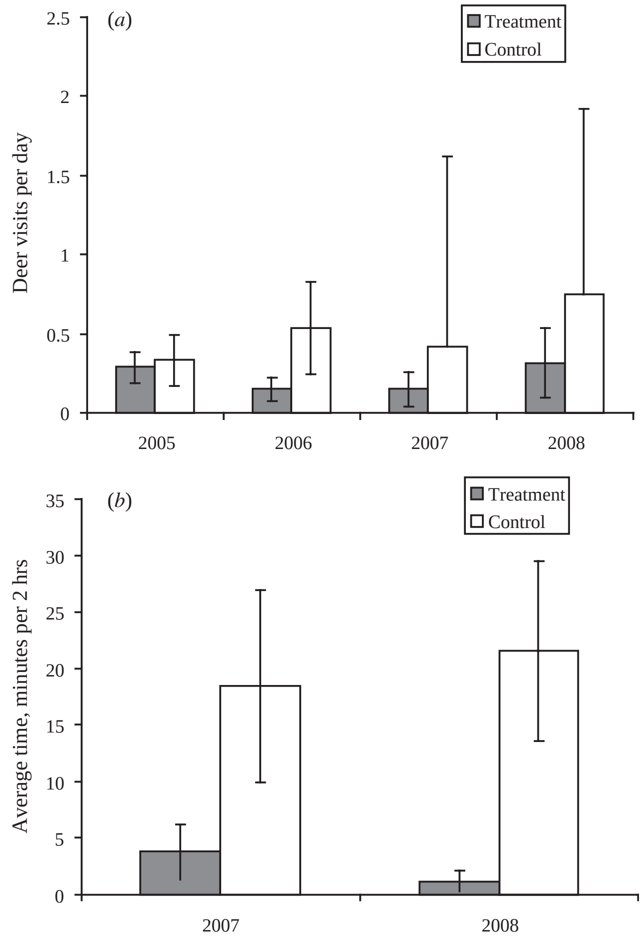

Fig. 2. Mean (± 1 s.e.) number of (*a*) deer visits per day into livestock pastures and (*b*) amount of time deer spent in pastures on study farms in the western Upper Peninsula of Michigan, May–August 2005–2008. No livestock-protection dogs (LPDs) were present in pastures during 2005. LPDs were present on treatment farms during 2006–2008.

livestock depredations occurred on our treatment farms, whereas neighbouring farms experienced depredations. Deer visitation was lower on treatment than on control farms, and remained relatively stable throughout time (Fig. 2). We noted a slight decrease in mesopredator visits to treatment farms during the first year that LPDs were present, compared with control farms ($S = 21$, $P = 0.083$, Fig. 3). Our personal observations and farmer accounts noted cases of LPD-killed mesopredators (raccoons, opossums, foxes and skunks) on protected pastures. We recorded 14 birds and four nests on treatment farms, whereas we recorded 14 birds and zero nests on control farms.

The amount of time deer spent on treatment pastures was not different from the time spent on control pastures during 2007 ($S = 16$, $P = 0.114$), whereas they spent less time in treatment than on control pastures during 2008 ($S = 6$, $P = 0.050$). During 2007 and 2008, deer spent an average of 3.8 min and 1.2 min on treatment pastures compared with 18.4 min and 21.6 min, respectively, on control pastures (Fig. 2). During 2007, one treatment farm accounted for 67% of total time deer spent on treatment farm pastures. In one case, deer were visually

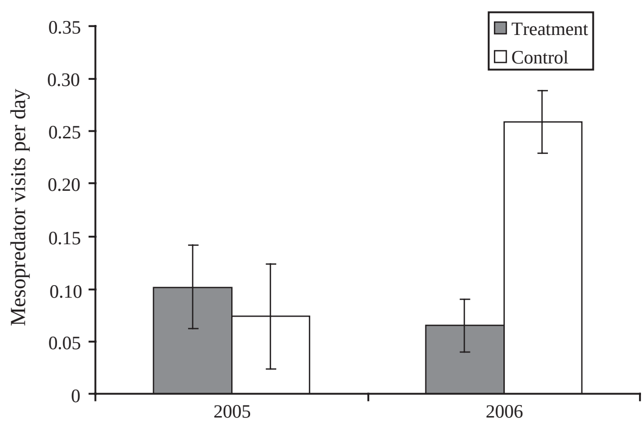

Fig. 3. Mean (± 1 s.e.) number of mesopredator visits per day into livestock pastures on study farms in the western Upper Peninsula of Michigan, May–August 2005–2006. No livestock-protection dogs (LPDs) were present in pastures during 2005. LPDs were present on treatment farms during 2006.

obstructed from the LPDs by forest cover and went undetected for 1 h.

Discussion

The effectiveness of LPDs has primarily been evaluated for predators, and more recently it has been assessed for ungulates. Among predator-based studies, most have relied on producer-based reporting and surveys, rather than field experimentation (Gehring *et al*. 2010*a*). We found only one field trial evaluating LPD efficacy with wolves (cited in Coppinger *et al*. 1988; Coppinger and Coppinger 1996). This study suggested that LPDs displayed protective behaviour against free-ranging wolves and defended experimenter-created bait stations. However, sample size was small and the researchers did not make direct observations on LPD behaviour while defending the bait stations. Linhart *et al*. (1979) provided the only field-trial evidence of the effectiveness of LPDs against coyotes. They found that LPDs reduced sheep depredations by coyotes on three ranches over a 20-day period, and coyotes appeared to be displaced from ranches for an additional 20 days after the LPDs were removed. Our study demonstrated reduced use of livestock pastures by wolves and coyotes, with visitation indices declining to zero. As such, we suggest that LPDs can be effective for reducing the risk of livestock depredations by wolves and coyotes on pastures associated with small- and medium-sized cattle farms.

VerCauteren *et al*. (2008) were the first to use an experimental design to examine LPDs in a novel application for deterring potentially infectious deer. They found that LPDs were effective at reducing the use of livestock pastures and consumption of livestock feed by deer. Shared use of concentrated livestock feed (Palmer *et al*. 2004) is a primary route of transmission of TB from deer to cattle (O'Brien *et al*. 2006). Gingold *et al*. (2009) found that LPDs modified the behaviour, movements and reproductive success of mountain gazelles (*Gazella gazella*) present in their study area. Our study demonstrated reduced use of livestock pastures by deer. We also demonstrated reduced time deer spent on pastures during one year. Our results support the assertion of VerCauteren *et al*. (2008) that LPDs may reduce the potential for disease transmission between deer and cattle by reducing the use of and time spent on pastures by deer. Our study also expands this assertion to moderately sized livestock operations.

Medium-sized mammals also have been excluded and/or killed by LPDs on livestock pastures (Hansen and Smith 1999). Our study noted a slight decrease in mesopredator visitation to livestock pastures during the first year when LPDs were present. We failed to continue monitoring mesopredator activity for subsequent years. Thus, we are not certain whether LPD effectiveness for deterring mesopredators would have increased as the dogs matured and became better protectors. We obtained preliminary field data that suggested that control pastures had fewer ground-nesting bird nests, possibly because of greater rates of nest predation from mesopredators, than did LPD-protected pastures (Gehring *et al*. 2010*a*). Thus, LPDs might also serve as a more general tool for wildlife-conservation objectives, such as reducing mortality of ground-nesting birds by limiting pasture use by mammalian species of wildlife. However, more research is needed on this topic.

The soil track swaths we used were a passive method for monitoring wildlife visitation. Visitation rates for predators were low, yet we showed a difference between treatment and control farms. We were unable to determine whether higher levels of predator visitation would be deterred by LPDs. We suggest that some wildlife visits into pastures should not be construed as a measure of LPD ineffectiveness. Our track swaths did not measure the outcome of wildlife trespasses into pastures. LPDs would still be effective if they chase out wildlife and limit interactions between wildlife and livestock. Also, imperfect detection of wildlife by LPDs may allow wildlife to temporarily use pastures, which likely explains the equal amounts of time deer spent on treatment and control pastures during 2007.

VerCauteren *et al*. (2008) estimated that the cost of LPDs was US$850 per year, assuming a 10-year effective working life of dogs (Green *et al*. 1994; Green and Woodruff 1999). Our purchase price for LPDs was US$400 per dog, monthly maintenance costs (food and veterinary care) were US$50 per dog, and farmer-assisted training costs during the first year (paid graduate-student assistant) was US$4000. Thus, our estimated cost of each LPD applied in our study was US$1040 per year. In addition to cost considerations, the application of LPDs to farms requires livestock producers that are genuinely interested in using LPDs and fully committed to proper training and maintenance of the dogs (Gehring *et al*. 2010*b*). We deem the assistance provided to farmers during the first year as important in successfully integrating LPDs.

Our results have provided evidence that LPDs are an effective non-lethal management tool for deterring wolves, coyotes and deer from livestock pastures. LPDs may have a more general application of protecting livestock and pastures from a range of wildlife species, and appear to be a very versatile and general conservation tool for managing wildlife–human conflict issues. LPDs could serve as a valuable, pro-active management tool producers could implement into their normal livestock husbandry to help reduce livestock losses from predators and wildlife diseases. LPDs also may be a more general conservation tool for excluding mesopredators from pastures, thereby reducing rates of nest predation on ground-nesting birds, although more research is needed on this issue. Although the utility of LPDs is clear and we advocate their application, additional research is required to better determine how to maximise their efficacy. Questions to explore include evaluating the number of LPDs needed relative to pasture size, wildlife species present and the level of motivation of wildlife to enter pastures.

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Exhibit 13

Non-lethal defense of livestock against predators: flashing lights deter puma attacks in Chile

Omar Ohrens[1,2,3,4]*, Cristian Bonacic[3,4], and Adrian Treves[1]

Anthropogenic mortality among populations of large terrestrial carnivores undermines the health of ecosystems globally, and generally increases when people respond lethally to real or perceived threats to property, including livestock. Reducing such threats through the use of non-lethal methods could therefore protect both large predators and human interests. However, the scarcity of information on the effectiveness of methods to prevent livestock predation hinders the formulation of science-based policy. We present the results of a randomized crossover experimental test of a method to prevent predation on livestock, which to our knowledge is the first such test in Latin America. By relying on a so-called "gold-standard" design, we evaluated the effectiveness of using flashing lights to deter predators. We found that light deterrents discouraged pumas (*Puma concolor*) but not Andean foxes (*Lycalopex culpaeus*) from preying on alpacas (*Vicugna pacos*) and llamas (*Lama glama*), and demonstrated that gold-standard experiments are feasible in large natural ecosystems, contradicting assumptions that people will reject placebo controls and that such systems contain too many confounding variables. Functionally effective non-lethal methods can protect wildlife, livestock, and people. Strong inference is needed for the development of sound policy concerning wildlife management, livestock husbandry, environmental conservation, and biodiversity.

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Declines in predator populations have resulted in ecosystem degradation and loss of biodiversity and ecosystem services worldwide (Crooks and Soulé 1999; Myers *et al*. 2007; Estes *et al*. 2011). Human-induced mortality is the primary cause of global endangerment of large carnivores (Woodroffe and Ginsberg 1998; Ripple *et al*. 2014). For terrestrial carnivores, much of this mortality results from retaliation against or pre-emptive responses to real or perceived threats to human interests. Sound policy to reduce conflicts between people and predators would balance human needs with environmental protection (Chapron *et al*. 2014; Treves *et al*. 2015); such a balance is mandated by the constitutions of a large majority of the world's nations (Boyd 2011; Treves *et al*. 2018).

Non-lethal methods that protect human property hold the greatest promise for finding a balance between the conservation of predator populations and human needs (Treves *et al*. 2016). Traditionally, threats to domestic animals prompted lethal retaliation against predators. Prior reviews revealed that few methods, whether lethal or non-lethal, have been rigorously evaluated for functional effectiveness: that is, for their effect in preventing future damage, in this case reducing predation on livestock (van Eeden *et al*. 2018). Controlled experiments are needed to draw strong inference about functional effectiveness and will thereby help to prevent the implementation of ineffective but popular interventions, which often lead to wasted resources and harm to animals, both wild and domestic. Rigorous experiments using random assignments as well as methods that avoid bias in sampling, treatments, measurements, and reporting (hereafter referred to as "gold-standard" experiments) (Platt 1964; Ioannidis 2005) are required, given widespread promotion of methods based on perceived effectiveness, small sample sizes, or flawed research designs (van Eeden *et al*. 2018; Ohrens *et al*. 2019).

Here we evaluate the effectiveness of a non-lethal light deterrent on pumas (*Puma concolor*) and Andean foxes (*Lycalopex culpaeus*) approaching alpacas (*Vicugna pacos*) and llamas (*Lama glama*) in the Andean plateau (hereafter "altiplano") of Chile. To the best of our knowledge, this is the first experiment of its kind conducted on puma deterrence (or for any predator in Latin America), and the first to evaluate the potential for camelid protection (van Eeden *et al*. 2018). Functionally effective non-lethal methods can protect wildlife, livestock, and people, and systematic evidence is needed for the development of effective policies concerning wildlife management, livestock husbandry, environmental conservation, and biodiversity (Sutherland *et al*. 2004).

Previous research in the Chilean altiplano revealed that pumas and Andean foxes were both viewed negatively by the region's indigenous residents, known as the Aymara, who blamed pumas for an average 10% loss per livestock herd annually. In the same survey, local people expressed preference for non-lethal predator deterrents with support from local gov-

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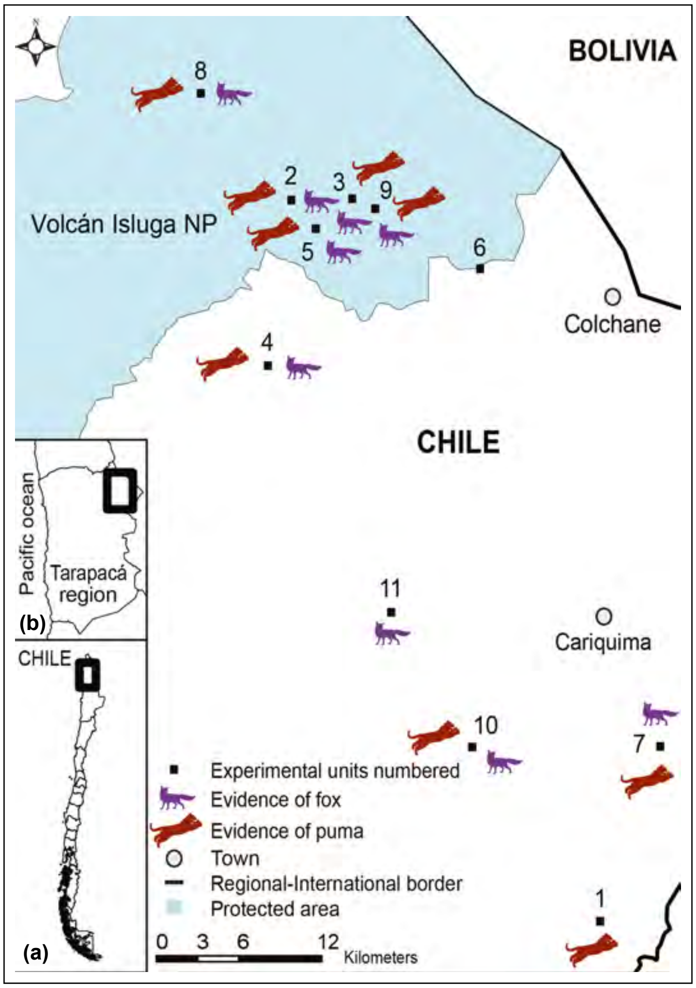

Figure 1. Study area with experimental units and evidence of carnivores. Inset maps show (a) the Tarapacá region within Chile and (b) the study area within the Tarapacá region. Experimental units follow the same numbering scheme as that presented in Table 1. Free public-domain vector clipart of both carnivores was obtained from www.clker.com.

ernment agencies to reduce predation on livestock (Ohrens *et al.* 2016). We built on this study by conducting a participatory intervention planning workshop (Treves *et al.* 2009) and a randomized experiment to evaluate methods preferred by livestock owners.

Methods

Method approval

We received approval from the Institutional Review Board at the University of Wisconsin–Madison and the Ethical Committee at the Pontificia Universidad Católica de Chile for human subject research. The study was performed in accordance with ethical guidelines from the Belmont Report, and written informed consent was obtained from all subjects. The animal protocol followed in this research was reviewed and approved by the University of Wisconsin–Madison Institutional Animal Care and Use Committee.

Study area

The study area covered one district (Colchane) of the Tarapacá region in the altiplano of Chile, at an altitude of 3500–5000 m (Figure 1) (19°23' S; 68°44' W). Here, the indigenous Aymara grow crops, raise livestock, and co-occur with both pumas and Andean foxes (WebPanel 1; Ohrens *et al.* 2016).

Participant enrollment and workshop design

We adopted a participatory approach because our previous baseline data and human dimensions fieldwork revealed (as mentioned above) that the Aymara people favored the adoption of non-lethal predator deterrents (Ohrens *et al.* 2016), and because participatory intervention planning is recognized as an effective approach in resolving conflicts and promoting the implementation and use of interventions (Treves *et al.* 2006, 2009; Reed 2008). In May 2016, a total of 54 affected and interested parties (livestock owners and government agencies) were recruited to help evaluate and select feasible interventions (WebPanel 1). We divided participatory workshops into five sections (following Treves *et al.* 2006, 2009; Newing *et al.* 2011): (1) introduction to the subject and aim of the workshop; (2) presentation of a wide range of possible interventions for reducing predation on livestock; (3) small-group discussions about interventions ("buzz groups" with 5–6 participants per group) assisted by facilitators; (4) presentation of ideal examples of interventions selected by the whole group; and finally (5) discussion about the selected intervention. During the workshops, we encouraged participants to choose feasible and cost-efficient methods to reduce predation on livestock for which there was at least some correlative evidence of effectiveness from previous research. Because all native carnivores are under legal protection in Chile, we provided a list of non-lethal options (eg barriers, guards, deterrents), and used audiovisual presentations (eg PowerPoint, videos) about these interventions, to help participants visualize how they work in the field. Participants were given the opportunity to share their personal knowledge about and experiences with carnivores, livestock, and carnivore–livestock interactions. Disagreements were moderated by the lead author, who also facilitated the process of considering scientific evidence with local, practical decisions about cost-efficiency and acceptability of an intervention. After consideration of the potential deterrents, participants selected a solar-powered light device known as Foxlights® (Bexley North, Australia); we then explained the crossover design of the experiment and described the trial procedures in full detail. Participants did not place any conditions on our experiment.

Farmers that agreed to implement light deterrents, the crossover experimental design, and monitoring by our team members also had to present pre-established sleeping areas for livestock prior to the random assignment. In this step, six units were first randomly assigned to a treatment–control sequence,

Table 1. Number of attacks on livestock by puma and Andean fox, sorted by experimental unit and period

			Attacks on livestock			
			By puma		By Andean fox	
Treatment sequence	Experimental unit	Livestock herd size	Period 1	Period 2	Period 1	Period 2
Light–control	1	100	0	1	0	0
Light–control	2	380	0	4*	5	1
Light–control	3	60	0	0	8	1
Light–control	5	38	0	1*	0	1
Light–control	7	22	0	0	0	0
Light–control	11	69	0	0	0	0
Control–light	4	160	0	0	0	0
Control–light	6	80	0	0	0	0
Control–light	8	180	0	0	4	0
Control–light	9	280	0	0	8	12
Control–light	10	46	1	0	0	0

Notes: *Predation events verified by a trained officer. In experimental unit 2, only one of the four predation events was verified by a trained verifier.

and an additional six units were then randomly assigned to the converse control–treatment sequence. One unit was excluded from the analysis, as the farmer could not be re-contacted, leaving us with 11 units in total (n = 22 replicates).

Experimental design

We evaluated the effectiveness of the light deterrents, using a randomized 2×2 crossover design in which each experimental unit (an established sleeping area ranging from 30 to 180 m in diameter used by a camelid livestock herd) received a light deterrent treatment (two lights and two camera traps) and a placebo control (two camera traps only) for 2 months through random assignment. In other words, the order of the experimental sequence would be determined by chance: a 2-month treatment period followed by 2-month control period (treatment then control) or a 2-month control period followed by 2-month treatment period (control then treatment). Each experimental unit (n = 11 herds) was managed by a different livestock owner, but owners were aware of whether their herds were treatment or control subjects because the lights were too obvious to conceal. However, our design reduced the likelihood that pre-existing differences and chance events during a trial would confound any treatment effects (Jones and Kenward 1989; Quinn and Keough 2002). The influence of confounding effects that did not vary in exactly the same sequence as the treatments is reduced because each experimental unit serves as its own control, and therefore comparisons between treatments are made within subjects, thereby increasing the statistical power to detect direct treatment effects. The procedure removes from the treatment comparison (light and control) any component that is related to the difference between units. Moreover, the fact that our experimental units were distributed over long distances (ie many kilometers; Figure 1) greatly reduced the likelihood of one event or local variable affecting all units in one treatment or during one period. The trial overlapped the 4-month calving season (November 2016–March 2017), a time when livestock are more vulnerable to predation by both pumas and foxes, as the latter appear to be capable of preying on only newborn calves and not on adult camelids.

Treatments

Participants and the lead author installed two light deterrents on either end of an imaginary ellipse surrounding a sleeping area, separated by approximately 50–200 m (depending on the size of the sleeping area) and high enough to be seen by predators (depending on vegetation and topography) (Figure 2; WebPanel 1). These devices continuously emit randomly varying, flashing lights in three colors, which are

Figure 2. Example of one of the Foxlights® deployed by farmers and researchers next to a sleeping site.

Figure 3. Images of predators captured by camera traps deployed around the experimental units. (a) Adult male puma (*Puma concolor*) and (b) Andean fox (*Lycalopex culpaeus*).

directed upward and outward; the devices are activated at dusk by declining light levels and are deactivated at dawn in response to increasing light levels.

Each farmer attended the treated sleeping site for about an hour for a maximum of three dusks, to detect whether the lights disturbed the livestock. No livestock were reported to have departed from sleeping sites after dark during the course of the 4-month trial.

Funding was available for only 12 light devices, which were installed on the 12 sleeping sites based on the experimental sequence; one of the 12 lights ceased working during the second period in the "control then treatment" sequence, but we were unable to replace it. However, the remaining light at that unit continued working; because no predation was reported for this unit in either period, we retained that unit for analysis.

Detecting predator presence

To confirm that predators were present in the vicinities of all units (treated and non-treated) during the experimental period, we deployed camera traps, conducted transect searches for carnivore tracks and feces, and collected field observations from farmers to complement the direct measurement of predation events by independent verifiers (see below). We installed two cameras (Bushnell Trophy Cam, Bushnell, Overland Park, KS) at each sleeping area, one of which was situated <50 m from each sleeping area and the second placed approximately 1 km away; both cameras were positioned on the edges of ravines, hills, or where carnivore tracks or feces were found (Figure 3). To complement the cameras, we walked circular transects 100 m out from the perimeter around each sleeping area to search for carnivore tracks and feces. Finally, we asked participants and neighboring land owners about observations of carnivores during the trial period.

Verifying predation

We trained park rangers and wildlife officers from three government agencies to conduct field investigations of predation complaints. We supplemented two verifiers' reports with farmers' self-reported losses at the end of both periods (two verified losses versus 45 self-reported losses; Table 1). We provided no incentives for data or for any outcomes. Previous work had built trust and all participants spoke Spanish (Ohrens *et al.* 2016), the lead author's native tongue. Long distances between villages and limited phone coverage are the main problems that farmers encounter when reporting predation events to government verifiers (V Malinarich pers comm; Ohrens *et al.* 2016). Self-reporting might represent a source of bias (non-random error) if farmers hoped that the light devices would deter pumas and intentionally blamed foxes for puma-associated losses in treated herds. However, several sources of evidence gave us confidence that measurement error was random, if it existed at all (WebPanel 1).

Data analysis

We adopted a conservative approach by employing multiple statistical tests of effectiveness. Shapiro–Wilk and analysis of variance (ANOVA) tests were used to assess non-normality and the distribution of residuals. Data for predator presence and treatment effect were determined to be non-normal, and thus a non-parametric test was used. For predator presence, we relied on a Wilcoxon rank sum test to compare differences between treatments and between periods. To test for the effect of light deterrents, we used three approaches: (1) a non-parametric approach for factorial design ANOVA-type-statistics based on ranks (Brunner *et al.* 2002; Noguchi *et al.* 2012); (2) a split-plot ANOVA with treatment (light and control), block (each unit or subject), and period as explanatory variables (Díaz-Uriarte 2002); and (3) the Hills–Armitage procedure (Jones and Kenward 1989; Díaz-Uriarte 2002). In the Hills–Armitage procedure, we first calculated the difference in predation between the first and the second period for each subject (sleeping site [unit]), and later used a Wilcoxon rank sum test to compare the values between the two sequences. We tested for both period effects and inequality of carryover effects to evaluate whether the results for the treatment effect were not biased by the treatment in the preceding period (Jones and Kenward 1989; Díaz-Uriarte 2002). We adopted a one-tailed test for the Hills–Armitage procedure because the a priori hypothesis was that the light devices are deterrents and not attractants (Ruxton and Neuhäuser 2010). Finally, we calculated the proper effect size following Nakagawa and Cuthill (2007) and Fritz *et al.* (2012) by quantifying the size of the treatment effect or the difference between groups ($r > 0.5$: strong effect; $0.5 > r > 0.3$: moderate effect; $0.3 > r > 0.1$: weak effect) (WebPanel 1).

Results

Predator presence

We confirmed the presence of both species of carnivores within the study area repeatedly using camera traps (independent events involving four puma visits and eight fox visits; Figure 3), circular transects searched for tracks (four puma, zero fox), and direct and indirect field observations reported by farmers (12 puma, three fox) – thus establishing that risk persisted for all sleeping sites (units) during the trial (Bomford and O'Brien 1990). The presence of predators analyzed separately and together did not vary between all units (Wilcoxon two-tailed, $P > 0.05$) or periods (Wilcoxon two-tailed, $P > 0.05$). We detected pumas and foxes relatively near all units, and therefore concluded that the treatments did not drive predators far from the sleeping sites (Figure 1).

Effect of treatment

Treated herds experienced zero losses to pumas as compared to seven losses in control herds (ANOVA-type statistic degrees of freedom [df] = 1, $F = 5.49$, $P = 0.0019$; split-plot ANOVA df = 1, $F = 5.21$, $P = 0.045$; Wilcoxon one-tailed, $P = 0.075$, effect size $r = 0.57$; WebFigure 1). Treated and control herds both experienced fox predation, but the observed difference in predation between these herds was insignificant (25 versus 15 total attacks on treated and control herds, respectively; ANOVA-type statistic df = 1, $F = 0.47$, $P = 0.49$; split-plot ANOVA df = 1, $F = 0.48$, $P = 0.5$; Wilcoxon one-tailed, $P = 0.79$, effect size $r = 0.18$; WebFigure 1). We did not detect period or carryover effects (Wilcoxon two-tailed, $P > 0.05$; Table 1). All predation was reported to occur in sleeping areas, or within the periphery in cases where predators chased individuals from the actual sleeping areas.

Discussion

This is, to the best of our knowledge, the largest randomized experiment without bias ever conducted on livestock predation, and the first in Latin America (Treves *et al.* 2016; van Eeden *et al.* 2018). Moreover, this is the first known random-assignment experiment testing the functional effectiveness of light devices in deterring puma predation. We found that the devices deterred predation by puma on camelid livestock (alpacas and llamas) but had no significant effect on predation by Andean foxes. Given the higher (but non-significant) effect of greater losses to foxes among treated herds, we recommend further testing with a larger sample size to evaluate if the light devices attracted foxes instead of deterring them, or possibly that the deterrence of pumas created opportunities for foxes.

Progress in predator management has been hampered by two widespread assumptions. First, it is assumed that gold-standard experiments are not feasible for studying livestock and predators under typical field conditions. For instance, the many potentially confounding variables in natural ecosystems and on working livestock farms do indeed hamper experimental control, but our work demonstrates that such challenges can be overcome by adopting crossover (reverse-treatment) and moderate control over recruiting participants (see also Quinn and Keough 2002; Donnelly and Woodroffe 2012; Treves *et al.* 2016). Second, some authorities (ie government agencies) assume that livestock owners will refuse the placebo control, and that such refusals might lead to the introduction of selection and response biases (Groves 2006; Creswell 2009). However, this was not a problem among our 11 participant farmers, probably due to the long-term prior engagement process, the lack of other sources of external support to farmers, and the crossover design, which gave all owners the opportunity to try the light devices.

However, we wish to highlight two issues concerning our research design. First, it was impossible to ensure that the participant livestock owners were unaware of which treatment they were assigned due to the conspicuousness of the nighttime lights, which could introduce at least some degree of confirmation bias if the owners believed the deterrents would be effective. We partially countered this potential measurement bias by recruiting independent verifiers from the government agency in charge of livestock protection; the verifiers did not ultimately visit all incident sites but owners did not know this ahead of time. It is not clear why verifiers or owners would have intentionally or unintentionally skewed results toward effectiveness against pumas but not foxes, especially given the product name of the light devices (Foxlights®). Regardless, we call for future experimenters to engage independent verifiers or to train owners and verify their reports (McManus *et al.* 2015). Second, we could not evaluate the duration of effectiveness of the lights or whether one or both of the predators would eventually habituate to the light devices after 4 months. However, providing protection to camelid young even just for a 4-month period might be enough for them to reach market size or grow to a large enough size that their vulnerability to predation is reduced by innate defenses.

Conceivably, the effectiveness of light deterrents might merely reflect the case of a single puma that was interested in preying on livestock but was afraid of the light; however, if we assume that there was a single livestock-killing puma in the area, then that puma had to have been responsible for all the camelids lost to puma predation. This might be possible, as pumas can travel very long distances, but we would have expected a switch in behavior of this hypothetical puma in response to switches in treatment; instead, control herds within reach of the hypothetical puma remained unaffected (Table 1). Moreover, the large expanse covered by the entire experiment – almost 2000 km^2 – would substantially reduce the likelihood that a single puma accounted for all predation. Using the widest home ranges described in the literature for pumas (Logan and Sweanor 2010), ~2000 km^2 in 4 months would require at least two individuals. We believe that there were almost certainly two pumas at a minimum and more likely several others, for the following reasons: the areal extent of our experiment could support 2–3 resident male pumas and 5–6 resident female pumas, as well as transients of either sex, which would suggest a minimum of 6–8 individual pumas. In addition, a camera trap study previously performed in roughly the same area (Leichtle 2013) estimated puma density at 0.5 pumas per 100 km^2, which translates to ~10 individuals in our study area of ~2000 km^2. On the basis of our own camera trap data, we confirmed the presence of three pumas (Figure 3; WebFigure 2). Tracks of two different pumas were also observed at one site in the northern part of our study area, indicating that there were at least two individuals in the vicinity of the northern sleeping sites used in our experiment (Figure 1). Given the distance from the location of these tracks to our southernmost experimental units (~65 km), it would seem that a minimum of three pumas is the most reasonable inference. Finally, if the light deterrents have an effect on even just a few livestock-killing pumas, then the results would have even greater relevance for predator–livestock coexistence and conflict mitigation, because "problem individuals" have long been recognized as the primary cause of most livestock deaths (Linnell *et al*. 1999). Furthermore, pumas and other carnivores are known to specialize on prey, such as livestock, even within a multi-prey landscape (Elbroch and Wittmer 2013), and so our findings suggest owners might be able to use lights to interfere with livestock selection before it occurs.

Scarcity of evidence and weak inferences regarding effectiveness have important consequences for all parties. For instance, implementation of ineffective methods might aggravate social conflicts over biodiversity by increasing the suffering of domestic animals and wildlife, as well as by increasing economic costs. When faced with social conflicts, people might revert to traditional lethal controls regardless of their effectiveness (Treves and Bruskotter 2014; Woodroffe and Redpath 2015). Moreover, when governments promote methods that show no evidence of being effective or, worse yet, invest in disseminating untested methods, trust in the government or confidence in its recommendations might be eroded. We expect that our experimental approach will help to inform evidence-based policy not only for wildlife and livestock, but also for environmental conservation and biodiversity, and help lead to the development of sound policies that promote the coexistence of humans and wild animals.

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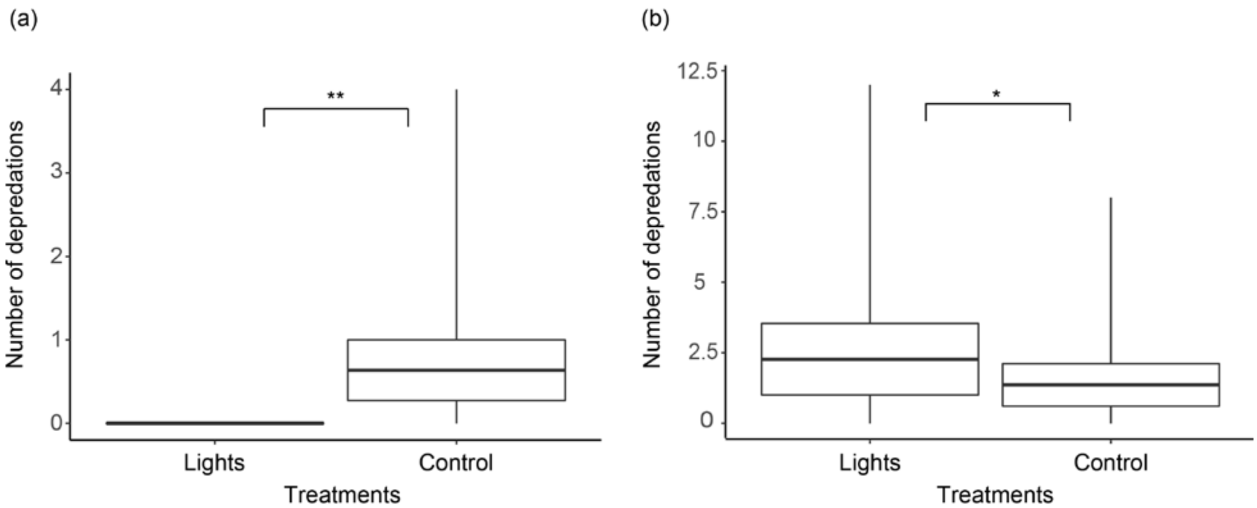
Supporting Information

Additional, web-only material may be found in the online version of this article at http://onlinelibrary.wiley.com/doi/10.1002/fee.1952/suppinfo



WebFigure 1. Predator attacks on livestock by treatment or placebo control. Means ± standard error (SE; boxes, n = 11), bars span the range of each, and statistical significance are presented for each plot. (a) Plot of puma (*Puma concolor*) attacks, (**significant). (b) Plot of Andean fox (*Lycalopex culpaeus*) attacks, (*not significant).

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(a)

(b)

WebFigure 2. Individual pumas identified within the study area over the course of the 4-month trial. Identification was performed independently by the lead author and an external colleague, based on patterns (eg marks, scars, shape of tail, spots) observed on puma individuals. (a) Female puma and (b) juvenile puma.

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WebPanel 1. Methods

Study area

The altiplano of Tarapacá is characterized by a cold, arid climate, with temperatures ranging from –10°C to 12°C and an annual average rainfall of 50–250 mm, which is largely concentrated between December and March. Human population densities within the study area are extremely low, from 0.01 to 0.4 individuals per square kilometer. The topography of this region is rugged, and characterized by large expanses of sandy and stony flats interspersed with ridges, moderate slopes, and boulder-strewn cliffs. With low primary productivity, the altiplano is predominantly covered by montane grasslands and shrublands, as well as Andean meadows or wetlands (*bofedales*). Most biodiversity is found in areas that are capable of supporting relatively higher productivity, such as the Andean meadows or *bofedales*. Wildlife such as the native vicuña (*Vicugna vicugna*), species of vizcacha (Chinchillidae), Andean mountain cat (*Leopardus jacobita*), Andean condor (*Vultur gryphus*), and introduced feral mammals (eg hare, donkey) are common in the study area (Ohrens *et al*. 2016).

From September to March (the rainy season), herds of llamas (*Lama glama*) and alpacas (*Vicugna pacos*) normally graze in *bofedales* and the surrounding montane grasslands and shrublands. Livestock grazing rules applicable to the local Aymara people do not differ between protected and non-protected areas.

Participant enrollment and workshop design

The Chilean government convened meetings between livestock farmers, National Forest Service (CONAF) park rangers, and agricultural officers of the National Agricultural Development Institute (INDAP) working in both the Indigenous Territorial Development Program (PDTI) and the Local Development Program (PRODESAL) in the Tarapacá region (Figure 1). We presented outlines of our research at three such meetings in May 2016 (during which we were explicit about our independence from the Chilean government, and that we were university representatives and funded by the US Fish & Wildlife Service, because livestock owners had expressed explicit discontent with the Chilean government in previous work; Ohrens *et al*. 2016). Farmers that agreed to the crossover design and presented pre-established sleeping areas for livestock then progressed to the randomization step. We started with 12 experimental units, but one unit was excluded from the analysis, as the farmer could not be re-contacted, leaving us with 11 units in total.

Experimental design

We defined the experimental unit as an established sleeping area (ranging from 30 to 180 m in diameter) used by a livestock herd owned by a participant. Although the camelid livestock ranged freely across the landscape during the day, they aggregated in specific sleeping areas every night, when supervision of livestock by people is less frequent (Ohrens *et al*. 2016).

Alpacas and llamas are the main traditional livestock breeds used by the Aymara people of northern Chile (Gundermann 1984; Ohrens *et al*. 2016). Herd sizes used in our trials varied from 22 to 380 animals (Table 1).

Treatments

We used solar-powered Foxlights® attached to wooden poles buried in the ground. The manufacturer recommended placement at a height visible to the predator species of interest; the height of the lights was therefore adjusted depending on the density and height of surrounding vegetation (eg shrubs can achieve 1.5 m in height), and any topographical feature that could affect light visibility by pumas (*Puma concolor*) and Andean foxes (*Lycalopex culpaeus*). Lights were generally situated between 1.5–2 m above the ground. Total cost per deterrent light was US$60, funding for which was provided by the local government agencies PRODESAL and PDTI.

Verifying predation

We found no discrepancies between verifiers' reports and farmers' self-reports. All 11 participant livestock owners reported to have experienced puma predation of their livestock in the past and claimed to be able to recognize and discriminate a puma predation event by tracks and feces. Six experimental units were exposed to puma presence during the 4-month trial periods, as shown by our independent tracking and camera data. Two participants (from a total of four that experienced puma attacks during the trial) reported prey dragging as evidence of a puma attack, which is unambiguous visually; however, even if this was simply a case of pumas scavenging the carcasses of livestock that had died from other causes, the observed deterrent effect against puma scavenging around sleeping sites would be relevant to the effectiveness of lights. Deterring predators from scavenging should also reduce the risk of predation of livestock, as has been demonstrated in several recent meta-analyses in which a lower number of carnivore incursions into pastures was characterized as evidence of the effectiveness of a given deterrent (Treves *et al*. 2016; Eklund *et al*. 2017).

Given that puma predation has been the focus of attention of the Chilean government and the primary concern of farmers (Ohrens *et al*. 2016), it would be odd if concerns about puma predation diminished and concerns about fox predation rose. Indeed, fox predation was reported to be almost six times higher than puma predation and, despite the name of the lights, foxes were apparently undeterred by the light devices. It therefore seems unlikely that farmers would contradict their own prior complaints and concerns about pumas. Research in another region of Chile is presently underway using only independent verifiers, to test our assumption that self-reporting introduces random error. Some of our confidence also comes from the design of workshops before the trial began.

Data analysis

We used a non-parametric ANOVA-type-statistic based on ranks, and an F1-LD-F1 model (ie an experimental design with one whole-plot factor and one sub-plot factor) in which treatment sequence was set as the whole-plot factor and treatment was the sub-plot factor (Brunner *et al*. 2002; Noguchi *et al*. 2012). For the split-plot ANOVA, we rank-transformed our dependent variable (counts of puma and fox predation events) before conducting the analysis (Conover and Iman 1981; Quinn and Keough 2002), and adjusted for the effects of period by incorporating period into the model prior to testing for direct treatment effects (eg predation = subjects + periods + treatments). For the Hills–Armitage procedure, we evaluated a discrete response variable (counts of puma and fox predation events) and several categorical independent variables (treatments, experimental units as blocks, and period), considering period effects while testing for treatment differences (Jones and Kenward 1989; Díaz-Uriarte 2002). All data were analyzed with Rstudio (v1.0.143) software.

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WebPanel 2. Acknowledgements

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Exhibit 14

CANADIAN WILDLIFE BIOLOGY & MANAGEMENT

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Wildlife Management Technique — Review

Humaneness and Selectivity of Killing Neck Snares Used to Capture Canids in Canada: A Review

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Abstract

Although killing neck snares are used on traplines in Canada to capture gray wolves (*Canis lupus*), coyotes (*C. latrans*), and red foxes (*Vulpes vulpes*), they are not subject to trap performance criteria set out in the Agreement on International Humane Trapping Standards (AIHTS). This paper reviews scientific information related to the humaneness and selectivity of killing neck snares used to capture canids. All past studies demonstrated that manual and power killing neck snares were inadequate to consistently and quickly render canids unconscious. Furthermore, killing neck snares are non-selective, and impact seriously on the welfare of non-target animals. We recommend that the AIHTS be modified to allow only killing neck snares that kill quickly and consistently, and in the absence of such snares, to phase-out all killing snares for which efficient and more humane alternatives exist.

Key Words: *Canis latrans*, *Canis lupus*, Coyote, Gray Wolf, Humaneness, Killing Neck Snares, Red Fox, Standards, Trapping, *Vulpes vulpes*.

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INTRODUCTION

To address animal welfare concerns about trapping in Canada, intensive research was conducted in Canada during the 1970s through the 1990s (Federal Provincial Committee for Humane Trapping – FPCHT – 1981; Proulx 1999). This research identified and developed several humane trapping devices for killing or restraining furbearers (Proulx *et al.* 2012). Yet, despite significant technological improvements, many antiquated trapping systems are still used today (Proulx and Santos-Reis 2012). Killing neck snares are one example. They are popular in Canada where they are set on traplines to harvest canids, i.e., gray wolves (*Canis lupus*), coyotes (*Canis latrans*) and red foxes (*Vulpes vulpes*) (Proulx *et al.* 2012; Fédération des Trappeurs Gestionnaires du Québec – FTGQ – 2014; Sinnema 2014). Killing neck snares are commercially available (e.g., Halford's 2014) and their use is being taught by professional trappers (e.g., Trapper Gord 2014). They are popular among trappers because they are cheap, lightweight, easy to set and camouflage (except power snares), and efficient at capturing a diversity of furbearers. Furthermore, some trappers claim that they are humane, as they compress the carotid arteries, thereby reducing blood flow to the brain, quickly leading to unconsciousness and then death (Sinnema 2014). In this paper, we review research related to the humaneness and capture selectivity of killing neck snares used to capture and kill canids.

KILLING NECK SNARE TECHNOLOGY

There are 2 types of killing neck snares. Both are usually made of braided, galvanized stainless steel wire (diameter: 1/16 to 1/8 inch – 1.6 to 3.2 mm). They are placed on animal trails or in enclosed areas with lures or baits. Ten or more killing neck snares may be set around large draw baits ("saturation snaring") to catch most of a wolf pack.

Manual killing neck snares – for which an animal provides the energy necessary to tighten the noose. One end of the snare is formed into a loop with a one-way locking tab that only allows the loop to tighten (Figure 1a). The more a captured animal struggles, the tighter the loop becomes, if the lock functions properly (e.g., malfunction may result from the animal's hair being pulled into the lock as the snare tightens). The other end of the snare is anchored to a fixed object (e.g., a tree) or, because the trapper wants to minimize disturbance at the trap site, to a "drag" that allows the snared animal to leave the location. Specific loop diameters and heights are recommended to capture canids in open or in forested sites (e.g., FTGQ 2014). The efficacy of killing neck snares to kill animals may be improved by using the smallest possible cable wire diameter for the target species, better one-way locking tabs that only allow the loop to tighten, locks with compression or quick kill springs to increase clamping force, and swivels to avoid cable torsion and breaking (FTGQ 2014; Klassen 2014) (Figure 1b).

Power killing neck snares – for which one or two springs provide the energy necessary to tighten the noose. No locks are needed because the clamping force is supplied by the spring pulling on the snare wire (Figure 2). Manufacturers of power killing neck snares claim without providing data that these devices are more selective than manual snares, and captured animals cannot chew the wire (e.g., Ram Power Snare Systems 2014).

KILLING NECK SNARES *VS.* TRAPPING STANDARDS

According to trapping performance requirements set out in the Agreement on International Humane Trapping Standards (AIHTS) signed by the European Community, Canada, and Russia in 1997, killing devices used for the capture of canids should render the animals irreversibly unconscious within 300 sec (Official Journal of the European Communities 1998). A killing trap would meet the standard if at least 80% of 12 animals are unconscious and insensitive within the time limit, and remain in this state until death. Therefore, at a 95% confidence level (one-tailed binomial test), such a killing trap would render ≥58% of target animals irreversibly unconscious in ≤5 min (Powel and Proulx 2003). However, a footnote to Article 7 in the AIHTS stipulates that the standards do not prevent individuals from constructing and using traps (which may not pass the 300 sec test), provided that such traps comply with designs approved by the relevant competent authority. Although killing neck snares are commonly manufactured and sold on the open market, they are deemed by all relevant Canadian competent agencies to be non-commercial devices and therefore not subject to the AIHTS. As a result, they may be used throughout Canada in accordance with provincial and territorial regulations. For example, in Alberta, Environment and Sustainable Resource Development (ESRD) is the relevant competent authority and it dictates the appropriate design for neck snares as: "Neck snares must be equipped with a locking device that is designed and set to prevent the snare loop from loosening again after it has tightened on the neck of the fur-bearing animal" (Craig Brown, Information Officer, ESRD, personal communication, April 22, 2014).

Proulx and Barrett's (1994) stricter standards for killing devices is considered to be the most representative of state-of-the-art technology (Powell and Proulx 2003; Proulx *et al.* 2012). This standard requires that, at a 95% confidence level, humane killing traps render ≥70% of target animals irreversibly unconscious in ≤3 min. It has been used in the past to test traditional trap designs, and to develop new trapping devices (Proulx 1999). Killing neck snares have not been evaluated according to Proulx and Barrett's (1994) standard.

A trap selectivity standard has also been developed by the International Organization for Standardization (ISO 1999a, b). The selectivity of a trap for a particular species is based on

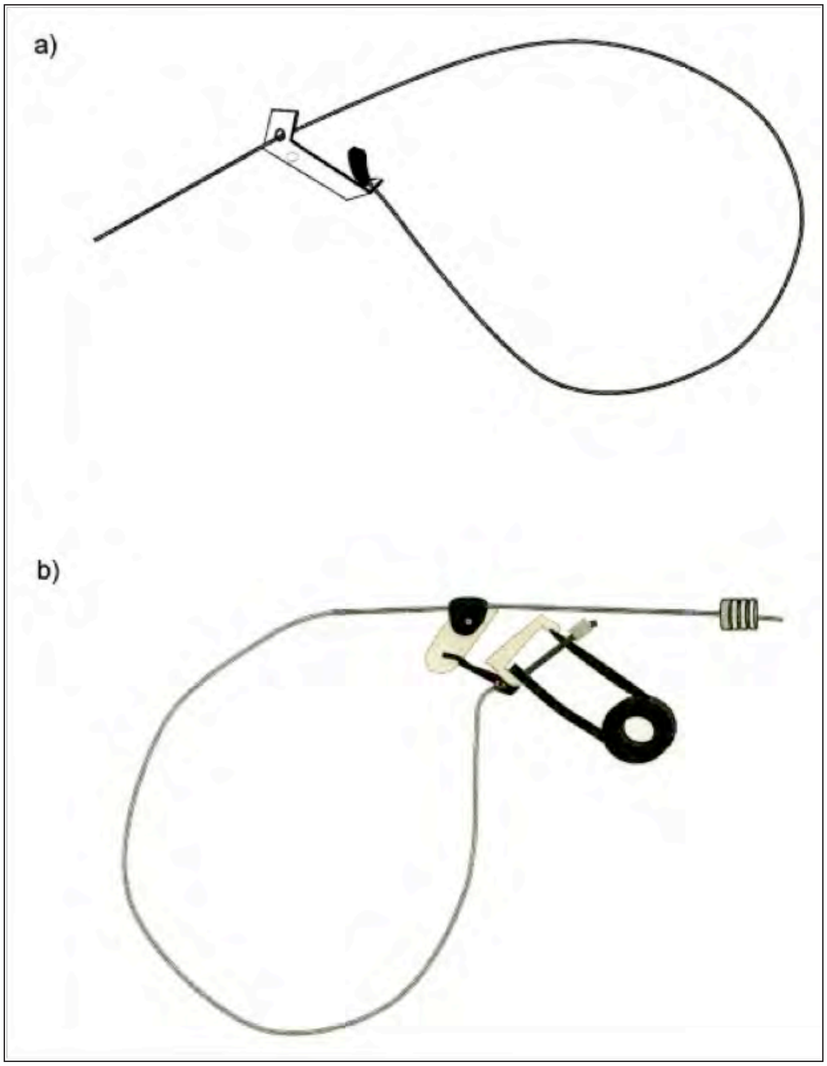

Figure 1. Manual killing neck snares: a) basic construction with a one-way lock; b) improved device with a Cam-Lock and a Senneker Stinger (http://martysenneker.com/) kill spring.

a comparison with the selectivity level of control (commonly used) traps (ISO 1999a, b). Trap selectivity is calculated as the number of captured target animals divided by the total number of captured animals. There is no minimum acceptable percentage of selectivity.

SCIENTIFIC ASSESSMENTS OF KILLING NECK SNARES TO HUMANELY KILL CANIDS

Manual killing neck snares

FPCHT (1981) first assessed the ability of manual killing neck snares to kill anaesthetized red foxes quickly. Researchers provided the power required to tighten the nooses, and although they attempted to simulate snare actions as described by an experienced trapper, the animals continued to breathe for 30-40 min after snaring. Even after tightening the snare to 2-3 cm less than the diameter of an animal's neck, researchers were able to push a swab into the trachea of animals while the snare was still tight. On the basis of laboratory kill tests, FPCHT (1981) concluded that killing neck snares could not be condoned as humane trapping devices for foxes. While it is best to snare canids behind the jaw where the carotid artery and the trachea are maximally exposed, FPCHT researchers failed to achieve exact positioning in the laboratory, and concluded that it would be even more difficult to accomplish in the field. Although trapper experience and expertise on the proper use and placement of snares is important in capturing animals properly, previous studies showed that it was impossible to restrict captures to the neck area. Guthery and Beasom (1978) reported that of 65 snared coyotes, 59% were neck catches, 20% flank, and 10% foot. Also, nearly half of the animals were alive the morning after being snared. Phillips' (1996) evaluation of killing

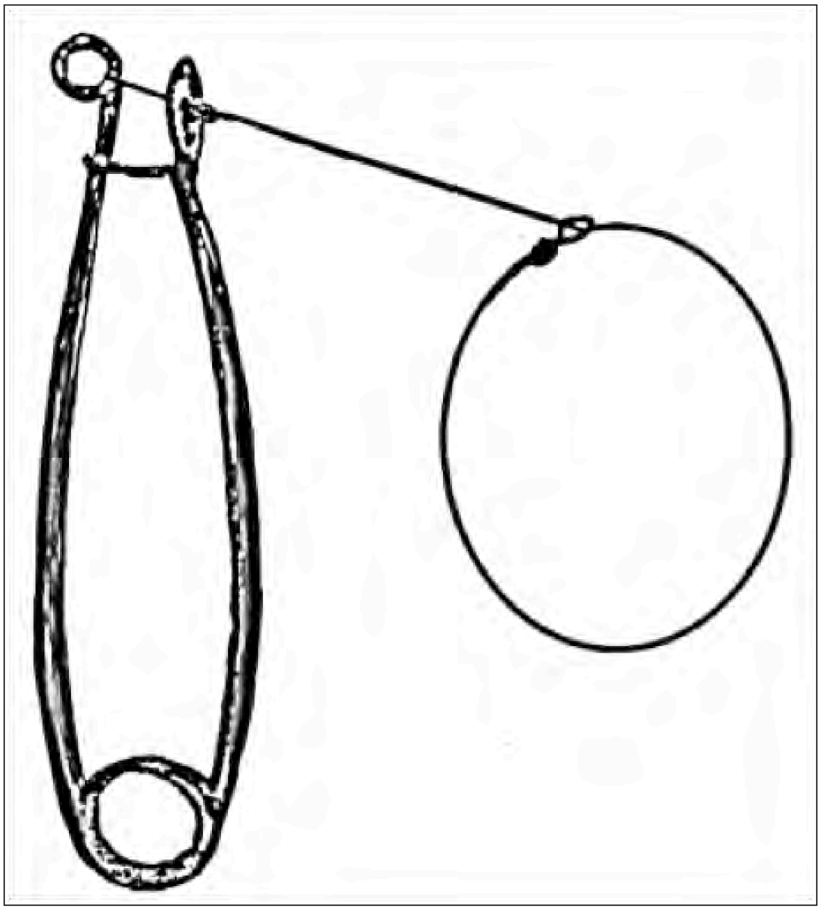

Figure 2. A power killing neck snare.

neck snares showed that out of 301 snared coyotes, 25 (7%) were captured by the body, and 12 (4%) by the leg. Phillips (1996) also reported that 5% to 32% of the animals captured in various snare models were still alive when found. Snare location on an animal is influenced by many factors such as the behaviour of the animal when entering the loop (Proulx and Barrett 1990), snare height and loop diameter, positioning of the lock, preload on the loop (i.e., a little tension is put into the loop to force it to close quicker), and environmental and maintenance factors (rust, twists in the snare cable, snowfall), etc. (G. Proulx and D. Rodtka, personal observations).

To gain more information on snared canids, FPCHT (1981) also examined 3 red foxes, 25 coyotes and 12 wolves captured on traplines in manual killing neck snares. Whereas many animals were still alive when found, some ≥12 h after being captured, post mortem examinations and observations by the trapper suggested that, in most cases, animals did not die within 300 sec. The pathologist on the Committee could not estimate the time to irreversible loss of consciousness.

It is often claimed that capture sites that show little disturbance are indicative of a quick death by asphyxiation (e.g., Phillips 1996). Nonetheless, FPCHT (1981) observed that snared animals could, in fact, react quite violently to capture without causing significant disturbance to the capture site. On traplines, Proulx also observed cases where captured animals remained conscious for several hours without disturbing the trapping site. Captured animals may remain conscious but physically inactive due to distress, shock, injury or pain.

Power killing neck snares

FPCHT (1981) tested the King Power Snare (Western Creative Services Ltd., Winnipeg, Manitoba) with 2 red foxes in enclosures. One fox remained conscious after 5 min, while the other had a weak corneal reflex at 5 min and was euthanized.

A more thorough evaluation of power killing neck snares was conducted by Proulx and Barrett (1990) who evaluated the King (1.6 mm diameter cable), Mosher (1.6 mm diameter cable; W. C. Mosher, Mayerthorpe, Alberta), and Olecko (1.2 mm diameter cable; R. Olecko, Winnipeg, Manitoba) power killing neck snares. All 3 models rendered at least 4 out of 5 anaesthetized red foxes irreversibly unconscious within 10 min, and were selected for tests with non-anaesthetized animals in semi-natural environments. Proulx and Barrett (1994) found it was difficult to capture foxes behind the jaw with power killing neck snares, and to cause an irreversible loss of consciousness within 300 sec. Both the King and Mosher power killing neck snares failed, i.e., they did not render irreversibly unconscious 2 neck-captured foxes in ≤5 min or they did not consistently capture the animals by the neck. Out of 7 tests with the Olecko killing neck snares, 2 animals lost consciousness within 5 min, 2 within 6 min, and 3 animals were euthanized. Proulx and Barrett (1990) questioned the ability of power killing neck snares to humanely kill canids, and they did not recommend them as humane trapping devices. As in FPCHT's (1981) studies with manual killing neck snares, Proulx and Barrett (1990) were unable to consistently capture the animals by the neck.

Anatomical and physiological considerations – It is difficult to constrict the trachea of a fox because of its rigid cartilaginous rings and adjacent musculature. In fact, the percentage of compression achieved by power killing neck snares as opposed to manual snares is not significantly different (FPCHT 1981). Rowsell (1981) noted that, although a 2-mm probe could not be passed down the trachea of 2 foxes captured in power killing neck snares, good aeration was present in the inflated lungs of each animal as evidenced by the organ's pinkish-red colour. Like many terrestrial mammals, foxes will gasp reflexively when carbon-dioxide levels in the blood rise and oxygen levels fall (Loufbourrow *et al.* 1957; Barrett *et al.* 2009). Gasping is a normal physiological response to stimulate a return to regular breathing (Guntheroth and Kawabori 1975; Coleridge and Coleridge 1994). Any slight passage left in the trachea allows air to reach the lungs in response to the reflexive gasp (FPCHT 1981).

Laboratory tests with dogs show that canids have the ability to continue to circulate blood to the brain after bilateral ligation of the common carotid arteries because of the ability of other arteries (e.g., vertebral arteries) situated more deeply within the neck to compensate (Moss 1974; Clendenin and Conrad 1979a, b). Collateral circulation also occurs within the venous blood flow from the brain such that drainage can continue if the internal jugular veins are occluded (Andeweg 1996; Daoust and Nicholson 2004). Because of collateral blood circulation, it is difficult, if not impossible, to stop blood flow to and from the brain by tightening a snare on the neck. To reinforce this point, Daoust and Nicholson (2004) reported the case of a 2-year-old male coyote found in a moribund state on Prince Edward Island, 1 month after the official end of the trapping season, with a snare deeply embedded in the ventral portion of its neck. The killing neck snare had presumably malfunctioned and the cable had cut through the soft tissues of the neck, transecting the full diameter of the trachea, and was embedded in scar tissue between the trachea and the esophagus. The snare had also completely obstructed both jugular veins and both common carotid arteries.

Coyotes captured in snares may break the lock or chew through the cable if the lock does not tighten sufficiently to cause death (Phillips 1996). Repanshek (2008) reported the case of 2 wolves that had been snared outside Denali National Park and Preserve, Alaska, and had then escaped with the tightened loops around their necks. Both wolves were spotted by park staff a few days before 1 of them was immobilized with a tranquilizer dart. The snare was deeply embedded in the wolf's neck (Figure 3). The other wolf was not relocated. Injuries and animal suffering resulting from escapes from a snare are known to occur (Table 1), but the majority of animals that escape killing neck snares and subsequently die likely go undetected by people.

CAPTURE SELECTIVITY

Killing neck snares are efficient at capturing canids (Haber 1996; Phillips 1996) but they are not selective. Selectivity rates of 52% (Guthery and Beasom 1978) and 77% (Phillips 1996) have been reported for coyote snares. Moose (*Alces alces*), caribou (*Rangifer tarandus*), and Sitka black-tailed deer (*Odocoileus hemionus sitkensis*)

Figure 3. Gray wolf that escaped from a killing snare and was found alive days after in Denali National Park and Preserve. The snare was deeply embedded in the neck of the animal (Photo: Denali National Park and Preserve).

Table 1. Specimens submitted to the Canadian Wildlife Health Cooperative from 1990-2014 that either were injured or died as a consequence of capture by killing neck snares. Canids had escaped from killing neck snares. All other specimens were by-catches.

Species		Number of cases		
Common name	Latin Name	Injured by snare	Killing by snare	Total snared
Mammals				
Target species				
Coyote	*Canis latrans*	2	0	2
Gray wolf	*Canis lupus*	4	0	4
Red Fox	*Vulpes vulpes*	1	0	1
Non-target species				
American black bear[a]	*Ursus americanus*	1	0	1
Bobcat[b]	*Lynx rufus*	0	1	1
Canada lynx[c]	*Lynx canadensis*	0	8	8
Fisher	*Pekania pennanti*	0	2	2
Mountain lion	*Puma concolor*	0	4	4
Snowshoe hare	*Lepus americanus*	0	1	1
White-tailed deer	*Odocoileus virginianus*	0	4	4
Wolverine[b]	*Gulo gulo*	0	1	1
Total		**8**	**21**	**29**
Birds				
Bald eagle	*Haliaeetus leucocephalus*	4	75	79
Barred owl	*Strix varia*	0	2	2
Common raven	*Corvus corax*	0	2	2
Golden eagle	*Aquila chrysaetos*	2	25	27
Goshawk	*Accipiter gentilis*	0	3	3
Great horned owl	*Bubo virginianus*	2	2	4
Red-tailed hawk	*Buteo jamaicensis*	1	10	11
Rough-legged hawk	*Buteo lagopus*	0	7	7
Total		**9**	**126**	**135**
Total specimens		**17**	**147**	**164**

are often caught in killing neck snares set for gray wolves (Gardner 2007). Cougars (*Puma concolor*) are susceptible to killing neck snares placed near carrion bait to harvest gray wolves. Knopff *et al.* (2010) reported that 11% of a cougar population in west-central Alberta was removed annually as a result of incidental snaring. Guthery and Beasom (1978) reported that a population of collared peccaries (*Pecari tacaju*) was largely extirpated due to coyote snaring. In February 2011, near Rocky Mountain House, Alberta, Rodtka (unpublished data) noticed that a trapper had set 8 wolf killing neck snares around a draw bait on a registered trapline. In 1 month the trapper captured 1 white-tailed deer (*Odocoileus virginianus*), 1 cougar, and 2 wolves. In August 2011, Rodtka also noted that a trapper had set 10-15 killing neck snares to capture wolves that had depredated livestock. Within 1 week, 1 white-tailed deer (*Odocoileus virginianus*), 1 black bear (*Ursus americanus*), and 1 grizzly bear (*Ursus arctos horribilis*), a threatened species in Alberta, were snared. The Canadian Wildlife Health Cooperative received 157 submissions of non-target snare captures between 1990 and 2014, representing 8 species of mammals and 8 species of birds (Table 1). Again, this probably represents a small proportion of the snared animals that die and go undetected or unreported by people. Non-target captures included a wolverine (*Gulo gulo*) and a Canada lynx (*Lynx canadensis*), which are designated species at risk in Quebec (Fortin *et al.* 2005) and Nova Scotia (Nova Scotia Lynx Recovery Team 2006), respectively.

DISCUSSION

Currently available manual and power killing neck snares do not meet the AIHTS' humaneness standards (although these standards do not apply to snares), or Proulx and Barrett's (1994) standard. The work conducted by FPCHT (1981) and Proulx and Barrett (1990) confirmed the original concerns of some wildlife biologists (e.g., Guthery and Beasom 1978) about the cruelty of killing neck snares, and it gives credibility to the recurrent reports of moribund, snared wild and domestic animals rescued by the public (e.g., Perkel 2004; McShane 2014). Neck killing snares with one-way locking tabs were made illegal in the United Kingdom in 1981 (Wildlife and Countryside Act 1981). Killing snares are not used to catch any of the 11 AIHTS species found in the European Union (Talling and Inglis 2009). They are, however, still being used in some US states (Association of Fish and Wildlife Agencies Furbearer Conservation Technical Work Group 2009) and Russia (Talling and Inglis 2009).

The poor performance of manual and power killing neck snares at killing canids was demonstrated in scientific studies where state-of-the-art equipment and set procedures were employed. On traplines, however, many trappers see little or no value in improved locks and swivels (Figure 4) because their snares catch the target animals anyway, albeit in an inhumane manner. Also, trappers are not legally required to update their equipment. In some provinces, e.g., Saskatchewan, killing snares must be visited within a certain period of time, i.e., 48-72 h depending on the proximity from urban areas. In British Columbia, killing snares must be checked at least once every 14 days. In Alberta, there are no mandated checking times for snares. Consequently, snared animals can die slowly from their injuries, but also from exposure, exhaustion, dehydration, or starvation.

The ISO standards are the result of compromises between participating governments and agencies, and they may not be stringent due to a lack of will among some participants to either pursue further technological development or implement state-of-the-art technology (G. Proulx, personal observations at ISO meetings in Brussels, Belgium). Nonetheless, killing neck snares impact significantly on the welfare of captured animals, in a manner similar to that of steel leghold traps, which have been judged unacceptable at the international level (Proulx and Barrett 1989). It is therefore difficult to understand how killing neck snares became an exception in AIHTS's standards,

Figure 4. Basic manual killing neck snare set on a canid trail in northwestern Saskatchewan, February 2009. Note the absence of all possible improvements (e.g., locking tab, lock with compression spring, and swivel) (Photos: Gilbert Proulx).

particularly because alternative restraining devices are available for capturing canids such as modified foothold traps and foot snares (Proulx *et al.* 2012) and cable restraints (Garvey and Patterson 2014.) These alternative trapping devices were found to be humane for capturing canids without compromising capture efficiency (Linhart and Dasch 1992; Pruss *et al.* 2002; Garvey and Patterson 2014). Even these restraining devices should, of course, be monitored within a 24-h period to minimize pain and discomfort. Reducing the time animals spend in restraining devices greatly reduces injuries (Proulx *et al.* 1994; Garvey and Patterson 2014).

The snaring of non-target species can be minimized with the use of an additional wire (diverter) placed at a height that allows ungulates taller than the set height of a wolf snare to contact and push the snare away prior to contact (Gardner 2010). Snares may be equipped with a ferrule to stop the noose from closing below a specific size (Guthery and Beasom 1978), or a breakaway system that releases larger animals such as adult ungulates, though they may still capture fawns (Phillips 1996). Snaring may become more selective through better selection of trap sites, lures, and loop diameters (Knopff *et al.* 2010; FTGQ 2014). In spite of all this, however, non-target species will continue to be snared because concealed snares are set on trails or close to baits that attract an array of species and have the potential to capture any individual entering the loop.

In light of the scientific evidence regarding the lack of humaneness and the non-selectivity of snares for capturing canids, we recommend that the relevant authorities in the international community:

• Modify AIHTS to accept only killing (commercial and non-commercial) neck snares that quickly render canids irreversibly unconscious, insofar as the state of the science or the art will allow; and

• In the absence of killing neck snares that kill quickly, phase-out all snares for which efficient and more humane alternatives exist.

If wildlife managers believe that killing neck snares must remain available to trappers, then intensive research must be conducted to develop reliable and selective sets to consistently snare canids by the neck (Proulx and Barrett 1990) and to minimize non-target capture, and a thorough research program with strict assessment criteria must be implemented (Proulx *et al.* 2012).

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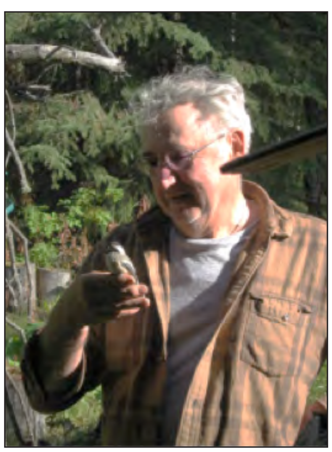
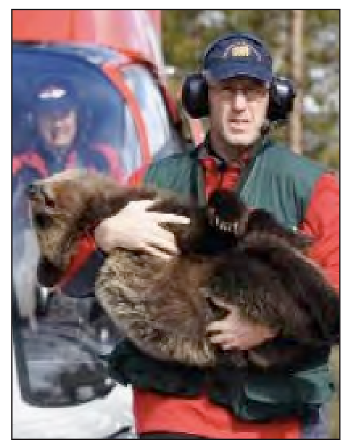
ABOUT THE AUTHORS

Gilbert Proulx is Director of Science at Alpha Wildlife Research & Management, Editor-in Chief of the Canadian Wildlife Biology & Management journal, and Chair of the *Martes* Working Group. Gilbert has 39 years of field experience as a wildlife biologist. He has published more than 120 scientific articles, 5 textbooks, and 8 field guides (species at risk). Since 1985, Gilbert has been involved in the evaluation and development of humane trapping devices, and published extensively on techniques to capture and handle mammals. His main research interest focuses on mammals, particularly in forest and agriculture ecosystems, and on technology development, mainly on mammal trapping and detection methods.

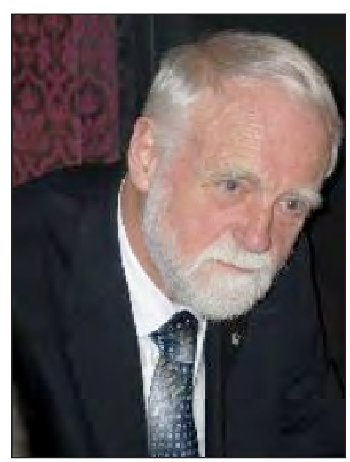


Dwight Rodtka – I was raised in the bush and on the trapline with my grandfather as soon as I could walk, with some rest breaks in his back pack fairly often. Then, all too soon, we moved out of the bush to a small farm and school. I was an Agricultural Fieldman for the Alberta Department of Agriculture for 39 years. My responsibilities were primarily to assist producers with predator problems both directly and through extension. The coyotes taste for sheep kept us busy using and teaching others about management, toxicants, and snares to reduce loss. During this time, we updated the snaring policy to reduce non-target catches and increase humaneness somewhat. I also began making all the snares used in the province, which were under Agricultural control. When jurisdiction for game farming and aquaculture transferred from Fish and Wildlife to Agriculture, I became a licensing inspector for both, in addition to my regular responsibilities. Today, my wife Glenda and I still live in the "bush", on a small farm a few kilometres southwest of Rocky Mountain House, Alberta.

Morley W. Barrett worked as a wildlife biologist for the province of Alberta for 32 years and subsequently worked for Ducks Unlimited Canada for 5 years. He has held management, research and executive positions during his career. His professional focus has included extensive work on pronghorns (*Antilocapra americana*), humane trapping and wildlife diseases. Dr. Barrett is currently retired and lives in the Rocky Mountain House area of Alberta.



Marc Cattet is a senior research scientist and a wildlife veterinarian with the Canadian Wildlife Health Cooperative at the Western College of Veterinary Medicine, University of Saskatchewan. He provides technical expertise in the areas of wildlife capture and handling to government wildlife agencies in Canada, and serves as project veterinarian for the Foothills Research Institute Grizzly Bear Research Program. His research is focused toward detecting, understanding, and reducing the effects of a range of human activities on the health of wild species.



Dick Dekker is an independent wildlife ecologist with a PhD from Wageningen University, The Netherlands. From 1964 to the present, he has recorded long-term wolf-ungulate dynamics in Jasper National Park, and detailed predator-prey interactions of falcons and waterbirds in central Alberta and along the Pacific west coast of British

Columbia. His publications include 260 titles in a wide variety of print media in English and Dutch, including 9 different refereed journals. He has written the scripts of 4 wildlife TV specials and is the author of 14 books published in Canada and The Netherlands.

Erin Moffatt received both BSc and MSc through the University of Saskatchewan, Departments of Biology and Veterinary Pathology, respectively. She has spent much of her career studying populations of mule deer (*Odocoileus hemionus*) in southern Saskatchewan. These populations were the focus of her graduate research, which looked at movement patterns and social dynamics in relation to chronic wasting disease spread. Erin is currently employed as a Data and Communications Technologist for the Canadian Wildlife Health Cooperative, where her interests in data quality and scientific communication are put to good use.

Roger A. Powell - Over the past 40 years, my research has emphasized how limiting resources affect animals. I have studied energy budgets, sexual dimorphism, population stability, coexistence of competitors, and territoriality of fishers, weasels, black bears and pine voles (*Microtus pinetorum*). My field research has emphasized animals' home ranges and spacing. I now envision animals living in a fitness landscape where the habitat value at each place is the potential contribution of that place to an animal's fitness. I still do not know what a home range is but am convinced that animals give us critical clues. Studying my own home ranges has provided me with important insights. As a kid, I read field guides with a flashlight under the covers after my parents told me to put out the lights. Did that destine me to become a field biologist or was I just a crazy kid? Since then I have held a frightened fisher by the tail, had a weasel urinate on my head, watched a mother black bear nurse her cubs in their den, and have spent too many hours in front of a computer monitor. In the end, I still don't know what I shall be when I grow up. Shall I be a biologist who builds wood/canvas canoes, does photography, runs, trains dogs and loves to camp, or shall I be a canoe builder who is also a biologist who does photography, runs and trains dogs, or shall I be a photographer who . . .

Submitted 4 November 2014 – Accepted 16 December 2014

Exhibit 15

animals

MDPI

Review

Killing Traps and Snares in North America: The Need for Stricter Checking Time Periods

Gilbert Proulx [1,*] and Dwight Rodtka [2]

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Simple Summary: In this review, we make the point that current checking times for killing traps and snares are inadequate or nonexistent in most North American jurisdictions. We use Conibear 120 rotating-jaw traps and killing neck snares as examples of trapping devices that may fail to consistently and humanely kill furbearers. Because these killing devices are not powerful enough for the target species, the trigger systems do not properly position the animals in traps, or trappers are inexperienced and improperly set traps or snares, these killing devices become restraining devices, and animals suffer long and painful deaths. Because trappers use a variety of trigger configurations and trap sets, all killing devices, even those certified by trapper organizations or governments, should be monitored at least once every 24 h on traplines, but preferably every 12 h, because one cannot know a priori whether traps will strike animals in appropriate locations for a quick kill. However, when using trapping devices such as killing neck snares that are legal and allowed by government agencies despite being inhumane, trappers should check them every 12 h. When traplines are situated near urban areas, e.g., within 10 km, checks should be done every 12 h to release pets and non-target animals.

Abstract: In this review, we make the point that current checking times for killing traps and snares are inadequate or nonexistent in most North American jurisdictions. We use Conibear 120 rotating-jaw traps and killing neck snares as examples of trapping devices that may fail to consistently and humanely kill furbearers. Because these killing devices are not powerful enough for the target species, the trigger systems do not properly position the animals in traps, or trappers are inexperienced and improperly set traps or snares, these killing devices become restraining devices, and animals suffer long and painful deaths. Because trappers use a variety of trigger configurations and trap sets, all killing devices, even those certified by trapper organizations or governments, should be monitored at least once every 24 h on traplines, but preferably every 12 h, because one cannot know a priori whether traps will strike animals in appropriate locations for a quick kill. However, when using trapping devices such as killing neck snares that are legal and allowed by government agencies despite being inhumane, trappers should check them every 12 h. When traplines are situated near urban areas, e.g., within 10 km, checks should be done every 12 h to release pets and non-target animals.

Keywords: AIHTS; killing traps; killing snares; wildlife welfare; trap check times; trapline management; international humane trapping standards

1. Introduction

Since 1995, organized efforts to reform animal trapping were aimed primarily at reducing cruelty to animals, particularly by outlawing the steel-jawed leghold trap [1]. In the last 40 years, however, there has been a growing societal concern regarding the issue of "humaneness" in wildlife trapping [1]. Trap research programs have been conducted in North America to identify or develop humane killing traps, i.e., traps that quickly render target animals unconscious and minimize pain and suffering [2]. Researchers also recommended that humane trapping standards be adopted to ensure that animals are either live-captured with minimal distress and trauma, or killed as quickly as possible, insofar as the state of the science or the art will allow [1].

According to the Agreement on International Humane Trapping Standards (AIHTS) [3], and the Agreed Minute between the European Community and the United States of America on humane trapping standards [4], Canada and the USA agreed to promote the use and application of traps and trapping methods for the humane treatment of animals. In their respective agreements, they indicated that, although welfare can vary widely, the term "humane" is used only for those trapping methods where the welfare of the animals is maintained at a sufficient level. They also acknowledged that in certain situations with killing traps, "*there will be a short period of time during which the level of welfare may be poor*". Both agreements set the time limits to unconsciousness to 45 s for *Mustela erminea*, 120 s for *Martes americana*, *Martes zibellina* and *Martes martes*, and 300 s for all other species in 80% of 12 tested animals [3,4]. In 20% (2 animals) of tests, poor welfare conditions may exceed these limits, likely by a few minutes only. In the context of this paper, poor animal welfare would relate to animals in pain while conscious, deprivation of water and food, increased heart rates and raised levels of corticosteroids ('stress hormones'), and incapability of the animals to cope with pain or discomfort [5,6].

Trap testing in semi-natural environmental conditions has shown that, with some killing traps and snares, animals would not have lost consciousness within the AIHTS' time limits and could have stayed alive for long periods of time if the researchers had not anesthetized them [7,8]. Work on traplines also showed that killing traps and snares were not always performing as expected, and ≥30% of animals captured in legal traps in Canada and the USA were struck in non-lethal regions and lost consciousness many minutes past the acceptable time limit, or were still alive for hours after capture [9,10]. Nevertheless, according to Dave Kay (2019, Fish and Wildlife Policy Branch, Alberta Environment and Parks, personal communication with Rodtka), check times are irrelevant for killing traps and snares because the animals should be dead at time of visit. Because trappers use a variety of trigger configurations and trap sets, one cannot be sure that animals will be struck in lethal regions. Without knowing a priori whether traps have struck animals in appropriate locations for a quick kill, assuming that traps worked as advertised and humanely killed all captures may lead to long and painful suffering, and poor levels of animal welfare [2,10].

In this review, we make the point that current checking times for killing traps and snares are inadequate or nonexistent in North American jurisdictions. Also, on the basis of published records of animals that were alive and conscious for long periods of time in killing traps and snares, we propose changes to current trapping practices to include stricter time limits in regulations for checking killing traps and snares.

2. Checking Times of Kill Traps and Snares in North American Jurisdictions

We consulted the trapping regulations of Canadian Provinces and Territories, and of American States, to determine checking times for killing traps and killing neck (body) snares (Appendix A). These regulations are subject to revision from year to year. At time of writing, in Canada, there are no legal requirements to check killing traps and snares in most Provinces and Territories (Appendix A). In nearly 35% of American jurisdictions, checking times for killing traps and snares exceed 24 h. In approximately 55% of American States, checking times for submersed killing devices exceed 36 h (Appendix A). In both countries, checking times for killing traps and snares often are longer than those of restraining traps which usually are 24 h (Appendix A).

3. Animals Restrained in Killing Traps and Snares: Three Case Studies

Killing traps and snares do not always kill animals quickly. Animals that are being restrained in such trapping devices may take hours or even days to die depending on the trapping device, the capture location, the physical condition of the animals, and the environmental conditions. In the following, we review examples of traps and snares that have been found to be ineffective to consistently kill animals humanely, even though they are either "AIHTS-certified" as being humane for some species in Canada or considered in Best Management Practices (BMPs) in the United States. BMPs are educational guides designed to address animal welfare and increase trappers' efficiency and selectivity.

3.1. The Conibear 120 Rotating-Jaw (Bodygrip) Trap Model to Kill Marten

According to AIHTS [3], a killing trap would meet the standards if 80% of 12 tested animals are unconscious and insensible within a pre-determined time limit (e.g., 2 min for small mammals like martens), and remain in this state until death. This means that, on the basis of the normal approximation to the binomial distribution (one-tailed test) [11], a humane trap would, with 95% confidence, render ≥58% of captured animals irreversibly unconscious within the prescribed time limit.

The Conibear 120 trap (Woodstream Corp., Lititz, PA, USA; Figure 1) is the most commonly used trap to harvest American martens (*Martes americana*) in North America [7]. It is not certified as humane for marten in Canada [12], but is part of the USA BMPs [13].

120 trap models may be, if they are equipped with two-prong triggers, improperly struck martens risk suffering for long periods of time.

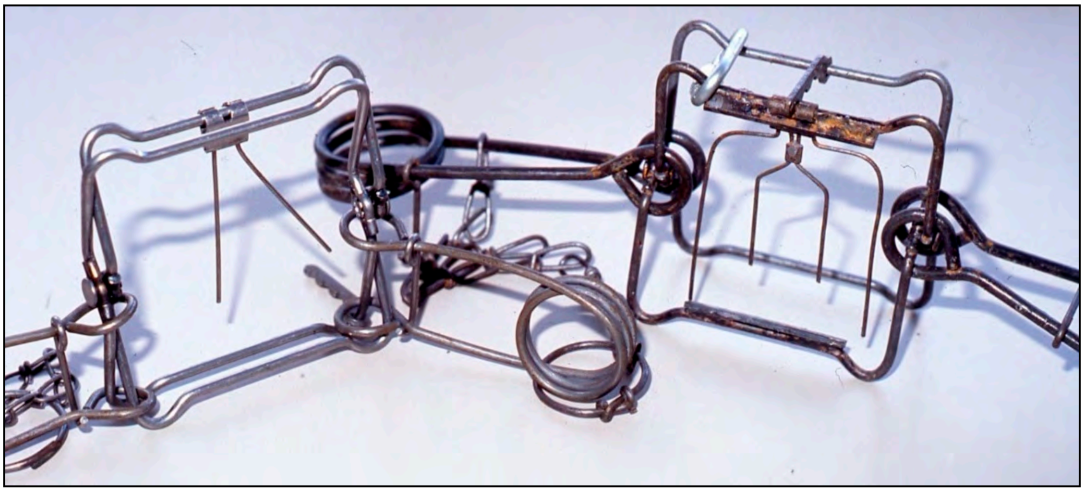
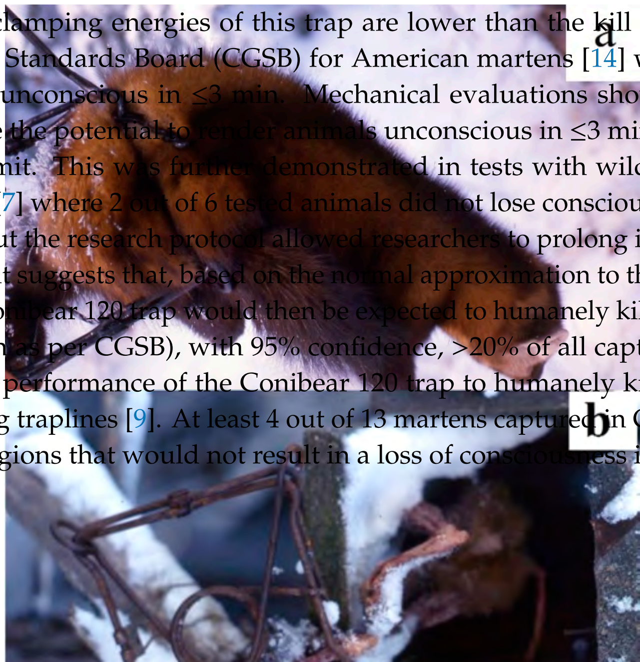


Figure 1. Examples of the Conibear 120 trap with a two-prong trigger (left) and the C120 Magnum trap with a pitchfork trigger (right). Note the larger springs and clamping bars welded to the striking jaws of the C120 Magnum (Photograph: Gilbert Proulx©).

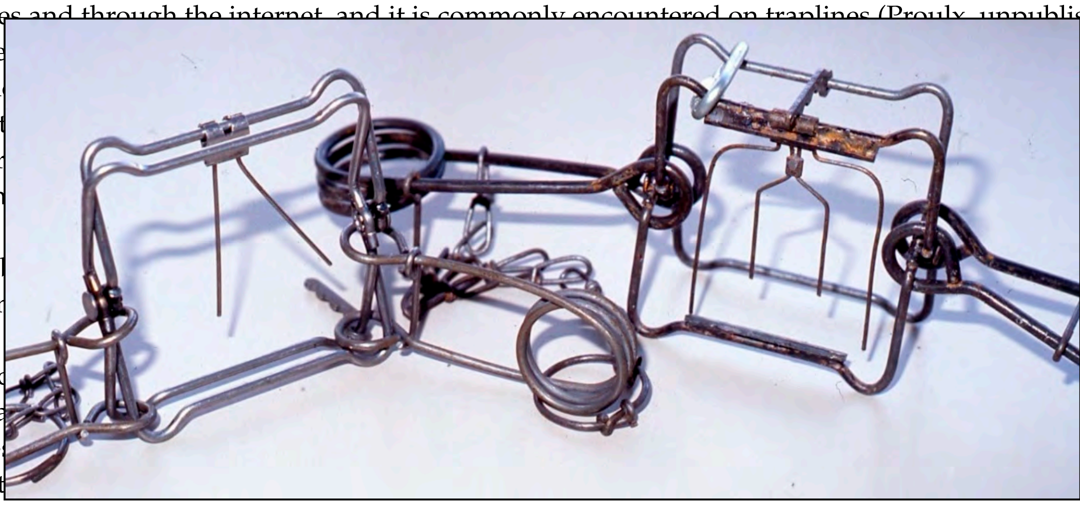


The impact and clamping energies of this trap are lower than the kill threshold standards of the Canadian General Standards Board (CGSB) for American martens [14] where animals must be rendered irreversibly unconscious in ≤3 min. Mechanical evaluations showed that the Conibear 120 trap does not have the potential to render animals unconscious in ≤3 min [15] and thus to meet AIHTS' 2-min time limit. This was further demonstrated in tests with wild animals in simulated natural environments [7] where 2 out of 6 tested animals did not lose consciousness within 5 min (the time limit was 3 min but the research protocol allowed researchers to prolong it to 5 min to learn more about traps). This result suggests that, based on the normal approximation to the binomial distribution (one-tailed) [11], the Conibear 120 trap would then be expected to humanely kill (by rendering animals unconscious in ≤3 min as per CGSB), with 95% confidence, >20% of all captured martens of a true population. The poor performance of the Conibear 120 trap to humanely kill martens was further determined on working traplines [9]. At least 4 out of 13 martens captured in Conibear 120 traps were struck in non-lethal regions that would not result in a loss of consciousness in ≤3 min. Thus, on the basis of a one-tailed binomial test, the trap would, with 95% confidence, render <40% of captured martens unconscious in ≤3 min.

120 trap models may be, if they are equipped with two-prong triggers, improperly struck martens risk suffering for long periods of time.

The Conibear 120 trap is still available on the market; it can be purchased at trapper supply stores and through the internet, and it is commonly encountered on traplines (Proulx, unpublished obse … and stan … ican mart … then, a ser … d as hum …

… gger can … while atten … ongs, and … t do not … d by the … ning trap … bear 120 t … s are consistently struck in vital regions and die quickly. No matter how powerful Conibear 120 trap models may be, if they are equipped with two-prong triggers, improperly struck martens risk suffering for long periods of time.



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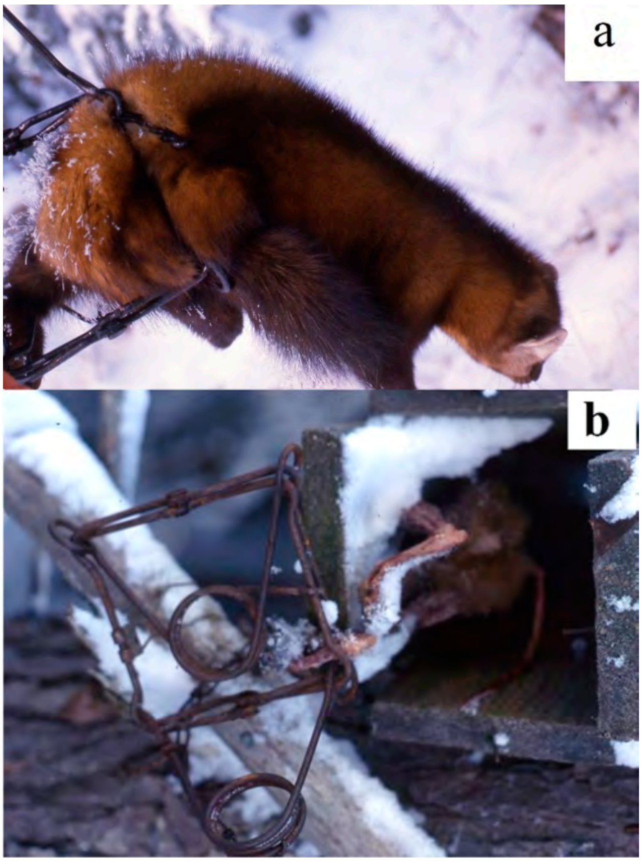

Figure 2. Photographs taken of Conibear 120 captures on working traplines: (**a**) an American marten struck in the lower abdomen; (**b**) this marten was captured by a hind leg and did not succeed in extracting itself from the cubby box where it died. It was later scavenged by other animals as the trapper did not check the trap site in time to retrieve the animal (Photographs: Gilbert Proulx©).

Figure 2. Photographs taken of Conibear 120 captures on working traplines: (**a**) an American marten struck in the lower abdomen; (**b**) this marten was captured by a hind leg and did not succeed in extracting itself from the cubby box where it died. It was later scavenged by other animals as the trapper did not check the trap site in time to retrieve the animal (Photographs: Gilbert Proulx©).

In North America, at least 100,000 martens are trapped every year [17,18], but the number of captures may vary from year to year depending on pelt price. The number of martens captured in

In North America, at least 100,000 martens are trapped every year [17,18], but the number of captures may vary from year to year depending on pelt price. The number of martens captured in the Conibear 120 traps is unknown, but due to the popularity of the trap model, it certainly amounts to several thousands of animals. If at least 30% of martens captured in Conibear 120 traps were struck in non-lethal regions [9], then a very large number of martens would likely experience pain and suffering for periods of time exceeding AIHTs' time limit of 2 min.

3.2. *The Conibear 120 Trap Model to Kill Mink (Neovison vison)*

There are no certified traps for mink in Canada [9] but the Conibear 120 rotating-jaw trap is most popular among trappers. In the USA, the Conibear 120 trap is recommended in BMPs for trapping mink, and neck strikes are identified as proper strike locations [19]. However, as we explained above, the Conibear 120 trap cannot consistently and humanely kill American martens. Mink have a greater cervical musculature and stronger bones than American martens [20], and cannot be humanely killed, i.e., lose consciousness in ≤3 min as per CGSB, by the Conibear 120 trap. In fact, even the mechanically superior and stronger C120 Magnum failed to humanely kill mink captured by the neck [21]. Furthermore, while the Conibear 120 trap is marketed with a two-prong trigger, its inability to properly strike mink in vital regions was reported nearly 50 years ago [22].

The stronger C120 Magnum trap equipped with a pan trigger humanely killed mink double-struck in the neck and thorax [21]. Because the two-prong trigger fails to ensure strikes in vital regions, and the Conibear 120 trap does not have the striking and clamping forces to produce a humane kill, many mink captured in this trap stay alive for many hours, and sometimes until the following day (Rodtka, unpublished data). Thousands of mink are trapped every year in North America [17,18], and many of those captured in the Conibear 120 trap must experience pain and suffering for periods of time exceeding AIHTs' time limit of 5 min.

3.3. *Killing Neck Snares for Wild Canids*

Killing neck snares are killing devices where the animals, or one or two springs, provide the energy necessary to tighten the noose. These are the most popular kill trapping devices used by trappers because they are cheap, lightweight, easy to set and camouflage, and are efficient at capturing a diversity of furbearers [10]. They are popular in Canada where they are set on traplines to harvest canids, i.e., gray wolves (*Canis lupus*), coyotes (*Canis latrans*) and red foxes (*Vulpes vulpes*) [2,23,24]. Although killing neck snares were originally considered for inclusion in ISO standards [25], which required that snares render captured animals unconscious within 5 min, these trapping devices are not covered under AIHTS [3]. A footnote to Article 7 of the Agreement stipulates that the standards do not prevent individuals from constructing and using traps (which may not pass AIHTS' time limit test), provided that such traps comply with designs approved by the relevant competent authority. Although killing neck snares are commercially manufactured and sold on the open market [10], they are deemed by competent authority to be non-commercial devices. Certified or not, killing neck snares do not have the ability to quickly and humanely render canids unconscious [26]. Less than 50% of canids captured by the neck in killing neck snares lose consciousness within 300 s [8,27]; death may come after hours or days [28], depending on the killing efficacy of the snare and the frequency of visits by trappers [8,26]. Trail video-cameras set on a working trapline showed that one neck-captured coyote and one wolf lost consciousness after 14 h 16 min and 3 h 39 min of repeated escape attempts, respectively [10] (Figure 3). These videos confirmed years of research showing that killing neck snares do not have the ability to quickly and humanely kill canids [8,26,27]. Although neck snares are sold as devices that are intended to kill, they behave like restraining trapping devices.

More than 100,000 red foxes, coyotes, and wolves are trapped every year in Canada [18], mostly in killing neck snares [10]. Thousands more are snared in the United States [17]. In a previous study of 65 snared coyotes, 59% were neck catches, 20% flank, and 10% foot [29]. Also, nearly half of the animals were alive the morning after being snared. Another study also reported that 5% to 32% of animals captured in various killing neck snare models were still alive when found [28]. While it is best to snare canids behind the jaw where the carotid artery and the trachea are maximally exposed [26], snare location on an animal is influenced by many factors such as the behaviour of the animal when entering the loop [8], snare height and loop diameter, positioning of the lock, preload on the loop (i.e., a little tension is put into the loop to force it to close quicker), and environmental and maintenance factors (rust, twists in the snare cable, snowfall), etc. [26]. Not surprisingly, the percentage of animals found alive in killing neck snares is relatively high [10]. Canids kept alive in killing neck snares die hours or days after being captured, with injuries akin to those recorded with steel-jawed leghold traps [30].

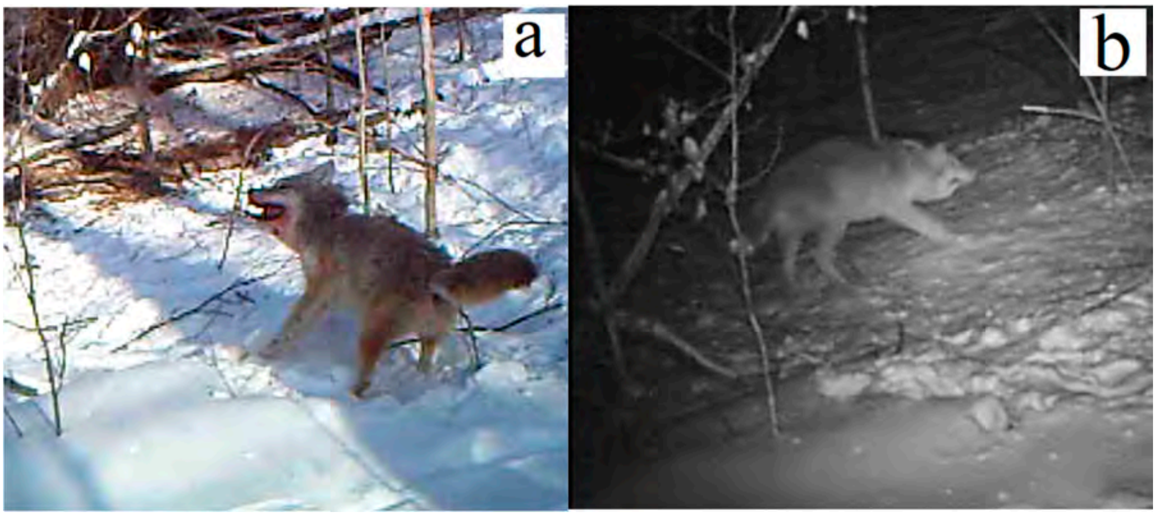

Figure 3. Trail cameras recorded the capture of a coyote in a killing neck snare on a working trapline [10]. The animal was alive for 14 h and 16 min: (**a**) the animal tried to escape at capture time; (**b**) 11 h 30 min later, the coyote was still fighting to escape (Photographs: Gilbert Proulx©).

Finally, snared animals may break the snare lock or chew through the cable if the lock does not tighten sufficiently to cause death [28,30]. The likeliness of an escape increases with the length of time an animal is restrained in the killing snare. A 2-year-old male coyote was found in a moribund state on Prince Edward Island, one month after the official end of the trapping season, with a snare deeply embedded in the ventral portion of its neck [31]. Two wolves that had been snared outside Denali National Park and Preserve, Alaska, and had then escaped with the tightened loops around their necks, were spotted by park staff a few days before one of them was immobilized with a tranquilizer dart [32]. The snare was deeply embedded in the wolf's neck. In both cases, such escapes and injuries could have possibly been avoided with relatively short check time periods [10].

4. Stricter Checking Times Are Needed for Killing Traps and Snares

On the basis of past research work, we believe that Conibear 120 traps with two-prong triggers and killing necks snares should be banned altogether [2,26]. However, all killing traps, even those that have been certified as being humane [12], should be monitored frequently because environmental conditions and trappers' modifications can impact on their killing performance, and one cannot guarantee that all animals will be struck in appropriate locations for a quick kill [2]. Even with certified traps, some animals will not lose consciousness within AIHTS' time limits and may suffer for long periods of time. When traplines are too long for frequent trap visits, they should be subdivided into smaller sections. Trappers would then be able to check their traps every 24 h, e.g., at sunrise, or even more often. However, when using trapping devices such as killing neck snares that are not considered to be humane by experts who assessed them [26,27,30] but are still being allowed by government agencies, trappers should check them every 12 h. Most carnivores are nocturnal or crepuscular, and the chances to find animals still alive in killing neck snares are greater at dusk and dawn. For example, in Proulx's video recordings [10], a coyote snared at 11:50 h could have been killed humanely at 17:00 h the same day (trap visit at dusk), instead of 09:00 h the following day (trap visit at dawn, 24 h later).

video recordings [10], a coyote snared at 11:50 h could have been killed humanely at 17:00 h the same day (trap visit at dusk), instead of 09:00 h the following day (trap visit at dawn, 24 h later).

When traplines are situated near urban areas, checks should be done every 12 h to release pets and non-target animals. In suburban areas, if traps cannot be checked easily, they should be equipped with a monitor [33–36] that allows false positives but not false negatives, and that notifies a trapper when battery power is low or when a trap has misfired [37].

Our recommendation to frequently check, preferentially every 12 h, killing traps and snares which act like restraining traps is in line with other scientists who recommended that live-holding devices be checked at least daily or more frequently depending upon target species, the potential for capture of nontarget species, and environmental conditions [38]. It is also in agreement with recommendations for the humane and efficient capture of carnivores [2]. Checking traps within a 24-h period on traplines, and within 12 h in urban and sub-urban areas or when using legal but inhumane trapping devices, would minimize pain and discomfort of animals kept alive in killing devices. It would also be advantageous to trappers as it allows them to retrieve captured animals before they are scavenged upon by animals, maintain trap sets that may have been disturbed by animals that avoided capture or by weather conditions, release non-target animals that have not suffered serious injuries during capture, or humanely kill those that are too badly injured to be released.

The concept of humane trapping involves more than just developing devices that meet standards. It also entails changes on how trappers carry out their activities. Shortening trap check times, and using only trapping devices that can consistently and humanely kill animals, would significantly minimize injuries, pain and suffering of trapped animals.

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Appendix A

Table A1. Checking times for killing and restraining traps in Canada and the United States of America, 2018–2019.

Jurisdiction	Checking Times			References (2018–2019)	Statement
	Killing Traps and Snares		Restraining Traps		
	Dry Land	Submerged			
Canadian Provinces and Territories					
Alberta	No checking time	No checking time	24–48 h	https://open.alberta.ca/dataset/8ccfe254-37d4-42fd-a8ec-fc08fa2fe687/resource/cdd685cf-eaad-4e14-a316-8e8d03da5034/download/albertaguidetrappingregs-2018-2019.pdf	Page 13—Restraining traps: 24 h—Resident Fur Management Licence 48 h—Regional Fur Management Licence
British Columbia	14 days		24–72 h	http://www.env.gov.bc.ca/fw/tmp/hunting-trapping-synopsis-2018-2020.pdf	Page 90—A holder of a licence, permit or other authorization to trap commits an offence unless that person examines the holding or non-killing traps he or she has set on a trapline at least once every 72 h, the egg trap(s) he or she has set for raccoons at least once every 24 h, and killing traps or killing snares that he or she has set on the trapline at least once every 14 days
Manitoba	No checking time	No checking time	72 h	https://www.gov.mb.ca/sd/pubs/fish_wildlife/trapping_guide.pdf	Page 9—No person shall trap fur bearing animals using live holding devices unless they are checked at least once every 72 h.
New Brunswick	No checking time	No checking time	48 h	https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/Wildlife/HuntTrap.pdf	Page 19—Individual fur harvesters are required to check all restraining trap sets at least once every 48 h. Page 27—Check traps regularly, preferably in the early morning.
Newfoundland and Labrador	No checking time	No checking time	24 h	https://www.gov.nl.ca/hunting-trapping-guide/2019-20/wp-content/uploads/sites/2/Hunting-Trapping-Guide.pdf	Page 96—Fox or Coyote or Lynx Restraining Neck Snare: this is a live capture device and requires a 24 h trap check.
Nova Scotia	No checking time	No checking time	Daily *	https://novascotia.ca/natr/hunt/pdf/Hunting_Summary_2018_Complete.pdf	Page 36—A person who sets cable restraints or traps designed to catch animals alive must examine each trap or snare set at least once every day.
Ontario	No checking time	No checking time	Daily	https://furmanagers.com/wp-content/uploads/2018/08/mnrf-regulations-english.pdf	Page 3—Relaxing cable restraints must be checked on a daily basis.
Prince Edward Island	48 h		Daily	http://www.gov.pe.ca/photos/original/fae_trap02_e.pdf	Page 3—No person shall set a trap designed to hold animals alive without examining each trap at least once a day. No person shall set a trap designed to kill animals without examining each trap at least once every 48 h.
Québec	No checking time	No checking time	No checking time	https://mffp.gouv.qc.ca/english/publications/online/wildlife/trapping-regulations/pdf/trapping-regulation-2018-2020.pdf	
Saskatchewan	1–5 days for killing snares	No checking time	No checking time	https://pubsaskdev.blob.core.windows.net/pubsask-prod/109243/109243-2018_Hunters_and_Trappers_Guide_-_Trapping_Supplement.pdf	Page 2—It is a violation to fail to check traps or snares: within one day when set within five kilometres of urban limits; within one day when setting a mechanically activated leg snare for bears in the SFCA; three days when set on other lands in the southern zones; five days when set on lands within the Fur Conservation Block.
Nunavut	No information found				
Northwest Territories	No checking time	No checking time	No checking time	https://www.justice.gov.nt.ca/en/files/legislation/wildlife/wildlife.r12.pdf	
Yukon	7 days	7 days	5 days	https://yukon.ca/sites/yukon.ca/files/env/env-trapping-regulations-summary.pdf	Every person who installs a snare or trap must: check the set at least once every five days if it is designed to restrain the animal; check the set at least once every seven days if it is designed as a quick killing set.

Table A1. *Cont.*

Jurisdiction	Checking Times			References (2018–2019)	Statement
	Killing Traps and Snares		Restraining Traps		
	Dry Land	Submerged			
United States of America					
Alabama	24 h	72 h	24 h	https://www.outdooralabama.com/sites/default/files/Hunting/Trapping/Fur%20Catcher%20Code-Regs%201-18.pdf	Section II—K.6: All traps set in or beneath water must be checked at least once every 72 h. All traps other than water sets must be checked at least once every 24 h. Regulation 220-2-.30: Killing neck snares are prohibited.
Alaska	72 h	72 h	72 h	https://www.adfg.alaska.gov/static/regulations/wildliferegulations/pdfs/trapping.pdf	Page 21—All traps/snares must be checked within 3 days of setting them and within each 3 days thereafter.
Arizona	Daily	Daily	Daily	https://repository.asu.edu/attachments/193157/content/2017-18-Trapping-Regulations.pdf	Killing neck snares and body-gripping traps are illegal.
Arkansas	72 h	72 h	Daily	https://agfc.com/en/hunting/furbearers/	Nondrowning sets with foothold traps, snares and box traps must be checked daily. Kill traps must be checked at least every 72 h
California	Daily	Daily	Daily	https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=45902&inline	All traps shall be visited at least once daily by the owner of the traps or his/her designee.
Colorado	Daily	Daily	Daily	https://cpw.state.co.us/Documents/RulesRegs/Regulations/Ch03.pdf	Page 2—All traps and snares must be visually checked on site at least once every day.
Connecticut	24 h	24 h	24 h	https://www.somersct.gov/download/Town%20Departments/Town%20Clerk/2019-Hunting-Trapping-Guide.pdf	Page 46—Trappers are required to tend all traps within a 24-h period.
Delaware	24 h	24 h	24 h	http://www.eregulations.com/delaware/hunting/furbearer-trapping-hunting/	It is unlawful to fail to visit traps at least once every 24 h. Only restraining snares are allowed.
Florida	24 h	24 h	24 h	http://www.eregulations.com/florida/hunting/furbearer-regulations/	Live traps and snares must be checked every 24 h. Body-grip traps are prohibited.
Georgia	24 h	24 h	24 h	https://georgiawildlife.com/regulations/trapping	It is unlawful to fail to inspect traps at least once each 24-h period and remove any animals caught in the traps. Killing neck snares are prohibited, except for beaver in water.
Hawaii	No trapping	No trapping	No trapping	https://dlnr.hawaii.gov/dofaw/files/2013/09/HAR-123-Game-Mammals.pdf	Page 28—No person shall possess or use tracer bullets, bullets with full metal jackets, blow guns, guns powered by compressed gas, animal traps, slingshots, poison, explosives, or snares in any public hunting area.
Idaho	72 h	72 h	72 h	https://idfg.idaho.gov/sites/default/files/seasons-rules-upland-furbearer-2018-2019.pdf	Page 36—No person shall place snares or traps for furbearing animals, predatory or unprotected wildlife except pocket gophers, most species of ground squirrels, and other unprotected rodents, without visiting every trap or snare once every 72 h and removing any catch therein.
Illinois	Daily	Daily	Daily	https://www.dnr.illinois.gov/hunting/Documents/HuntTrapDigest.pdf	Page 44—It is unlawful to fail to visit and remove all animals from traps at least once each calendar day.
Indiana	24 h	24 h	24 h	http://www.eregulations.com/wp-content/uploads/2018/07/18INHD_LR7.pdf	Page 43—Traps must be checked and animals removed at least one time every 24 h.
Iowa	24 h	No checking time	24 h	https://bidopportunities.iowa.gov/Home/GetBidOpportunityDocument/91d03035-815c-49c2-afb2-88c30918ab5f	Page 25—All animals or animal carcasses caught in any type of trap or snare, except those that are placed entirely under water and designed to drown the animal immediately, must be removed from the trap or snare by the trap or snare user immediately upon discovery and within 24 h of the time the animal is caught. Mechanically powered snares are prohibited.

Table A1. *Cont.*

Jurisdiction	Checking Times: Killing Traps and Snares: Dry Land	Checking Times: Killing Traps and Snares: Submerged	Checking Times: Restraining Traps	References (2018–2019)	Statement
Kansas	Daily	Daily	Daily	https://ksoutdoors.com/Hunting/Hunting-Regulations/Furbearers/Trap-Tagging-and-Tending	All traps, including snares and deadfalls, must be tended and inspected at least once every day.
Kentucky	24 h	24 h	24 h	https://fw.ky.gov/Hunt/Pages/Furbearer-Hunting-and-Trapping.aspx	All traps must be visited at least once every twenty-four (24) h and all animals removed.
Louisiana	Daily	Daily	Daily	http://www.wlf.louisiana.gov/sites/default/files/pdf/page/41407-regulations/2018-2019trappingregulations.pdf	All traps must be checked daily.
Maine	3–5 days	1–5 days depending on towns, times of the year, and trap sets.	Unspecified	https://www.maine.gov/ifw/hunting-trapping/trapping-laws/regulations.html#specifictraps	All traps set in organized towns must be tended daily, except for killer-type traps, drowning sets, and under-ice drowning sets. Each killer-type trap or drowning set, except under-ice drowning sets, in organized towns must be tended at least once every three calendar days except if the drowning set is within $\frac{1}{2}$ mile of the built up section of town, then it must be checked every 24 h. All traps set in unorganized towns must be tended daily, except for killer-type traps, drowning sets, and under-ice drowning sets. Each killer-type trap or drowning set, except under-ice drowning sets, in unorganized towns must be tended at least once in every 5 calendar days. During November, December, March and April if a drowning set is under-ice there will be no tending requirement. However, if a trap set is in open water the trap tending requirements are: • 3 days for killer-type traps and drowning sets, except if the drowning set is within $\frac{1}{2}$ mile of the built up section of town it must be checked every 24 h, and • 5 days for killer-type traps and drowning sets in unorganized towns.
Maryland	Daily	48 h	Daily	http://www.eregulations.com/wp-content/uploads/2018/06/18MDHD_LR.pdf	Page 52—Traps must be checked once per calendar day except those traps that are set in water or tidal marshes which must be checked once per two days.
Massachusetts	Daily	Daily	Daily	https://www.mass.gov/regulations/321-CMR-300-hunting#3-02-5-hunting-and-trapping-of-certain-mammals	It shall be unlawful for any person to fail to visit and remove all animals trapped in, at least once in each calendar day between the hours of 04:00 A.M. and 10:00 P.M., all traps by him staked out, set, used, tended, placed, or maintained.
Michigan	No checking time	No checking time	24–48 h depending on zones	https://www.michigan.gov/documents/dnr/michigan_fur_harvester_digest_625943_7.pdf	Page 24—Trappers are legally required to check traps set in a manner to hold animals alive at least once each day in Zones 2 and 3 and at least once within each 48-h period in Zone 1. It is highly recommended that trappers in Zone 1 check traps daily.
Minnesota	Killing traps: 72 h Snares: daily.	72 h	Daily	https://files.dnr.state.mn.us/rlp/regulations/hunting/full_regs.pdf#view=fit&pagemode=bookmarks	Page 49—Traps capable of capturing a protected animal and not capable of drowning it must be tended at least once each calendar day, except body-gripping traps. Traps capable of drowning the animal and body-gripping traps must be tended at least once each third calendar day, except traps set under the ice.
Mississippi	36 h	36 h	36 h	http://www.mdwfp.com/wildlife-hunting/furbearer-trapping/trapping-regulations.aspx	Every trapper shall visit his traps at least every thirty-six (36) h.
Missouri	Daily	48 h	Daily	https://huntfish.mdc.mo.gov/sites/default/files/downloads/2019HuntTrapRegs.pdf	Page 23—Wildlife must be removed or released from traps daily, except for colony and killing-type traps set under water, which must be checked every 48 h.

Table A1. *Cont.*

Jurisdiction	Checking Times			References (2018–2019)	Statement
	Killing Traps and Snares		Restraining Traps		
	Dry Land	Submerged			
Montana	48 h	48 h	48 h	http://fwp.mt.gov/hunting/planahunt/huntingGuides/furbearer/	Page 3—Traps should be checked at least once every 48 h.
Nebraska	48 h	48 h	Daily	http://digital.outdoornebraska.gov/i/1008617-small-game-guide-2018-web	Page 20—Once every two calendar days: • Metal spring traps and snares affixed to one-way, slide-wire drowning sets. • Underwater snare sets that remain under water when fully extended. • Underwater body-gripping sets. Once every calendar day: • All others.
Nevada	96 h	96 h	96 h	http://www.ndow.org/Hunt/Seasons_and_Regulations/Furbearer/Trapping_in_NV/	A person taking or causing to be taken wild mammals by means of traps, snares or any other devices which do not, or are not designed to, cause immediate death to the mammals, shall, when the traps, snares or devices are placed or set for the purpose of taking mammals, visit or cause to be visited at least once each 96 h each trap, snare or other device during all of the time the trap, snare or device is placed, set or used in the taking of wild mammals, and remove therefrom any mammals caught therein.
New Hampshire	Daily	72 h	Daily	http://www.eregulations.com/newhampshire/hunting/furbearer-trapping/	A trapper must visit traps set at least once each calendar day. A person trapping beaver through the ice must visit his traps at least once each 72 h.
New Jersey	24 h	24 h	24 h	https://www.njfishandwildlife.com/pdf/2018/trapping_summary18-19.pdf	All traps must be checked and tended at least once every 24 h, preferably in the morning except traps set for semi-aquatic species in tidal waters only must be checked once per calendar day.
New Mexico	Daily	Daily	Daily	http://www.wildlife.state.nm.us/download/publications/rib/2019/hunting/30-Furbearers.pdf	Page 125—A licensed trapper or his/her representative (agent) must personally visit and inspect each trap every calendar day, and all wildlife must be removed. Every other calendar day all traps must be checked personally by the trapper.
New York	24–48 h depending on zones	48 h	24 h		Page 56 In the Southern Zone: You must check traps once in each 24-h period. In the Northern Zone, once in each 48-h period. Traps set in water during the open season for beaver, otter, mink and muskrat, once in each 48-h period. Body-gripping traps set on land, once in each 48-h period. Restraining traps, once in each 24-h period
North Carolina	Daily	72 h	Daily	http://www.eregulations.com/northcarolina/hunting-fishing/trapping-regulations/	Every trap must be visited daily and any animal caught therein removed, except for completely submerged Conibear™-type traps, which must be visited at least once every 72 h and any animal caught therein removed.
North Dakota	No checking time	No checking time	No checking time	https://gf.nd.gov/regulations/small-combined#fur	
Ohio	Daily	Daily	Daily	http://wildlife.ohiodnr.gov/portals/wildlife/pdfs/hunting/2018-19%20Ohio%20Hunting%20Regs_Web.pdf	All traps and snares must be checked and all animals removed once every calendar day.
Oklahoma	24 h	24 h	24 h	http://www.eregulations.com/oklahoma/hunting/furbearer-regulations/	Traps must be tended once each 24-h period.

Table A1. *Cont.*

Jurisdiction	Checking Times: Killing Traps and Snares: Dry Land	Checking Times: Killing Traps and Snares: Submerged	Checking Times: Restraining Traps	References (2018–2019)	Statement
Oregon	48 h	48 h	48 h	https://www.dfw.state.or.us/resources/hunting/small_game/regulations/docs/Furbearer_Regulations.pdf	Page 2—All traps or snares set or used for the taking of furbearing or unprotected mammals shall be inspected at least every 48 h and all trapped animals removed.
Pennsylvania	36 h	36 h	36 h	http://maps.dcnr.pa.gov/bof/huntmap/pdfs/2018-19%20Hunting%20Trapping%20Digest.pdf	Traps must be visited by the owner once every 36 h, and each animal removed or released.
Rhode Island	24 h	24 h	24 h	http://www.eregulations.com/rhodeisland/hunting/trapping/	All traps must be checked at least once in every 24-h period
South Carolina	24 h	48 h	24 h	http://www.dnr.sc.gov/regs/furharvest.html	All traps must be checked at least once daily from two hours before official sunrise to two hours after official sunset. Body gripping traps used in water sets and other traps used in submersion sets must be checked once every 48 h.
South Dakota	2–3 days	5 days	2–3 days	https://gfp.sd.gov/trapping/	Traps, including snares, must be checked prior to midnight of the second full calendar day (from the time the trap was initially set or last checked) east of the Missouri River and prior to midnight of the third full calendar day west of the Missouri River. Any animal caught must be removed. Traps or snares that are entirely submerged in the water and remain set beneath ice must be checked and any caught animals removed prior to midnight of the fifth full calendar day statewide.
Tennessee	72 h	72 h	36 h	https://www.tn.gov/content/dam/tn/twra/documents/huntguide.pdf	Page 15—Lethal sets such as instant kill traps and water set ("drowning") traps must be inspected every seventy-two (72) hours. All other traps must be inspected every thirty-six (36) hours and any wildlife caught in the traps shall be removed.
Texas	36 h	36 h	36 h	https://tpwd.texas.gov/regulations/outdoor-annual/hunting/fur-bearing-animal-regulations/means-methods	It is unlawful to take fur-bearing animals with snare, foothold, body grip traps, and live or box trap unless such devices are examined at least once every 36 h and animals are removed.
Utah	96 h	96 h	48 h	https://wildlife.utah.gov/guidebooks/2018-19_furbearer.pdf	Page 15—All trapping devices used to take a furbearer, coyote or raccoon must be checked, and any animals removed, at least once every 48 h. The only exception is if you are using the following types of traps, which must be checked, and have any animals removed, every 96 h: • Killing traps that strike the top and bottom of the animal simultaneously • Drowning sets • Lethal cable devices that are set to capture on the neck, that have a nonrelaxing lock without a stop, and that are anchored to an immovable object.
Vermont	Daily	72 h	Daily	http://www.eregulations.com/vermont/hunting/furbearer-hunting-trapping/	Trappers are required to check their traps at least once a day and dispatch or release any captured animal. The only exception is body gripping traps set in the water or set under the ice, colony/cage traps set underwater, or foothold traps under the ice, which trappers are required to check every three calendar days and remove any animal caught.
Virginia	Daily	72 h	Daily	https://www.dgif.virginia.gov/wp-content/uploads/2018-2019-Virginia-Hunting-and-Trapping-Regulations-Digest.pdf	Page 52—Trappers must visit all traps once each day and remove all animals caught therein, except for completely submerged body-gripping traps which must be visited once every 72 h.

Table A1. *Cont.*

Jurisdiction	Checking Times			References (2018–2019)	Statement
	Killing Traps and Snares		Restraining Traps		
	Dry Land	Submerged			
Washington	72 h	72 h	24 h	https://wdfw.wa.gov/sites/default/files/publications/02012/wdfw02012.pdf	Page 2—It is unlawful to trap for wild animals unless traps are checked and animals removed within 72 h (non-body gripping kill traps); and unless animals captured in restraining traps (any nonkilling set) are removed within 24 h of capture.
West Virginia	Daily	Daily	Daily	http://www.wvdnr.gov/hunting/Regs1819/2018-19_Hunting_Regs.pdf	Page 4—All traps must be checked and tended daily.
Wisconsin	Daily	96 h	Daily	https://dnr.wi.gov/files/pdf/pubs/wm/wm0002.pdf	Page 8—non-submersion sets must be attended and checked in person at least once each day; water sets, except submersion sets, must be attended and checked in person at least once each day; submersion sets must be attended and checked in person within a 4-day period following the last tending of the set.
Wyoming	Once per week **	Once per week	72 h	https://wgfd.wyo.gov/Regulations/Regulation-PDFs/REGULATIONS_CH4.pdf	Page 4–8—Check Period for Leg-Hold Traps, Live Traps, Snares and Quick-Kill Body-Grip Traps. (a) All leg-hold traps and live traps shall be checked by the owner a minimum of once during each seventy-two (72) h period. (b) All snares and quick-kill body-grip traps shall be checked by the owner a minimum of one time each week, except during the initial week the snares or quick-kill bodygrip traps were set.

* Daily: the checking period could exceed 24 h if a kill trap/snare was set or checked on a morning of one day and rechecked in the afternoon or evening of the following day. ** Once per week: the checking period could be as long as 13 days if a kill trap/snare was set or checked on a Monday of one week and rechecked on the Sunday of the next week.

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Exhibit 16

Evaluation of two restraining traps to capture raccoons

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Evaluation of two restraining traps to capture raccoons

George F. Hubert, Jr., Laura L. Hungerford, Gilbert Proulx, Robert D. Bluett, and Laurel Bowman

Abstract We compared the efficiency of the No. 1 Victor™ coil spring (CS) and EGG™ traps for capturing raccoons (*Procyon lotor*) in nondrowning water sets on 5 Illinois traplines during a 1-year field study. We also assessed the nature and magnitude of injuries to raccoons caught in both types of traps. Both traps caught a similar number of raccoons on 3 traplines, but on 2 of the traplines, the EGG was more successful than the CS. Overall, the EGG captured raccoons more efficiently than the CS. Trap firing without a catch was recorded more often with the CS than the EGG, and more animals escaped from the CS. There was no difference in the number of non-raccoon captures in the CS versus the EGG. The total (whole body) and trapped-limb-only injury scores for raccoons captured in the CS were higher than for the EGG. Most raccoons (94%) showed no oral injuries, and frequency of oral injuries failed to differ between trap types. Sixty-three percent of the raccoons caught in the EGG compared with 25% of those captured in the CS had an injury score <50. The proportion of captured raccoons with injuries due to self-mutilation in the CS (25%) was higher than that observed with the EGG (3.3%). The injury performance threshold was 95 points for the EGG (i.e., ≥70% of the raccoons captured in EGG traps could be expected to score ≤95 points with 95% confidence) compared with 220 points for the CS. The EGG is more efficient and humane for capturing raccoons in nondrowning water sets than the CS. On traplines checked daily, the EGG reduces the severity of trap-related injuries compared with the CS and minimizes the incidence of self-mutilation. The EGG is an effective alternative restraining device for raccoons under certain trapping conditions and should be used whenever appropriate circumstances exist.

Key words EGG™ trap, foothold trap, *Procyon lotor*, raccoon, restraining trap, selective trap, trap efficiency, trap injuries, Victor™ coil spring trap

The foothold trap is popular with raccoon (*Procyon lotor*) trappers because it is versatile, efficient, and allows nontarget catches to be released. The sizes most commonly recommended for capturing raccoons are the Nos. 1 and 1½ (Black undated, Boggess and Loegering 1985, Krause undated). In 1992, American trappers reported that 86% of all sets made for raccoons employed foothold traps (Int. Assoc. Fish and Wildl. Agencies 1993).

Raccoons have a tendency to chew captured toes or feet regardless of the type of foothold trap used (Berchielli and Tullar 1980, Tullar 1984). Most severe injuries sustained by raccoons in standard as well as padded foothold traps are caused by self-mutilation (Hubert et al. 1991, Proulx et al. 1993). Thus, traps designed to prevent self-mutilation should reduce the occurrence and extent of injuries to captured raccoons.

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Raccoon in EGG™ trap. Photo by George F. Hubert, Jr., Illinois Department of Natural Resources.

Killing traps theoretically eliminate the possibility of self-mutilation but may not be a viable alternative to restraining devices because they may function inefficiently under certain conditions, present safety concerns, or fail to permit the release of nontarget catches (Boggess et al. 1990). Currently, 16 states that allow raccoon trapping either prohibit or restrict the use of body-gripping (i.e., killing) traps with a jawspread >14 cm to sets which are largely ineffective for raccoons (Fur Resour. Comm., Int. Assoc. Fish and Wildl. Agencies, Washington, D.C., unpubl. data). Also, based on tests with immobilized animals, Proulx and Drescher (1994) reported that it may not be possible to develop a rotating-jaw killing trap for raccoons which meets all performance requirements of the current Canadian National Standard (Can. Gen. Standards Board 1984) for devices of this type. Consequently, there is a need to identify and test new restraining devices for raccoons.

The EGG™ trap (EGG Trap Co., Wagner, S.D.; reference to trade names or companies does not constitute endorsement) is an innovative trapping device specifically designed to preclude self-mutilation by raccoons. Protection from self-mutilation is accomplished by restraining the captured animal's foot in an oval, plastic casing. Proulx et al. (1993) reported that this device successfully held raccoons in a controlled situation for 24 hours without major injuries or self-mutilation. They concluded that the EGG trap was more humane than the foothold trap for capturing raccoons and recommended that this trap be field tested.

We conducted a 1-year field study in Illinois to determine if the EGG trap is an effective, alternative restraining device for capturing raccoons. Our objectives were to compare: (1) the capture efficiency of No. 1 Victor™ coil spring (Woodstream Corp., Lititz, Pa.) and EGG traps set in nondrowning (shallow) water sets for raccoons, and (2) injuries in raccoons captured in both types of traps. We hypothesized that both traps would catch raccoons with equal efficiency and that injuries sustained by captured raccoons would not differ between trap types.

Methods

Study areas and personnel

Our study was conducted 5-30 November 1992 during the legal furbearer trapping season on 5 traplines located in DeKalb, Brown, Cass, Champaign, and Union counties, Illinois, denoted A-E, respectively. Traplines A-D were in agricultural areas on small streams and ditches fed by drainage tiles. Trapline E was located along streams and ponds in forested areas. In all cases, water depth at the trap site was insufficient to drown trapped raccoons. Temperatures during the study ranged from overnight lows of -2° to 10°C to daytime highs of 5° to 15°C.

Five trappers (designated A-E according to the trapline to which each was assigned) were selected on the basis of their skill at trapping raccoons and a willingness to participate. All had extensive experience (>15 seasons) using foothold traps. None had used EGG traps but were provided with the manufacturer's instructions.

Investigations in each area were conducted by the trapper and a technician. Continuous technical supervision was intended to eliminate trapper bias toward specific traps, which might influence capture efficiency (Skinner and Todd 1990). Trappers were responsible for selecting trap locations, making sets, and dispatching or releasing trapped animals. Technicians collected data, marked captured raccoons, and transported specimens to a storage facility.

Trapping devices

The No. 1 Victor coil spring trap (CS) has 2 coil springs and a 9.2-cm jaw spread. A 38-cm anchor chain is attached to 1 end of the base plate with a prebent rivet that acts as a swivel. The smooth steel jaws (unpadded) close completely when the trap is fired. B. F. Tullar, Jr. and F. J. Phillips (A comparative evaluation of two sizes of padded and standard foothold traps for capturing raccoons, unpubl. rep., N.Y. State Dep. Environ. Conserv., Delmar, 1990) reported that use of the CS resulted in significantly fewer, less severe injuries to captured raccoons than the No. 1½ Victor™ coil spring trap (Woodstream Corp., Lititz, Pa.), without a loss in efficiency. Also, many raccoon trappers believe that the small size of the CS results in a high percentage of pad (metacarpal) catches,

EGG™ trap and No. 1 Victor™ coil spring trap. Length of ruler above trap is 38.1 cm. Photo by George F. Hubert, Jr., Illinois Department of Natural Resources.

which reduce escapes and minimize injuries to trapped animals (Black undated, Messineo 1994). The CS cost approximately $63/dozen.

The EGG trap (EGG) consists of a white oval plastic casing 9.5 cm in diameter and 11.4 cm long (Fig. 1). A 51-cm anchor cable is affixed to the base with 2 ferrules which allow the trap to swivel. A 3.8-cm diameter opening at the top of the trap provides access to a pull-trigger mechanism housed in the plastic casing. The trigger releases a 5.7-cm long striking bar (diameter 0.38 cm), which is powered by a single coil spring and moves laterally across the opening to block the animal's paw. The EGG is designed to be selective; only species that grasp and pull up on the trigger can be captured, i.e., raccoons and opossums (*Didelphis virginiana*), but not dogs (*Canis familiaris*), and only rarely cats (*Felis catus*). Cost of EGG traps was $114/dozen.

EGG traps were soaked in water for 24 hours before use according to the manufacturer's instructions. Also, a cotton ball was wired to the trigger of each EGG used on traplines A, B, D, and E. All trappers treated the CS traps according to their customary methods (dyeing and waxing) and made trigger adjustments to insure proper functioning before setting them in the field.

Field procedures

Each trapper was supplied with 12 new CS and 12 new EGG traps, which were placed in pairs about 3 m apart. CS traps were submerged (<15 cm deep) at the entrances of baited pocket sets (Kelm et al. 1981). EGG traps were set in holes dug into streambanks within 25 cm of the waterline. The opening of the EGG was approximately the same distance above the waterline as the center of the bait hole for the CS (Fig. 2). Each trapper was assigned a quota of 20 raccoons and instructed to continue trapping with both types of traps for 10 days or until the quota was reached. This requirement insured that both trap types were used in equal numbers and in all weather conditions.

The same baits and lures (fish and fish oil) were used for all paired sets on a particular trapline. Traps were solidly staked as far away from the bank as the factory anchor system would allow and checked daily, as required by law, beginning early in the morning. Live raccoons were euthanized by shooting in the dorsal cranium with a .22-caliber rimfire firearm. Data relative to captures or animal activity in the vicinity of individual trap sets were recorded when traps were checked. A numbered aluminum tag was attached to each raccoon captured prior to leaving the trap site. All specimens were placed in plastic bags and frozen intact until necropsy.

Necropsy procedures

Raccoons were thawed prior to examination. Standard anterior-posterior and lateral radiographs were taken of all limbs to aid in the detection of small fractures and joint luxations of the digits. Age classes (juvenile, adult) were assigned by examining the condition of the epiphyses of the radius and ulna (Sanderson 1961).

Whole body necropsies were performed using the general procedures described by Onderka et al. (1990). A coded marking system insured that persons performing the radiographic and necropsy procedures did not know what type of trap was used to capture the animal or which limb(s) was held in the trap. If a raccoon had sharp-edged dental injuries, which were not discolored, we assumed the injuries occurred while the raccoon was in the trap.

Scoring injuries

A scoring system was modified from Onderka et al. (1990) to reflect the types of injuries observed for plantigrade species like the raccoon (Table 1). Scores for individual injury types were summed to obtain a total score for each limb (limb score) and the entire animal (whole body score). The range of

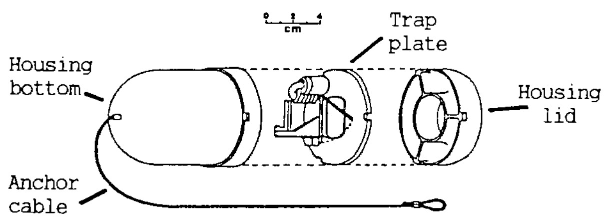

Fig. 1. Diagram of EGG™ trap.

Fig. 2. Paired set used to evaluate raccoon restraining traps in Illinois. For purposes of illustration the traps are set <3 m apart, the anchor stakes for both traps and the EGG™ trap anchor cable are painted white and left exposed, and the No. 1 Victor™ coil spring trap is painted white and exposed above surface of water to show positioning. Length of ruler above traps is 1 m.

points allowed for overlap between categories to accomodate differences in severity of injury and degree of debilitation.

Points were assigned for each category when a particular injury was observed. However, no points for skin laceration were allotted if the laceration was, by definition, part of a higher-scoring injury (e.g., compound fracture, amputation). Tendon damage or fractures which were part of an amputation were not scored separately. For control samples we used the limbs opposite those held by the traps.

Terminology and statistical analysis

A trap *visit* was recorded if an animal disturbed a trap or if a raccoon investigated the set, but failed to step on or pull the trigger of the trap. The number of trap visits was compared between devices to ascertain any apparent differences in raccoon behavior, which might arise either from differences in devices or varying trap-setting skills of trappers.

We defined *capture*, *escape*, and *capture efficiency* according to Skinner and Todd's (1990) terminology. A *capture* took place if an animal was trapped and held until the next trap check. An *escape* occurred if an animal was caught at least temporarily, but was not present when the trap was checked. *Raccoon capture efficiency* equaled raccoon captures/1,000 trap nights (TN).

We altered Linscombe and Wright's (1988) nomenclature by defining *potential captures* as the sum of: (1) all animals captured, (2) any animals that were temporarily caught but escaped, (3) all animals that sprung traps but were not captured, (4) any animals that moved a trap but did not spring it, and (5) those raccoons that investigated a set, i.e., left tracks at the set, but did not move the trap. We included only those animals that moved a trap (as opposed to animals that contacted any part of a device, see Skinner and Todd [1990]) because conditions of our experiment did not allow us to detect contact with a CS trap unless its position was altered. We also counted raccoons that investigated a set without moving a trap as potential captures because the likelihood of a raccoon activating the pan or trigger may be affected by the location of the bait in relation to the device when comparing the EGG with a standard foothold trap. *Potential raccoon captures* were potential captures minus the number of other animals caught. Subsequently *raccoon capture rate* was defined as the number of raccoon captures/potential raccoon captures.

A 2-step approach was used to analyze various aspects of trap performance. Cochran-Mantel-Haens-

Table 1. Point scores assigned to injuries of raccoons (*Procyon lotor*) trapped in Illinois during November and December 1992 in EGG™ and No. 1 Victor™ coil spring traps.[a]

Description of injury	Points Scored
Apparently normal	0
Edematous swelling and/or hemorrhage	1–5
Avulsed nail	5
Cutaneous laceration ≤2 cm long	5
Cutaneous laceration >2 cm long	10
Permanent tooth fracture exposing pulp cavity	10
Subcutaneous muscle laceration or maceration	10–20
Tendon or ligament maceration with partial severance	20–40
Damage to periosteum	30
Partial fracture of metacarpi or metatarsi	30
Fracture of digits - hind foot or digits 2,3,4,5 on fore foot	30–40
Fracture of digit 1 on fore foot	50
Joint luxation of digits	50
Simple fracture below carpus or tarsus	50
Damage or severance of tendons below carpus or tarsus affecting hind foot or digits 2,3,4,5 on fore foot	20
Damage or severance of tendons below carpus affecting digit 1 on fore foot	50
Amputation of digits - hind foot or digits 2,3,4,5 on fore foot	30–40
Amputation of digit 1 on fore foot	50
Compound fracture below carpus or tarsus	75
Subluxation at carpus or tarsus	100
Simple fracture above carpus or tarsus	100
Compound fracture above carpus or tarsus	200
Luxated elbow or hock joint	200
Amputation of limb	400

[a] Points were summed to obtain a total score for each limb and each animal.

zel (CMH) stratum-adjusted chi-square statistics (Breslow and Day 1980:136–142) were used to compare outcomes, controlled for individual trapper differences, when the Breslow–Day test (Breslow and Day 1980:142–146) showed homogeneity between strata. In this manner we compared trap visits, potential raccoon captures, raccoon capture rate, trap disturbance without firing, trap firing without a catch, escapes, and the number of nonraccoons captured. Results for individual trappers were then analyzed separately using Fisher Exact tests (Fleiss 1981:24–26). We also used the Fisher Exact test to compare raccoon capture efficiency, and the incidence of self-mutilation, injury scores ≥50, oral injuries, and front foot captures between trap types. Injury scores were compared between trap types using the Mann–Whitney U test (Zar 1984:138–146). A Friedman's ANOVA (Zar 1984: 228–230) was used to compare injury scores among trappers and among raccoons based on age, position of catch, limb captured, and presence or absence of self-mutilation. The difference between the total injury score and trapped-limb injury score was analyzed using the Wilcoxon signed rank test (Zar 1984:153–156). An *injury performance threshold* (IPT) was determined for each trap on the basis of a 1-tailed binomial test (Zar 1984:383–384) as suggested by Proulx et al. (1993). At a 95% level of confidence, ≥70% of the raccoons captured in the trap in question can be expected to have a total injury score ≤ the IPT, when the raccoons are caught on traplines that are checked daily. We considered $P < 0.05$ to be statistically significant.

For comparisons that did not yield statistically significant differences, the minimum detectable difference (δ) was determined to allow evaluation of study power. This was calculated based on the actual sample sizes, observed standard deviations or proportions, an α level of 0.05 and power ($1 - \beta$) of 0.80 (Hintze 1991).

All research procedures and the protocol were approved by the Laboratory Animal Care Advisory Committee of the University of Illinois, Champaign-Urbana.

Results

Trap performance

One hundred raccoons (134/1,000 TN) were trapped under conditions specified for efficiency testing (Table 2). Raccoon capture efficiency of the EGG was 1.7 times that of the CS. Both traps captured a similar number of raccoons (range = 9–13 animals) on 3 traplines. In contrast, the EGG (16 and 15 raccoons) performed more successfully than the CS (4 and 3 raccoons) for Trappers A and B, respectively ($P = 0.008$, *Fisher*; $P = 0.005$, *Fisher*). During 1–15 December 1992, Trapper E captured an additional 3 raccoons in the CS, which were subsequently necropsied for injury analysis.

The majority of raccoons captured in the CS (89%) and the EGG (90%) were alive when the traps were checked. One of 10 raccoons found dead at the time of trap check had been killed by a predator. The other 9 apparently died from hypothermia.

Raccoons were more likely to be captured by a front paw in the EGG compared with the CS ($P < 0.001$, *Fisher*). All EGG captures ($n = 63$) involved front paws compared with 81% for the CS ($n = 37$). Eight (13%) of the raccoons caught in the EGG were held by both front feet; none were caught by both front feet in the CS.

Trap disturbance without firing was recorded on 21 occasions for the EGG compared with 14 for the CS (Table 2). Both traps failed to fire a similar number of times on Traplines A, B, D, and E ($P = 0.318$, *Fisher*; $P = 0.238$, *Fisher*; $P = 1.000$, *Fisher*; and $P = 0.648$, *Fisher*; respectively). However, Trapper C experienced 16 such failures with the EGG versus 6 with the CS ($P = 0.019$, *Fisher*).

Thirteen of the 15 other animals caught were legal furbearers. One dog and 1 cat were caught and released unharmed. Nine opossums and the cat were taken in sets employing the EGG. Three opossums, a mink (*Mustela vison*), and the dog were trapped with the CS.

Injuries to raccoons

A total of 102 raccoons was examined to assess trap-related injuries. One raccoon caught in an EGG was omitted from the injury analyses because it was lost in storage. No neck, shoulder, or chest injuries were encountered. The only pelt damage recorded was in the 1 animal that was killed by a predator while in an EGG.

The total (whole body) as well as the trapped limb only injury scores for raccoons captured in the CS were greater than for those caught in the EGG (Table 3). Also, for both trap types combined ($n = 102$), injury scores based only on the limb(s) in the trap were lower than the total injury scores ($S = 770$, $P < 0.001$). The untrapped (control) limb score was 0 for 38 (70%) of the raccoons captured in the EGG and 0 for 34 (85%) of those taken in the CS. Six EGG and 2 CS control limbs had injury scores >10; the injuries related to 4 and 2 of these, respectively, were apparently sustained while the control limb was held temporarily in the trap along with the limb by which the raccoon was captured. The remaining control limbs had minor injuries such as edema or skin lacerations which may or may not have been related to the trapping event.

The 2 traps caused noticeably different types of injuries to raccoons (Table 4). When oral injuries oc-

Table 2. Trapping events and raccoon (*Procyon lotor*) capture data for 2 restraining traps used in Illinois, November 1992.

Item or event (n)	EGG™	No. 1 Victor™ coil spring	P[a]	δ[b]
Trap nights (746)	373	373	—	
Raccoons caught, held (100)	63	37	—	
Sets visited (195)	102	93	0.435	0.09
Potential raccoon captures (180)	92	88	0.589	0.09
Raccoon capture efficiency[c]	169	99	0.007	
Raccoon capture rate %[d]	68	42	0.001	
Trap disturbed, did not fire (35)	21	14	—[e]	
Trap fired, failed to catch an animal (45)	8	37	<0.001	
Animals caught, escaped (36)	7	29	<0.001	
Non–raccoon captures (15)	10	5	0.143	0.04

[a] P = significance level of fisher's Exact test (raccoon capture efficiency) or CMH χ^2 statistic controlling for trapper (remaining comparisons) testing differences between trap types.

[b] δ = minimum detectable difference between proportions for trap types based on α = 0.05, power $(1 - \beta)$ = 0.80, actual sample sizes and actual proportion for coil spring trap.

[c] Raccoon captures/1,000 trap nights.

[d] (Raccoon captures/potential raccoon captures) x 100.

[e] CMH χ^2 statistic not appropriate due to significant stratum differences (Breslow–Day test $P < 0.05$); see text for individual trapper analyses.

curred, they were limited to permanent tooth fractures which exposed the pulp cavity in all animals except one. The single exception was a split mandible in a raccoon trapped in a CS. This injury may have occurred post-euthanization because no edema or lacerations were noted at the fracture site. The frequency of oral injuries did not differ between trap types (P = 1.000, *Fisher*).

The proportion of raccoons with an injury score ≥50 was greater for the CS than for the EGG (P < 0.001, *Fisher*; Table 5). No differences in total injury scores existed among trappers (F = 1.05, 4 df, P = 0.388) or by position of catch, i.e., toe, pad, wrist-ankle, leg (F = 1.09, 3 df, P = 0.358). The total injury scores for juveniles (n = 49) failed to differ from those for adults (n = 53; F = 0.18, 1 df, P = 0.670). In addition, the total injury scores for raccoons captured in the CS by a front limb (n = 32) did not differ from those for hind limb (n = 8) catches (F = 0.63, 1 df, P = 0.434).

Self-mutilation of the trapped limb was observed in 12 of the 101 raccoons examined and resulted in higher (F = 5.59, 1 df, P = 0.020) total injury scores than those for raccoons which did not exhibit this behavior. The average total injury score for the raccoons with injuries caused by self-mutilation was 244 compared with 62 for those without such injuries. The proportion of self-mutilated and nonmutilated raccoons in the CS (10 and 30 animals, respectively) was higher (P = 0.001, *Fisher*) than that observed with the EGG (2 and 59, 1 unknown). All 10 that had injuries caused by self-mutilation in the CS chewed their toes on the trapped limb distal to the point of trap attachment. The 2 EGG-trapped raccoons with injuries caused by self-mutilation chewed their legs proximal to where the trap held the limb.

We calculated an IPT of 95 points for the EGG (i.e., based on our study, ≥70% of the raccoons captured in EGG traps could be expected to score ≤95 points with 95% confidence). The CS had an IPT of 220.

Discussion

New or improved trap designs that reduce injury must maintain a reasonable level of efficiency compared with traps currently in use if they are to be readily adopted by fur trappers (Warburton 1982). Capture efficiency is influenced by trapper experience (Skinner and Todd 1990). Normally a trapper is more efficient when using a familiar trapping device. However, in our study the overall raccoon capture ef-

Table 3. Injury scores assigned to raccoons (*Procyon lotor*) captured in 2 restraining traps in Illinois during November–December 1992 and to limbs not held in traps (control).

Injury score	EGG™ $\bar{x}$	EGG™ SD	EGG™ n	No. 1 Victor coil spring™ $\bar{x}$	No. 1 Victor coil spring™ SD	No. 1 Victor coil spring™ n	Z[a]	P	δ[b]
Total (whole body)	68	99	62	116	87	40	3.598	<0.001	
Trapped limb(s) only	52	89	62	96	92	40	3.177	0.002	
Oral	1	5	62	3	16	40	−0.269	0.788	7.29
Control	13	37	54	4	12	40	−1.305	0.192	14.38

[a] Mann–Whitney U test for differences in injury score between trap types.

[b] δ = minimum detectable difference in injury scores between trap types based on α = 0.05, power $(1 - \beta)$ = 0.80, actual sample sizes and standard deviations for uniformly distributed data.

Table 4. Injuries of raccoons (*Procyon lotor*) captured in 2 restraining traps in Illinois during November–December 1992.

Description of injury[a]	Trap: EGG™ (n = 62)	Trap: No. 1 Victor™ coil spring (n = 40)
Apparently normal	5 (8.1)[b]	1 (2.5)
Edematous swelling and/or hemorrhage	125 (82.3)	95 (92.9)
Avulsed nail	7 (8.1)	4 (10.0)
Cutaneous laceration ≤2 cm long	47 (37.1)	52 (57.5)
Cutaneous laceration >2 cm long	3 (3.2)	1 (2.5)
Permanent tooth fracture exposing pulp cavity	8 (8.1)	1 (2.5)
Subcutaneous muscle laceration or maceration	2 (3.2)	2 (5.0)
Tendon or ligament maceration with partial severence	7 (4.8)	4 (7.5)
Damage to periosteum	19 (22.6)	33 (42.5)
Fracture of digits - hind foot or digits 2,3,4,5 on fore foot	9 (9.7)	17 (25.0)
Fracture of digit 1 on fore foot	3 (4.8)	0
Joint luxation of digits	9 (9.7)	12 (22.5)
Simple fracture below carpus or tarsus	0	5 (2.5)
Damage or severence of tendons below carpus or tarsus affecting hind foot or digits 2,3,4,5 on fore foot	6 (6.5)	3 (7.5)
Damage or severence of tendons below carpus affecting digit 1 on fore foot	1 (1.6)	0
Amputation of digits - hind foot or digits 2,3,4,5 on fore foot	0	23 (17.5)
Amputation of digit 1 on fore foot	0	3 (7.5)
Subluxation at carpus or tarsus	1 (1.6)	1 (2.5)
Simple fracture above carpus or tarsus	4 (4.8)	1 (2.5)
Amputation of limb	2 (3.2)[c]	0

[a] Each injury category is considered separately.
[b] Numbers in parentheses indicate percentage of raccoons with injury. Each injury category is considered separately and a raccoon may be represented in >1 row. Total percent exceeds 100.
[c] Injury recorded as amputation of limb even though amputation not complete.

ficiency of the EGG was significantly better than the CS in spite of the fact that none of the trappers had previously used the EGG.

More than 76% of the instances of trap disturbance without firing for the EGG were recorded on trapline C. We believe this problem may have resulted from Trapper C's failure to wire cotton balls to the triggers of his EGG traps according to the manufacturer's instructions (i.e., the EGG should be baited by tying a cotton ball, sponge, tissue, or ball of soft cellophane to the trigger, and applying a liquid such as honey or syrup onto the trigger ball and around the lid opening).

The EGG was easy to operate; it could be baited and pre-set prior to placement in the field thus reducing time spent on the trapline. However, when an animal was captured, the space between the trap lid and housing frequently was packed with mud or sand, making disassembly of the trap and removal of the animal somewhat difficult. This problem is addressed in the manufacturer's instructions and can be solved by securing the lid with 2 No. 8 x 1.27-cm hexhead sheet metal screws and bypassing the tab-locking system. Our cooperating trappers found the EGG safe to use and durable.

Injury scores >50 points indicate serious damage, and those >125 are considered severe damage (Olsen et al. 1988). Proulx et al. (1993) reported the EGG was considered humane for trapping raccoons in simulated natural environments. All 9 of the raccoons they captured in the EGG sustained minor injuries (≤20 points) over a 24-hour capture period. However, Proulx et al. (1993) cautioned that raccoons captured on traplines may be approached by other animals. Their behavior in the wild may differ from behavior in enclosures and may result in higher injury scores.

During our field study, the EGG failed to perform as well from an injury standpoint as it did in Proulx et al.'s (1993) simulation tests. Nevertheless, we found this device substantially reduced the frequency of serious and severe injuries in raccoons when compared with the CS. The IPT of the EGG was also lower than that of the CS. Thus, the EGG is a more humane device for capturing raccoons.

Self-mutilations are common in raccoons caught in unpadded and padded foothold traps (Berchielli and

Table 5. Cumulative injury scores[a] assigned to raccoons (*Procyon lotor*) captured in 2 restraining traps in Illinois during November–December 1992.

Trap	n (%)	Injury–score classes: 0–15	20–45	50–80	85–120	125–395	≥400
EGG™	62 (100)	24 (39)	15 (24)	8 (13)	6 (10)	7 (11)	2 (3)
No. 1 Victor™ coil spring	40 (100)	7 (18)	3 (8)	5 (12)	10 (25)	15 (37)	0 (0)

[a] Point scores provided in Table 1.

Tullar 1980, Tullar 1984, Hubert et al. 1991). Berchielli and Tullar (1980) observed injuries due to self-mutilation in 33% (n = 18) of the raccoons captured with unpadded No. 1½ coil spring traps. In contrast, Tullar (1984) reported none of 12 raccoons trapped with padded-jaw No. 1½ coil spring traps had injuries caused by self-mutilation, but 24% (n = 17) of those caught with the unpadded No. 1½ coil spring did. This difference was not significant at the 95% confidence level. Hubert et al. (1991) observed self-mutilation of the trapped limb in 29% (n = 99) of the raccoons captured using unpadded No. 11 Montgomery™ (Montgomery Traps, Inc., Mahaffey, Pa.) and padded No. 1½ Soft Catch™ (Woodstream Corp., Lititz, Pa.) foothold traps, and stated the frequency of self-mutilation did not differ between the 2 devices. In simulated natural environments, none of 18 raccoons trapped using the EGG, and 6% (1 of 18) captured in the padded No. 1½ Soft Catch, sustained injuries resulting from self-mutilation (Proulx et al. 1993). In our study, 25% of the raccoons caught in the CS had injuries due to self-mutilation compared with 3.3% in the EGG. The EGG significantly reduces the incidence of self-mutilation and thus represents a major improvement over unpadded and padded foothold traps.

Use of a different trapping system may make it possible to further reduce the incidence of self-mutilation among raccoons captured in the EGG. Proulx et al. (1993) anchored the EGG to a tree above ground level. This arrangement did not allow raccoons to use their captured limb for support; the trapping system we used did. With Proulx et al.'s (1993) set, no part of the trap could become entangled around the anchor point; in our study, the trap's anchor cable sometimes was found twisted around the stake thereby restricting the trapped animal's movements. We believe the 2 raccoons we caught in EGG traps that sustained injuries due to self-mutilation represent unusual cases. We are not aware of other reports of self-mutilation by raccoons proximal to the point of trap attachment.

At least 2/3 of the control-limb injury scores >10 that we recorded for raccoons captured by 1 foot in the EGG apparently were sustained while the control limb was temporarily held in the trap along with the limb by which the animal was captured. We hypothesize further reduction of physical trauma to raccoons captured in the EGG may be possible if care is taken to avoid sets which allow the trapped raccoon to wrap the anchor cable around something solid and use its hind legs for leverage to pull its foot from the trap. The manufacturer's instructions and Davis (1993) caution that entanglement of the anchor cable may result in escapes.

Previous reports, with the exception of Proulx et al. (1993), of trap-related physical trauma in raccoons have presented injury data based on the limb held in the trap (Tullar 1984, Olsen et al. 1988, Saunders et al. 1988, Hubert et al. 1991). Such studies fail to tabulate all trap-related injuries. Whole body necropsies must be conducted to insure that all trap-related physical trauma is considered.

At least 6 injury scoring systems have been published (Tullar 1984, Olsen et al. 1986, Olsen et al. 1988, Onderka et al. 1990, Warburton 1992, this study). It is difficult to compare results of studies using different scoring systems and different trap sets used under different environmental conditions, or to apply to 1 species the trap acceptance criteria developed for another species. We agree with Linhart et al. (1986) that research is needed to develop standard tests for restraining traps to permit comparative analyses.

Management and research implications

Standards for restraining traps have not yet been established (Proulx and Barrett 1991). However, at least 3 aspects of trap performance should be taken into account when such standards are developed. The trap should be as humane as possible and minimize trauma in the animals being held (Olsen et al. 1988, Proulx et al. 1993). The trap should also be capture-efficient to promote acceptance by trappers (Novak 1987). Finally, trap selectivity is important because it directly affects trap efficiency (Boggess et al. 1990).

The EGG is more efficient than one of the foothold-ing devices typically employed by raccoon trappers, at least in the trapping system we tested. It substantially reduces physical trauma and the frequency of self-mutilation in captured raccoons compared with unpadded and padded foothold traps. Its design is also relatively selective for raccoons. Therefore, the EGG appears worthy of promotion by wildlife professionals as an alternative restraining device for raccoons under certain trapping conditions.

Skinner and Todd (1990) commented that a study of capture efficiency requires large samples, massive effort, and a long time period to assess trap performance over a variety of field conditions. Broad geographic scope and relatively large numbers of participants are needed if the field performance of a trap is to be assessed accurately. We agree and suggest the EGG be field tested in other portions of the raccoon range using different sets, baits, and anchoring systems. Finally, research to evaluate the performance of other restraining traps designed to preclude self-mutilation by trapped raccoons (e.g., Dog-Proof (DP™) Coon Trap, DP Trap Co., Willits, Calif.) is needed.

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George F. Hubert, Jr. (photo) has been a Wildlife Biologist with the Illinois Department of Natural Resources' (IDNR) Furbearer Program for 21 years and an Affiliate Research Scientist in the Center for Wildlife Ecology, Illinois Natural History Survey for 7 years. He has an M.S. in Wildlife Biology from Colorado State University. An active TWS member since 1968, George is a Certified Wildlife Biologist, past president of the Illinois Chapter, past secretary of the North Central Section and currently serves as interim-chair of TWS' Furbearer Working Group. His professional focus is on the management and ecology of furbearers, trap tech-

nology, wildlife census techniques, and public education about natural resource management. ***Laura L. Hungerford*** is an Associate Professor of Veterinary Epidemiology at the University of Illinois, College of Veterinary Medicine, and an Affiliate Research Scientist in the Center for Wildlife Ecology, Illinois Natural History Survey. She received her B.S. and D.V.M. from Michigan State University and her M.P.H. and Ph.D. from the University of Illinois. Her research interests include analysis of disease patterns in wild populations and assessment of potential for transmission of pathogens from wildlife to humans and domestic animals. ***Gilbert Proulx*** is Director of Science for Alpha Wildlife Research & Management Ltd. and Adjunct Professor in the Department of Renewable Resources at the University of Alberta. Formerly, he was Manager of the Wildlife Section of the Alberta Research Council from 1989 to 1993. He has a Ph.D. from the University of Guelph and is a Certified Wildlife Biologist. Gilbert's research interests relate to mammalian ecology and wildlife management philosophy and practice. ***Robert (Bob) D. Bluett*** is a Wildlife Biologist for the IDNR and has supervised the Division of Wildlife Resources' Furbearer Program since 1993. He received his B.A. from Ripon College and M.S. in Wildlife Management from the University of Wisconsin-Stevens Point. Bob is a Certified Wildlife Biologist and currently serves as president of the Illinois Chapter TWS. ***Laurel Bowman*** received her B.A. from William Woods College and her B.V.Sc. and D.V.M. from the University of Illinois. She has research and clinical experience with native and exotic wildlife. Laurel's current position is as an Associate Veterinarian at the Cat Clinic of Omaha, Nebraska.

Associate Editor: Brennan

Exhibit 17

Dorothy Slaugh
Dennis Slaugh

Vernal, Utah 84078

December 6, 2006

Peter DeFazio
151 W. 7th, Suite 400
Eugene, Oregon 97401

Dear Congressman DeFazio:

On May 4, 2003, my husband Dennis Slaugh was shot with an M-44 sodium cyanide ejector at Cowboy Canyon, Bonanza Utah, in Uintah County. We had been RV-ing on a late Easter family camp out. The weather was good, so going off-road was a perfect option on this weekend. We are avid rock hounders, so at about 8:30 a.m. we were off rock hunting--looking for rocks, fossils, and old bricks from an old brick factory in the bottom of the canyon. We were about halfway to the bottom of the canyon when Dennis and his brother Deloy Slaugh decided to get off the ATVs and look around. They were looking and walking about when Dennis saw an object on the ground. To him it looked like a surveyor's marker and being that his brother was a surveyor, Dennis brushed across the top of it to see what township and range it was when he heard a loud pop. It exploded in his face hitting him on the right side of his chest then glancing off and hitting the right side of his face and getting into his eye. It was an orange or pink powder, his eyes were burning, lips tingling, and it felt like small rocks or gravel hitting his lips. He began wiping the powder stuff off. By then Deloy saw what had happened and came over to see what was going on. There were no signs or warning devices so he really didn't know what had hit him. Dennis was disoriented and Deloy kept asking him questions but he was out of it for a while. Then they realized that Dennis must have triggered some predator's bait.

After a while Dennis could start talking to Deloy telling him what had happened. He told him that he still had some of the powder on his face, so Deloy wiped the rest of it off. We went to see what had happened and we thought it was some sort of bait. We had heard of cyanide traps but we felt sure they had been banned years ago. M-44 cyanide traps set on public or private lands are triggered when pulled on by a curious rock hound or by a child or pet that could not read a warning sign even if one existed. A lethal dose of cyanide is fired forcefully at the unsuspecting victim. The poison is delivered instantly and you could die instantly, or, like my husband you can suffer for many years, and have your life cut short.

I heard of a similar accident that happened to a couple in Utah in which they lost a beloved pet German Shepard named "Max". They told me of an organization--Predator Defense--with Brooks Fahy, executive director. Mr. Fahy is actively seeking a ban of M-44 cyanide traps. I would like to express my support of this organization's efforts to have these devices banned. I can personally attest to the horrific results produced by M-44s.

We sought legal advice from an attorney, but to no avail, because they did not know where to lay blame. But, I do because I have in my possession the actual M-44 weapon that is clearly marked property of the U.S. Government. I would like to see a ban on the M-44's and to have all the M-44's cleaned up across the country.

We had no warning of the presence of cyanide traps on the public lands in this area where we go camping and have fun riding ATVs. Before my husband was shot with the M-44 I had never heard of the USDA APHIS Wildlife Services program that uses poison to control coyote populations. I have learned the hard way watching my husband suffer every day of his life. It is now getting hard for him to breath and he has many other medical problems--he is in and out of the hospital. He says he would have been better off if the cyanide had killed him because he would not have to endure so much suffering.

I don't want anyone to ever succumb to the same inhumane death or near deaths that have been endured. I don't want another wife, mother, child, husband, father, grandparent, or pet owner to suffer the same type of loss. Falling victim to the effects of cyanide released from an M-44 device causes much pain and suffering.

I am asking that you please take a few minutes to hear my plea and help Brooks Fahy and Predator Defense ban the M-44. I believe that you will find my husband's story portrays actual, devastating results of M-44 use on our public and private lands across this country. His story fortifies the battle waged by Predator Defense against these devices. My hopes are that you will support this battle and submit a bill to Congress to ban all M-44 devices.

I thank you for your time. And I give great thanks for your past and present efforts to prevent the use of M-44s and other poisons on our lands. Please continue your efforts and work to ban the M-44 and other poisons.

Respectively,

Dorothy Slaugh

DOROTHY SLAUGH
cc: Brooks Fahy, Predator Defense

Exhibit 18

Amanda Kingsley

Port Townsend, WA.   98368

January 9th 2007

Congressman Peter DeFazio
151 W. 7th, Suite 400
Eugene, OR. 97401

Dear Congressman DeFazio:

This is a hard letter for me to write as it drags out memories of an event from which I am still trying to recover. But for those very reasons, drag I will -- in hopes that you will work in Congress for a ban on the M-44 poison traps used by the USDA APHIS Wildlife Services Program (WS). I hope if we can get M-44s and other irresponsibly used poisons out of the hands of WS it may save other people from suffering similar or worse nightmares.

In the fall of 1994 my fiancé and I were living on a farm north of Eugene that has been passed down to me through four generations of my family. We moved down to begin restoration on the property's 125 year-old farmhouse. We had many wonderful experiences while living in the Willamette Valley but it's hard to not let it all be overshadowed by one event. While walking our dog across the middle of my property she came upon an M-44 coyote trap set in the grass by Federal agents. She died horribly of cyanide poisoning with us kneeling beside her in the mud. In the process of trying to help her I was also exposed to cyanide and according to poison specialists am lucky to be alive.

When we moved down from Seattle we were trying hard not to be dumb city people and were grateful for advice from our Oregon friends and relatives about the dos and don’ts of life in the Valley. Everyone warned us that loose-running dogs would likely be shot by livestock farmers so the first thing we did upon arriving was to fence the yard for our two dogs, Jake and Ruby. Even on our own property we were always with the dogs and usually had them on leashes. The one thing no one thought to mention was the poison traps set out by Wildlife Services.

October 28th the rain gave way to a beautiful fall afternoon so we leashed the dogs and took them on a long walk across the property to play in Pierce Creek. Coming home we crossed the creek that runs across the middle of my land, less than1/4 mile from the house. I stopped to pick wild mint and Michael started on across the last field towards the house. The dogs were wandering in the ditch near me; when I saw Ruby rolling on her back in the grass I laughed thinking she was playing. She got up then and started following Michael but suddenly dropped over on her side and was kicking at the mud. My heart went to my throat; I knew something was extremely wrong.

I threw down everything I was carrying and screamed for Michael. We both ran to Ruby. Her eyes were rolled back; she was in violent convulsions and was having trouble breathing. There was a strong, chemical smell -- sharp and metallic. We immediately suspected poison and I bent near her mouth and inhaled deeply to try and identify the smell or to be able to describe it to a vet or medic. It didn't occur to me right then that it might be poison gas and that I shouldn't breath it. Ruby was gasping and crying with her head arched back, eyes wild, fighting for air. Her strong legs thrashed and with every choking breath she let out a screaming moan. Ruby, who had always seemed impervious to any kind of pain, was suffering terribly. She was foaming at the mouth and her tongue was hanging limp in the dirt. I reached in her mouth to make sure her windpipe was clear and she bit my hand hard in her panic and convulsions. Michael began to run the 1/4 mile back to the house to get the van and call a vet. I knelt in the mud shaking and trying to get our big girl to keep breathing. More than anything I felt devastatingly helpless. As minutes ticked by she struggled less and less and breathed less and less, but when I would call her name sharply she would always gasp in one more breath. Just as Michael got back with the van -- it must have been fifteen minutes – Ruby stopped breathing. We briefly tried to do CPR on her (through a plastic tube pushed down her throat) but it was clearly over.

According to Wildlife Services, death by M-44 cyanide is supposed to take about 45 seconds. It took ten or fifteen agonizing minutes for our dog.

We sat there in the mud sobbing, in absolute disbelief; it was hard to reconcile that such a sweet landscape could be hiding something so terrible, something that could strike down our mighty friend so quickly. Michael searched the grass where she had first rolled over and found the detonated trap as well as the tiny sign warning that it was sodium cyanide. Both sign and trap were completely buried in tall grass. We then washed our hands in the creek and that's when Michael saw that I had been bitten. Fresh blood was running from a puncture wound on my right hand. With all my attention on Ruby, I hadn't even thought about it. It suddenly occurred to both of us that we didn't know how cyanide worked and that I probably had it in my system by then. We ran to the van and raced for the farmhouse to call 911.

During the seemingly endless ride across the field my heart began to race and I started to feel light headed and nauseous. I was getting tunnel vision and was struggling not to pass out. I usually do all right in a crisis but at that point panic set in. Here we were, 25 miles from a hospital, having just watched a very tough animal that weighed the same as I do die horribly and fast. For the first time in my life I thought I was going to die.

The 911 Operator told Michael that basically if I was still alive at that point then I'd probably be all right. They said to clean the wound and stay close to a phone. At that point I assumed that my reaction, which was beginning to subside, must have just been panic.

First thing Monday morning I tried to reach the Linn County Wildlife Services trapper. He called me back later in the day to say that he was very sorry and that he had removed all poison from my property early that morning after getting the call from our farmer. He told me of several other incidents that year where similar "accidents" had killed other dogs in the area. That did not make me feel better. He also said not to worry, that the traps “are never harmful to people”.

In the months following Ruby's death I had various symptoms that were worse in the first few weeks and slowly improved. I had an unusual metallic taste in my mouth and my heart never seemed to beat at a normal rate. I had never had insomnia until then, but my heart was pounding so hard at night I couldn't get to sleep. For the first few nights I was afraid that if I did fall asleep I'd have a heart attack. My arms started tingling and going numb, which I don't remember ever happening before. They'd fall asleep from the shoulders down any time I sat still for more than a few minutes. Months later when I finally called the Washington State Poison Center hotline I was told: "what you're describing are the classic symptoms of low-level cyanide exposure." They said the numb arms were an example of the temporary neuralgic problems that cyanide can bring on. They also said they were surprised that I was alive to talk about it.

When I asked Wildlife Services how the traps could be on my land without my permission they said that they had the consent of the Farmer that leases part of my farmland and that it should have been his responsibility to notify me. They explained that for them to try to obtain the consent of property owners would be "too difficult". (The "difficulty," I was told, was that many owners live out of the area and it would be too much hassle to track them down). It blew my mind that could poison my land without even *notifying* me. At the very least one would think that with a residence so near the trap site it would be mandatory to notify the homeowner so that whoever was living there would be warned of the danger to their pets and families. It's preposterous to claim that M-44s pose no danger to children. I was a kid who liked the salt licks my grandparents put out for their cows and I would certainly have closely investigated any mysterious post poking out of the grass.

In my dealings with Wildlife Services following our loss I was stunned at their lack of accountability. If this sort of "accident" happens once or many times one would think there would be some sort of review process to help prevent it from happening again -- especially in cases like ours where the traps were in violation of several Wildlife Services regulations. (They installed the trap beside a stream, there were no warning signs at the nearest property entrance, no effort made to notify the family living in the house nearby, and the warning signs on the trap were completely obscured by thick brush and grass.) It took many months and a lot of noise on my part before I ever received a letter of regret about the incident from Wildlife Services (although no admission of any error on their part). In spite of the fact that we were walking our dog, the only record WS made of the event was that a "loose running dog" was poisoned. In sheep country, *loose running dogs* are considered predators so I'm sure that categorization is one more way for WS to make her death seem justifiable for their year-end tally.

Within a week or two of Ruby's death I located Brooks Fahy and Predator Defense in Eugene. I don't know what I would have done without them as a source of support and straight information as I have struggled over the years to make *something* good come out of this terrible business.

During that first year I mounted the best protest I could, writing to Wildlife Services and every politician I could think of. Thanks (no thanks) to the incredible lobbying power of WS and the ranching industry my letters and protests fell on deaf ears. It was extremely disillusioning. My dealings with WS proved them to be an arrogant and extremely short-sighted agency experimenting with dangerous chemicals at the risk of many. For decades WS has operated with almost complete impunity, which means they don't have to be smart or careful in what they do, and they aren't. In response to complaints the WS simply denied each and every violation and it came down to my word against theirs.

I continue to feel bitter about a Federal government that would support such an agency and sad that Oregon, my ancestral homeland, may never again feel like the haven it always was for me growing up. I don't have a good solution for the centuries old coyote/sheep issue, but neither does Wildlife Services. From everything I've read, their efforts don't significantly reduce wildlife predation and I fail to see the sense in perpetuating a program that not only doesn't solve the problem but creates a whole set of new ones by littering an otherwise peaceful environment with land mines that wait indiscriminately for whoever happens along.

Sloppy *and* lethal: a losing combination.

I'm not contesting a farmer's right to protect his or her own livelihood, but why should the government and taxpayers be doing it for them, and with such a broad-sweeping, unaccountable and clearly dangerous approach? The Wildlife Services program is reminiscent of the bad old days of wild animal genocide in the 19th century American west -- with bounties on wolves and shooting buffalo from trains; it's just astounding to me to realize that this is still going on, and in my own back yard.

I like to think I'm pretty tough and resilient, so it's hard for me to admit this sort of thing, but the whole event left me dealing with many months of anxiety attacks and what turned out to be Post Traumatic Stress Disorder. I've been troubled by bouts of depression ever since, and it's been 12 years.

Predator Defense has my undying gratitude for all the support they have given me when there was none other to be found. They seem to the only group in the region that's watch-dogging Wildlife Services or insisting on accountability for their continuing "accidents" and violations. I continue to be impressed by the guts and tenacity of Predator Defense in taking on a nasty Goliath of an agency.

From my own experience I know what a battle it will be to get these poisons out of the grip of Wildlife Services. I greatly hope you will support the efforts of Predator Defense and introduce the legislation to ban any further use of M-44s on public and private lands.

I appreciate your record in fighting the use of other poisons in the past and I thank you ever so much for your consideration of this issue.

Sincerely,

Amanda Wood Kingsley

cc: Brooks Fahy, Predator Defense

Exhibit 19

TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY

PETITION TO CANCEL REGISTRATIONS OF M-44 CYANIDE CAPSULES (SODIUM CYANIDE)

EPA REGISTRATION NOS. 56228-15, 35978-1, 35975-2, 39508-1, 33858-2, 13808-8 & CA840006

Photo by Tom Koerner, USFWS.

AUGUST 2017

AUTHORED BY:

WILDEARTH GUARDIANS
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Via Electronic and Certified Mail

August 10, 2017

Mr. Scott Pruitt, Administrator
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Ms. Wendy Cleland-Hamnett, Acting Assistant Administrator
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Dear Administrator Pruitt, Acting Assistant Administrator Cleland-Hamnett, and Acting Director Keigwin,

WildEarth Guardians, the Center for Biological Diversity, and several other wildlife and animal protection organizations seek a ban on use of M-44 cyanide capsules (sodium cyanide) in the lower 48 states. Sodium cyanide is a highly toxic pesticide registered for restricted use under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. §§ 136 et seq.[1] Sodium cyanide is used in M-44 ejector devices — also known as "cyanide bombs" — to kill coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), and wild dogs suspected of preying on livestock.

Because of the dangers posed by sodium cyanide to wildlife and people, we hereby petition the U.S. Environmental Protection Agency (EPA), with respect to sodium cyanide registrations authorizing use in the lower 48 states, to: (1) Cancel all active and pending

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[1] Petitioners request action be taken to cancel all active registrations for M-44 cyanide capsules (sodium cyanide) in the lower 48 states and hereinafter reference all active registrations collectively when using the term "sodium cyanide" or "M-44 devices," including EPA Registration No. 56228-15 (APHIS), EPA Registration No. 35978-1 (Wyoming), EPA Registration No. 35975-2 (Montana), EPA Registration No. 39508-1 (New Mexico), EPA Registration No. 33858-2 (Texas), EPA Registration No. 13808-8 (South Dakota), and EPA Registration No. CA840006 (Sodium Cyanide).

registrations for sodium cyanide pursuant to FIFRA § 136d(b); (2) Suspend all sodium cyanide registrations pending completion of cancellation proceedings pursuant to FIFRA § 136d(c)(1); (3) Invoke a stop order prohibiting all current and future use of sodium cyanide effective immediately pursuant to FIFRA §§ 136k, 136j(a)(2)(G); and (4) Initiate Special Review proceedings for all sodium cyanide registrations pursuant to 40 C.F.R. Part 154. Thank you for your consideration. We look forward to your timely response.

Respectfully submitted,

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I. INTRODUCTION

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. § 136 et seq., provides the framework for federal regulation of pesticide use, sale, and distribution. The law is intended to prohibit the use of pesticides that cause unreasonable adverse effects on the environment.[2] The Administrator of the EPA is responsible for carrying out the mandates of the Act.[3] Pursuant to this obligation, the Administrator may limit the use of certain pesticides to prevent unreasonable adverse effects on the environment.[4]

M-44 cyanide capsules (containing a pesticide called sodium cyanide) are registered for restricted use under FIFRA (EPA Registration No's. 56228-15, 35978-1, 35975-2, 39508-1, 33858-2, 13808-8, and CA840006). Wildlife Services, a program of the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), is a registered user of sodium cyanide (EPA Registrant No. 56228-15). Other registered users include Wyoming Dept. of Agriculture (No. 35978-1), Montana Dept. of Agriculture (No. 35975-2), New Mexico Dept. of Agriculture (No. 39508-1), Texas Dept. of Agriculture (No. 33858-2), and South Dakota Dept. of Agriculture (No. 13808-8). This Petition hereby requests that the Administrator use his authority to prohibit use of sodium cyanide in the lower 48 states pursuant to FIFRA and the Act's implementing regulations. With respect to the lower 48 states, we request the Administrator: (1) Cancel all active and pending registrations for sodium cyanide pursuant to FIFRA § 136d(b); (2) Suspend all sodium cyanide registrations pending completion of cancellation proceedings pursuant to FIFRA § 136d(c)(1); (3) Invoke a stop order prohibiting all current and future use of sodium cyanide effective immediately pursuant to FIFRA §§ 136k, 136j(a)(2)(G); and (4) Initiate Special Review proceedings for all sodium cyanide registrations pursuant to 40 C.F.R. Part 154.

M-44 Devices and Overview of Use

Sodium cyanide is the pesticide active ingredient used in M-44 devices, which are also known as "cyanide bombs." These devices are not actually bombs, however, because no explosives are used. Instead, an M-44 uses a spring-loaded device that is screwed or pushed into the ground. The device is topped with scented bait to lure animals (such as coyotes, foxes, and other canids) to bite. Once the animal's teeth clench on the bait, a spring shoots a pellet of sodium cyanide into the animal's mouth.

The sodium cyanide combines with available moisture including saliva to make hydrogen cyanide gas, which is readily absorbed by the lungs and poisons the animal by inactivating an enzyme essential to mammalian cellular respiration.[5] That quickly leads to central nervous system depression, cardiac arrest, and respiratory failure.[6]

[2] 7 U.S.C. § 136a(a).
[3] 7 U.S.C. § 136(b).
[4] 7 U.S.C. §§ 136a(c)(5)-(6).
[5] U.S. Fish & Wildlife Service, *Biological Opinion: Effects of 16 Vertebrate Control Agents on Endangered and Threatened Species* (1993) at II-73 [hereinafter "1993 BiOp"].
[6] *Id.* at II-73.

Sodium cyanide is a Category 1 toxicant according to the EPA: the most acute, due to the imminent harm it poses to the environment and to humans.[7] Sodium cyanide is highly soluble in water and highly toxic to most aquatic organisms, and as a result, M-44 capsules may not be used within 200 feet of water.[8]

Wildlife Services and state agencies use M-44s in locales across the country to kill so-called "nuisance" wildlife, including coyotes, gray foxes and red foxes, and free-roaming dogs.[9] M-44s containing sodium cyanide are deployed primarily by Wildlife Services; however, the following states also have authority for their use: South Dakota, Montana, Wyoming, New Mexico, and Texas.[10] According to its 2015 and 2016 data, Wildlife Services uses M-44s in the following states: Colorado, Idaho, Montana, North Dakota, Nebraska, New Mexico, Nevada, Oklahoma, Oregon, Texas, Utah, Virginia, West Virginia and Wyoming.[11]

Impacts of M-44s on Endangered Wildlife

In a 1993 Biological Opinion that analyzed the impacts of sodium cyanide on endangered wildlife, the U.S. Fish and Wildlife Service (FWS) found that any carrion-feeding animal able to activate the M-44 device is at risk. For that reason, FWS placed additional restrictions on use of M-44s to try to reduce the risk to wildlife protected under the Endangered Species Act.

In its 1994 Reregistration Eligibility Decision (RED) pertaining to the use of sodium cyanide capsules in M-44 units, EPA concluded that the M-44 did not pose unreasonable risks to humans or the environment if used in accordance with the 26 use restrictions listed on the label, plus language determined by the FWS to be needed to protect endangered species likely to be jeopardized by use of M-44s.[12]

That analysis by FWS and EPA is decades old. Since then, M-44s have killed numerous non-target, federally protected endangered animals. Even when M-44s are used as intended to kill coyotes and other canids, harm to the environment can occur because of the important ecosystem roles played by these animals.

Availability of Viable Alternatives

The balance of interests clearly weighs in favor of prohibiting M-44s given the numerous viable alternatives to protect livestock from predation. For example, guard animals (including dogs, llamas, and donkeys) can be deployed, herders and range riders can

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[7] U.S. Environmental Protection Agency, Reregistration Eligibility Decision (R.E.D.) Facts: Sodium Cyanide (1994) *available at* https://archive.epa.gov/pesticides/reregistration/web/pdf/3086fact.pdf.
[8] 1993 BiOp at II-73.
[9] 1993 BiOp at II-73.
[10] 1993 BiOp at II-73.
[11] U.S. Dep't of Agriculture, Wildlife Services, *2016 Program Data Reports*, *available at* https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_reports/sa_pdrs/ct_pdr_home_2016; U.S. Dep't of Agriculture, Wildlife Services, *2015 Program Data Reports*, *available at* https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_reports/sa_pdrs/ct_pdr_home_2015.
[12] 1993 BiOp at II-74.

be employed, and livestock operators can change animal husbandry practices to lessen the risk of predation. Deterrents, such as sound- and light-emitting frightening devices, can also be used to scare away potential predators.

In short, a number of viable alternative tools to address livestock conflicts exist, eliminating the need for M-44 sodium cyanide capsules altogether.

II. Petitioners

WILDEARTH GUARDIANS is a non-profit 501(c)(3) organization dedicated to protecting and restoring the wildlife, wild places, wild rivers, and health of the American West. Guardians has over 215,000 activists and members supporting their efforts to end government-funded programs of cruelty to native wildlife.

The CENTER FOR BIOLOGICAL DIVERSITY is a non-profit 501(c)(3) organization with over 48,500 active members and 1.3 million supporters. The Center and its members are concerned with the conservation of imperiled species and the effective implementation of the ESA. Recognizing that pesticides are one of the foremost threats to the earth's environment, biodiversity, and public health, the Center works to prevent and reduce the use of harmful pesticides and to promote sound conservation strategies.

ADVOCATES FOR THE WEST is a non-profit organization protecting and defending public lands, wildlife, watersheds and air through litigation and negotiation.

The ANIMAL LEGAL DEFENSE FUND's mission is to protect the lives and advance the interests of animals through the legal system.

BORN FREE USA, a non-profit 501(c)(3) organization, believes that every animal matters. Inspired by the Academy Award® winning film *Born Free*, the organization works locally, nationally, and internationally to end wild animal cruelty and suffering, and protect threatened wildlife. Born Free USA also operates one of the country's largest wildlife sanctuaries.

The ENDANGERED SPECIES COALITION is a 501(c)(3) organization working to stop the human-caused extinction of our nation's at-risk species, to protect and restore their habitats, and to guide these fragile populations along the road to recovery. The Coalition is a network of conservation, scientific, education, religious, sporting, outdoor recreation, business and community organizations — and more than 150,000 individual activists and supporters — all dedicated to protecting our nation's disappearing wildlife and last remaining wild places.

The HUMANE SOCIETY OF THE UNITED STATES ("The HSUS") is among the nation's largest animal protection organizations, headquartered in Washington, D.C. Since its establishment in 1954, The HSUS has worked to combat animal abuse and exploitation and promote the welfare of all animals. In particular, The HSUS works extensively to promote the conservation of native carnivores through research, public outreach and education, advocacy and litigation. The HSUS has long advocated humane, non-lethal alternatives to cruel killing techniques including steel-jawed, leg-hold traps, strangling neck snares and the use of poisons such as sodium cyanide.

The INTERNATIONAL FUND FOR ANIMAL WELFARE's mission is to rescue and protect animals around the world. The organization rescues individuals, safeguards populations, and preserves habitat.

The NATURAL RESOURCES DEFENSE COUNCIL (NRDC) is an international nonprofit organization with more than 2 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment.

PREDATOR DEFENSE is a national non-profit advocacy organization working to protect native predators and end America's war on wildlife. Our efforts take us into the field, onto America's public lands, to Congress, and into courtrooms.

PROJECT COYOTE is a national non-profit organization and a North American coalition of wildlife educators, scientists, ranchers, and community leaders promoting coexistence between people and wildlife, and compassionate conservation through education, science, and advocacy.

PUBLIC EMPLOYEES FOR ENVIRONMENTAL RESPONSIBILITY (PEER) is a non-profit organization protecting public employees who protect our environment. PEER serves professionals who uphold environmental laws so that public servants may work as "anonymous activists," and their agencies must confront the message, not the messenger.

The SIERRA CLUB is one of America's largest and most influential environmental organizations, with more than 3 million members and supporters. In addition to helping people from all backgrounds explore nature and our outdoor heritage, the Sierra Club works to promote clean energy, safeguard the health of our communities, protect wildlife, and preserve our remaining wild places through grassroots activism, public education, lobbying, and legal action.

The SOUTHWEST ENVIRONMENTAL CENTER works to protect and restore native wildlife and their habitats in the Southwest.

The WESTERN ENVIRONMENTAL LAW CENTER uses the full power of the law to defend and protect the American West's treasured landscapes, iconic wildlife, and rural communities.

WESTERN WATERSHEDS PROJECT is a non-profit environmental group working to protect and restore western watersheds and wildlife.

The mission of WILDLANDS NETWORK is to reconnect, restore and rewild North America so that the diversity of life can thrive. The organization envisions a world where nature is unbroken, and where humans co-exist in harmony with the land and its wild inhabitants.

The WOLF CONSERVATION CENTER (WCC) is an environmental education organization committed to conserving wolf populations in North America through science-based education programming and participation in the federal Species Survival Plans for the critically endangered Mexican gray wolf and red wolf. Through wolves, the WCC teaches the broader message of conservation, ecological balance, and personal responsibility for improved stewardship of our World.

III. LEGAL BASIS FOR PETITIONING

Cancellation, suspension, issuance of a stop order, and initiation of a Special Review for all sodium cyanide registrations in the lower 48 is appropriate at this time pursuant to FIFRA and its implementing regulations.

First, cancellation of a pesticide's registration is warranted where the pesticide, "when used in accordance with widespread and commonly recognized practice, generally causes unreasonable adverse effects on the environment."[13] Here, the registration for sodium cyanide must be cancelled because, as documented below, its continued use is causing unreasonable adverse effects on the environment, members of the public, and non-targeted companion animals.

Second, suspension of a pesticide's registration is warranted under FIFRA § 136d(c)(1) when such action is necessary to prevent an imminent hazard[14] during the time required for cancellation.[15] Here, as documented below, the registration for sodium cyanide should be suspended pending cancellation proceedings to prevent an imminent hazard to the environment and protected species.

Third, a "stop sale, use, or removal" order pursuant to FIFRA § 136k is appropriate when a registered pesticide is being used in an unlawful manner.[16] As documented below, evidence suggests that sodium cyanide — a restricted use pesticide — is being used in

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[13] 7 U.S.C. § 136d(b); *see also id.* § 136(bb) (providing that "[t]he term 'unreasonable adverse effects on the environment' means (1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide ….").

[14] 7 U.S.C. § 136(l) ("The term 'imminent hazard' means a situation which exists when the continued use of a pesticide during the time required for cancellation proceeding would be likely to result in unreasonable adverse effects on the environment or will involve unreasonable hazard to the survival of species declared endangered or threatened by the Secretary pursuant to the Endangered Species Act of 1973 [16 U.S.C. 1531 et seq.].").

[15] 7 U.S.C. §136d(c)(1) ("If the Administrator determines that action is necessary to prevent an imminent hazard during the time required for cancellation … the Administrator may, by order, suspend the registration of the pesticide immediately.").

[16] 7 U.S.C. § 136k(a) ("Whenever any pesticide or device is found by the Administrator in any State and there is reason to believe on the basis of inspection or tests that such pesticide or device is in violation of any of the provisions of this chapter … or when the registration of the pesticide has been canceled by a final order or has been suspended, the Administrator may issue a written or printed 'stop sale, use, or removal' order to any person who owns, controls, or has custody of such pesticide or device ….").

violation of the pesticide's use restrictions, and thereby, its labeling requirements, which is unlawful under FIFRA § 136j(a)(2)(G).[17]

Fourth, the Administrator may initiate a Special Review pursuant to 40 C.F.R Part 154 when one or more of the risk criteria of 40 C.F.R § 154.7 are met.[18] As evidenced below, the Administrator may find that multiple risk criteria triggering such Special Review for sodium cyanide registrations are present.[19] For example, continued sodium cyanide use: "[m]ay pose a risk of serious acute injury to humans or domestic animals[;]" "[m]ay pose a risk to the continued existence of any endangered or threatened species designated by the Secretary of the Interior or the Secretary of Commerce under the Endangered Species Act of 1973, as amended[;]" and "[m]ay otherwise pose a risk to humans or to the environment which is of sufficient magnitude to merit a determination whether the use of the pesticide product offers offsetting social, economic, and environmental benefits that justify initial or continued registration."[20]

IV. FACTUAL AND SCIENTIFIC SUPPORT FOR PETITION

M-44 Use has Unreasonable Adverse Impacts on the Environment and Presents an Imminent Hazard

Evidence exists that past and present uses of sodium cyanide have unreasonable adverse impacts upon the environment and present an imminent hazard, as those terms are defined by FIFRA and the Act's implementing regulations.[21] M-44 use causes harm to non-target wildlife, federally protected threatened and endangered species, and people and companion animals. The harms caused by M-44 use are not outweighed by the benefits of continued use because viable alternatives exist.

<u>Impacts to Non-target Wildlife</u>

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[17] 7 U.S.C. § 136j(a)(2) (G)("It shall be unlawful for any person — … to use any registered pesticide in a manner inconsistent with its labeling.").

[18] *See* 40 C.F.R. § 154.1 ("The purpose of the Special Review process is to help the Agency determine whether to initiate procedures to cancel, deny, or reclassify registration of a pesticide product because uses of that product may cause unreasonable adverse effects on the environment, in accordance with sections 3(c)(6) and 6 of [FIFRA]. The process is intended to ensure that the Agency assesses risks that may be posed by pesticides and the benefits of use of those pesticides, in an open and responsive manner.").

[19] 40 C.F.R. § 154.7.

[20] 40 C.F.R. §§ 154.7 (1), (3), (4), (6).

[21] 7 U.S.C. § 136(bb) (providing that "[t]he term 'unreasonable adverse effects on the environment' means (1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide …."); 7 U.S.C. § 136(l) ("The term 'imminent hazard' means a situation which exists when the continued use of a pesticide during the time required for cancellation proceeding would be likely to result in unreasonable adverse effects on the environment or will involve unreasonable hazard to the survival of species declared endangered or threatened by the Secretary pursuant to the Endangered Species Act of 1973 [16 U.S.C. 1531 et seq.]."). *See also Environmental Defense Fund, Inc. v. EPA*, 510 F. 2d 1292, 1297 (D.C. Cir. 1975) (upholding EPA suspension and cancellation order for aldrin and dieldrin and stating: "We have cautioned that the term 'imminent hazard' is not limited to a concept of crisis. 'It is enough if there is a substantial likelihood that serious harm will be experienced during the year or two required in any realized projection of the administrative process.'" (citing *Defense Fund, Inc. v. EPA*, 465 F.2d 528, 540 (D.C. Cir. 1972)).

M-44s are indiscriminate killers that are responsible for the deaths of thousands of non-target animals.

The U.S. Department of Agriculture's Animal Damage Control program (predecessor to APHIS-Wildlife Services) recorded 103,255 animals killed by M-44's between 1976 and 1986, including 4,868 non-target animals (approximately 5% of all animals killed).[22] Non-target species identified as having been killed by M-44s included grizzly bear, black bear, mountain lion, badger, kit and swift fox, bobcat, ringtail cat, feral cat, skunk, opossum, raccoon, Russian boar, feral hog, javelin, beaver, porcupine, nutria, rabbit, vulture, raven, crow, and hawk.[23] In addition, a California condor was found dead near the vicinity of an M-44 in 1986.[24]

A review of the Ecological Incident Information System in 2010 shows 45 terrestrial non-target animal incidents resulting from M-44 use from 1983-2009. The database records mortality for 26 birds, 15 dogs, ten wolves, three foxes, and two bears.[25]

According to Wildlife Services' most recent available data, from 2010-2016, over 2,600 animals were unintentionally taken by M-44s. For example, during that time period, Wildlife Services killed 882 non-target animals in Texas, 635 in Virginia, 336 in West Virginia, 315 in New Mexico, and 283 in Oklahoma.[26]

Wildlife Services' 2016 data shows that 321 animals were unintentionally killed by M-44s *in that year alone*.[27] Included among the non-targeted animals killed in 2016 were: 101 gray fox, 61 red fox, 57 raccoons, one black bear, one fisher, and seven domestic animals (such as family dogs). Such verified deaths almost certainly underestimate the total number of non-target species impacted because the likelihood of locating the carcass of a non-target species is small, especially with respect to small birds and small mammals.

More recently, in February 2017, a wolf died in northeastern Oregon from an M-44 used by Wildlife Services to target coyotes. In March 2017, in two separate incidents, M-44s temporarily blinded a child and killed three family dogs in front of their families in Idaho and Wyoming.

Impacts to Threatened and Endangered Species

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[22] 1993 BiOp at II-74.
[23] *Id.*
[24] *Id.*
[25] Memorandum dated Sept. 20, 2010 from Valerie Wood, Biologist at the Environmental Fate and Effects Division of EPA, to Kathryn Jakob, Chemical Review Manager at EPA with attached draft "Problem Formulation for the Ecological Risk Assessment, of Sodium Cyanide (M-44)" at 12.
[26] U.S. Dep't of Agriculture, Wildlife Services, *2016 Program Data Reports*, *available at* https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_reports/sa_pdrs/ct_pdr_home_2016 (last visited July 21, 2017).
[27] U.S. Dep't of Agriculture, Wildlife Services, *Program Data Report G – 2016 Animals Dispersed/Killed or Euthanized/Removed or Destroyed/Freed*, *available at* https://www.aphis.usda.gov/wildlife_damage/pdr/PDR-G_Report.php?fy=2016&fld=KILLED_EUTH&fld_val=0 (last visited June 5, 2017).

M-44s also put federally protected threatened and endangered species at greater risk. Registered use of M-44s has unintentionally killed a threatened grizzly bear, endangered California condors, wolves and other species protected under the Endangered Species Act (ESA). M-44s placed in the habitat of Canada lynx, a threatened species under the ESA, or in the habitat of wolverine, a candidate species for ESA protection, further place these imperiled species at risk of extinction.

Specifically, according to documents received by the Center pursuant to the Freedom of Information Act, in 1978 a threatened grizzly bear in Montana died from an M-44. In 1983, an endangered California condor died from an M-44 in Kern County, California. In 1995, an endangered wolf in the panhandle of Idaho died from an M-44 set for coyotes. In March of 2001, an endangered wolf died from an M-44 in South Dakota. Two years later, in March of 2003, another wolf died in an undisclosed location. In March of 2005, a bald eagle, protected under the ESA at that time, died from an M-44 in McHenry County, North Dakota. In January of 2007, two wolves died from M-44s in Idaho near Riggins. In December of 2008, an endangered wolf was killed from an M-44 north of Cokeville, Wyoming, in Lincoln County. In May of 2013, a federally protected bald eagle died from an M-44 in Richland County, North Dakota.[28]

The number of federally-protected animals killed by M-44s are likely under-represented here as these incidents only reflect deaths reported to the EPA. Many killed animals are likely never discovered as they can die some distance from the M-44 device, and other animals could be discovered but not reported.

The incidents detailed here do not include other protected non-endangered wildlife, such as state-listed or "special concern" species, killed by M-44s. As just one additional example, a protected[29] wolf died in 2017 from an M-44 device in northeastern Oregon.[30]

Threats to People and Companion Animals

Sodium cyanide is a Category 1 toxicant because it is highly lethal to people and domestic animals in addition to native wildlife. M-44s put people and their companion animals unnecessarily at risk of being severely injured, or even killed.

In one tragic incident in March of 2017, a 14-year old boy was poisoned when he unsuspectingly tugged on an M-44 device while hiking behind his home in Idaho.[31] The boy watched in horror as his golden retriever convulsed and died within only minutes of the

[28] Incident reports and other documentation are on file with author Collette Adkins and included with this petition.

[29] Wolves throughout the State of Oregon are considered "a special status game mammal, protected by the Oregon Wolf Plan." Oregon Dep't of Fish & Wildlife, *Frequently Asked Questions about Wolves in Oregon*, http://www.dfw.state.or.us/Wolves/faq.asp (last visited Aug. 9, 2017).

[30] Oregon Dep't of Fish & Wildlife, *Press Release: Wolf Dies in Unintentional Take in Northeast Oregon* (Mar. 2, 2017) http://www.dfw.state.or.us/news/2017/03_mar/030217.asp.

[31] Cristina Corbin, *USDA Must Rethink Cyanide Bombs That Injured Boy, Killed Pets, Lawmaker Says*, FOX NEWS U.S. (Mar. 21, 2017) http://www.foxnews.com/us/2017/03/21/usda-must-rethink-cyanide-bombs-that-injured-boy-killed-pets-lawmaker-says.html.

device being activated. This incident sparked a public outcry,[32] led to a statewide moratorium, and the introduction of federal legislation[33] to ban the devices from further use nationwide. Sadly, this tragic incident is only one of many that have occurred in the past and are likely to occur in the future if the devices remain in use.

In another recent incident, in March of 2017, M-44s killed two family dogs while the family hiked together on a prairie on public lands in Wyoming.[34] That incident not only put the dogs at risk but also the family members who were exposed to sodium cyanide when they tried to save the dogs by washing them in a creek and when they hugged and kissed their beloved dying pets.

In 2016 alone, Wildlife Services admitted to unintentionally killing seven domestic animals with M-44s.[35] In addition, in 2016, Wildlife Services reported unintentionally killing 22 dogs that were classified as feral, free-ranging or hybrids. Many of these dogs were likely family dogs running off-leash. As of June, at least three domestic dogs were killed by M-44s in 2017.[36] Appendix B, which is attached, provides a list — compiled by Wildlife Services — of dogs unintentionally killed by M-44s.

A number of employees and unsuspecting members of the public have also been put at risk from sodium cyanide's toxic effects. The Center received documentation of several such incidents in response to a request under the Freedom of Information Act. For example, in December of 1999, a private landowner tried to remove an M-44 placed on property that he was leasing and accidentally triggered the device. He tasted the poison in his mouth and his wife drove him to the hospital, where he received medical attention. In November of 2002, a woman accidentally triggered an M-44 device placed on her property. She experienced increased respiratory rate and eye irritation but was able to drive herself to the hospital. In May of 2007, a person spraying for mosquitoes accidentally stepped on a M-44 device and sodium cyanide sprayed into his eyes causing burning and irritation, as well as disorientation. He received emergency medical assistance, and several others, including a county sheriff, came to the scene and had to shower because of exposure to sodium cyanide. In February of 2011, a border patrol agent in Kinney County, Texas, kicked and then tugged at an unknown object, which turned out to be a M-44. The device exploded in his gloved hands and he called an ambulance, which brought him to the hospital for medical attention.[37]

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32 Sarah V. Schweig, *Family's Dog Was Just Killed By This Tool — And the U.S. Government Put It There*, THE DODO (Mar. 20, 2017) https://www.thedodo.com/usda-m44-kills-idaho-dog-2322197701.html.
33 *See* Press Release: Rep. Peter DeFazio Introduces Legislation to Ban Lethal Poisons Compound 1080, Sodium Cyanide from Predator Control (Mar. 30, 2017) http://defazio.house.gov/media-center/press-releases/rep-peter-defazio-introduces-legislation-to-ban-lethal-poisons-compound.
34 http://www.predatordefense.org/features/m44_WY_Amy_dogs.htm
35 U.S. Dep't of Agriculture, Wildlife Services, *Program Data Report G – 2016 Animals Dispersed/Killed or Euthanized/Removed or Destroyed/Freed*, *available at* https://www.aphis.usda.gov/wildlife_damage/pdr/PDR-G_Report.php?fy=2016&fld=KILLED_EUTH&fld_val=0 (last visited June 5, 2017).
36 Cristina Corbin, *USDA Must Rethink Cyanide Bombs That Injured Boy, Killed Pets, Lawmaker Says*, FOX NEWS U.S. (Mar. 21, 2017) http://www.foxnews.com/us/2017/03/21/usda-must-rethink-cyanide-bombs-that-injured-boy-killed-pets-lawmaker-says.html.
37 Incident reports and other documentation are on file with author Collette Adkins and included with this petition.

Other reports of incidents have been gathered by the co-petitioning non-profit organizations, Predator Defense and The Humane Society of the United States. Dozens of these incidents are listed in Appendix A (attached). For example, in May of 2003, an M-44 device exploded and harmed a man who was rock hounding in Uintah County, Utah. His family did not know what hit him because of the lack of warning signs in the area. He immediately experienced disorientation and was unable to speak. His wife explains that he suffered for many years and had his life cut short because of the encounter.[38] Another incident involved a woman who was exposed to sodium cyanide after trying to resuscitate her dog, who died from an M-44 set on her land without her permission.[39] She immediately tasted the poison in her mouth and then felt disorientated. Over the next several months she experienced tingling in her arms and insomnia. Another incident involves a rancher who pulled on what he thought to be just a pipe sticking out of the ground but was actually an M-44 device that Wildlife Services set on his property without his permission.[40] When the device exploded, it badly cut and burned his hand. He experienced pain in his hand for several months during the slow healing process.

Several other reported incidents include pesticide applicators, which carry antidotes in case of sodium cyanide exposure. For example, in May 2001, an applicator accidentally triggered the device. He experienced temporary blindness in one eye, as well as blisters on his tongue and lips and went to the emergency room to receive medical attention. In January 2002, an applicator tried to cover an M-44 with a concrete block because he knew of hunting dogs in the area. He accidentally triggered the device and the sodium cyanide capsule hit his face and eye. He flushed his eyes and went to the hospital for medical attention. In March 2002, an applicator accidentally triggered an M-44 when he reached into a bucket in his vehicle that held the assembled device. He experienced burning of his eyes and could taste the poison in his mouth, and he drove himself to the emergency room, where he received medical assistance. In April 2005, an applicator accidentally triggered the device while installing it and administered the antidote. In January 2007, an applicator working on behalf of Wildlife Services in Oklahoma triggered an M-44. He experienced eye irritation and disorientation but was able to administer the antidote and drive himself to the hospital. In November 2008, an applicator accidentally triggered the device and the sodium cyanide capsule hit him in the face. After tasting the poison, he administered the antidote and went to the hospital for medical attention.[41]

Alternatives to Sodium Cyanide

M-44s are indiscriminate killing devices that are not needed in modern wildlife management because ample viable alternatives currently exist.

Numerous, proven effective and nonlethal methods of reducing conflicts with coyotes and other canids exist. For example, electric fences (that can be solar powered for use in remote areas), fladry (flags tied to ropes or fences), guard animals, range riders, strobe

38 https://www.predatordefense.org/docs/m44_letter_Slaugh_DeFazio.pdf
39 https://www.predatordefense.org/docs/m44_letter_Kingsley_DeFazio_01-09-07.pdf
40 https://www.predatordefense.org/docs/m44_letter_Guerro_DeFazio.pdf
41 Incident reports and other documentation are on file with author Collette Adkins and included with this petition.

lights and noisemakers can be used in lieu of M-44s to effectively deter coyotes and other so-called "problem wildlife" from disturbing livestock. Indeed, numerous studies have demonstrated the effectiveness of nonlethal methods to protect livestock from predators (e.g. Shivik et al. 2003[42]; Lance et al. 2010[43]).

Moreover, numerous scientific studies seriously call into question the efficacy of lethal predator control (e.g., Berger 2006[44], Harper et al. 2008[45]; Musiani et al. 2003[46]). For example, in a study based upon a review of 25 years of livestock depredation data, Wielgus and Peebles (2014)[47] found that with increased predator persecution, livestock losses *increased* in the following year. Additionally, Treves et al. (2016),[48] a meta-review of 24 studies, showed little or no scientific support for the efficacy of killing predators to protect livestock. Just as many livestock are likely to die, or in some cases even more, after predators are killed.

Scientists explain that indiscriminate killing of coyotes disrupts the stability and equilibrium of their social structure, triggering compensatory breeding and an increase in the coyote population.[49] Specifically, younger pairs begin to breed and juvenile males move in to fill the gap. Increasing the number of juvenile males in a destabilized population increases the likelihood of predation on wild ungulates and on livestock.[50]

While we do not condone — nor does the science support — the use of lethal techniques to control predators, even if Wildlife Services and state agencies insist on using lethal methods to target coyotes and other canids, more selective and more effective alternatives to M-44s are available. Firearms can be used with relatively minimal risk to people and non-targets as long as the shooter makes a positive identification before shooting. Traps, such as cage traps, can be used with specifications to reduce non-target

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[42] Shivik, J. A., A. Treves, and P. Callahan. 2003. *Nonlethal techniques for managing predation: Primary and secondary repellents*. CONSERVATION BIOLOGY 17: 1531-1537, *available at* http://wscinof.dreamhosters.com/wp-content/uploads/SHIVAKNon-Lethal.pdf.
[43] Lance, N.J., S.W. Breck, C. Sime, P. Callahan, and J.A. Shivik. 2010. *Biological, technical, and social aspects of applying electrified fladry for livestock protection from wolves* (*Canis lupus*). WILDLIFE RESEARCH 37: 708-714, http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2257&context=icwdm_usdanwrc.
[44] Berger, K.M. 2006. *Carnivore-Livestock Conflicts: Effects of Subsidized Predator Control and Economic Correlates on the Sheep Industry*. CONSERVATION BIOLOGY 20: 751-761.
[45] Harper, E.K., W.J. Paul, and D.L. Mech, et al. 2008. *Effectiveness of lethal, directed wolf-depredation control in Minnesota*. JOURNAL OF WILDLIFE MANAGEMENT 72: 778–84.
[46] Musiani, M., C. Mamo, L. Boitani, C. Callaghan, C. C. Gates, L. Mattei, E. Visalberghi, S. Breck, and G. Volpi. 2003. *Wolf depredation trends and the use of fladry barriers to protect livestock in western North America*. CONSERVATION BIOLOGY 17: 1538-1547, http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1616&context=icwdm_usdanwrc.
[47] Wielgus, R. and K. Peebles. 2014. *Effects of Wolf Mortality on Livestock Depredations*. PLOS ONE 9: e113505, http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0113505.
[48] Treves, A., M. Krofel, J. McManus. 2016. *Predator control should not be a shot in the dark*. FRONTIERS IN ECOLOGY AND THE ENVIRONMENT 14: 380-388, *available at* http://faculty.nelson.wisc.edu/treves/pubs/Treves_Krofel_McManus.pdf.
[49] *See e.g.*, Letter from Dr. Robert Crabtree, Yellowstone Ecological Research Center (Revised Draft June 21, 2012), *available at* http://www.predatordefense.org/docs/coyotes_letter_Dr_Crabtree_06-21-12.pdf (presenting research showing that indiscriminate killing of coyotes results in population booms with consequent increases in livestock and wild ungulate predation).
[50] *Id.*

capture, and as long as traps are frequently checked (at least once every 24-hours), non-target animals may often be released without lethal injuries.

An analysis of Wildlife Services' own data demonstrates that alternatives to M-44s are more effective for capturing coyotes and other canids. For example, in 2015, Wildlife Services reportedly killed 68,905 coyotes. Wildlife Services killed just 18.7 percent of these coyotes using M-44s. Using the more effective — and more selective — technique of shooting coyotes with firearms, Wildlife Services killed 27,181 coyotes in 2015. That's nearly 40 percent of the total number of coyotes killed that year.[51] In short, given the alternatives to M-44s, continued M-44 use is economically unjustified.

<u>Ecological Benefits of Conserving Predators Targeted by M-44s</u>

Prohibiting the use of M-44s would benefit the health of ecosystems and native wildlife populations altogether. Carnivores targeted by M-44s, such as coyotes and foxes, play an essential role in maintaining healthy ecosystems. Predator species modulate prey populations and increase the health of those populations. The presence of carnivores on the landscape increases the biological diversity and overall functionality of ecosystems. Indeed, numerous studies analyze how carnivore removal, in particular, can cause a wide range of unanticipated impacts that are often profound, including on native plant communities, wildfire and biogeochemical cycles, the spread of disease or invasive species, and more (e.g. Beschta and Ripple 2009[52]; Levi et al. 2012[53]; Bergstrom et al. 2013[54]; Bergstrom 2017[55]).

Mesopredator species, like coyotes, are essential to maintaining ecological balance. Coyotes play a keystone role in the American West's native ecosystems by preying upon smaller carnivores such as skunks, foxes, and raccoons.[56] This predation indirectly benefits the prey of smaller carnivores. For instance, the resulting decreased nest predation by smaller carnivores increases ground-nesting birds like the imperiled greater sage grouse.[57] Coyotes also increase the diversity of rodent species by increasing the competition amongst smaller carnivores.[58]

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51 U.S. Dep't of Agriculture, Wildlife Services, *2016 Program Data Reports*, *available at* https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_reports/sa_pdrs/ct_pdr_home_2016 (last visited July 21, 2017).

52 Beschta, R.L., and W.J. Ripple. 2009. *Large predators and trophic cascades in terrestrial ecosystems of the western United States*. BIOL. CONSERV. 142(11): 2401–2414.

53 Levi, T., A.M. Kilpatrick, M. Mangel, and C.C. Wilmers. 2012. *Deer, predators, and the emergence of Lyme disease*. PROC NATL ACAD SCI 109(27): 10942–10947.

54 Bergstrom, B.J., L.C. Arias, A.D. Davidson, A.W. Ferguson, L.A. Randa, and S.R. Sheffield. 2014. *License to kill: reforming federal wildlife control to restore biodiversity and ecosystem function*. CONSERVATION LETTERS.

55 Bergstrom, B.J. 2017. *Carnivore conservation: shifting the paradigm from control to coexistence*. J. MAMMAL. 98 (1): 1-6.

56 Crooks, K.R. and M.E. Soule. 1999. *Mesopredator Release and Avifaunal Extinctions in a Fragmented System*. 400 J. NATURE 563–566; Henke, S.E. and F. C. Bryant. 1999. *Effects of Coyote Removal of the Faunal Community in Western Texas*. 63 J. WILDLIFE MGMT. 1066–1081.

57 Mezquida, E.T. et. al. 2006. *Sage-Grouse and Indirect Interactions: Potential Implications of Coyote Control on Sage-Grouse Populations*. 108 J. CONDOR 747–759.

58 Ripple, W.J. and R. L. Beschta. 2006. *Linking a Cougar Decline, Trophic Cascade, and Catastrophic Regime Shift in Zion National Park*. 133 J. BIOLOGICAL CONSERVATION 397–408.

In summary, the harms associated with continued use of M-44 sodium cyanide devices far outweigh the benefits of that use.

M-44s are Being Used Illegally, In Violation of Labeling Requirements and FIFRA

The labels[59] for registered sodium cyanide products require that users comply with all twenty-six use restrictions outlined in the Use Restriction Bulletin.[60] Even though FIFRA requires strict adherence to pesticide labels,[61] numerous incidents involving accidental exposure to sodium cyanide show that the registered users do not consistently abide by a number of these use restrictions.

The recent incidents in Idaho and Wyoming provide ample evidence demonstrating how registered users are violating the label requirements and other use restrictions when placing M-44s. The incident in Pocatello, Idaho involved an illegally-placed M-44 that injured a teen-aged boy, killed his dog and exposed several family members to sodium cyanide. Media reports and written accounts from the family demonstrate violations of the following use restrictions:

- "The M-44 device shall not be used: (1) in areas within national forests or other Federal lands set aside for recreational use, (2) areas where exposure to the public and family and pets is probable, (3) in prairie dog towns, or (4) except for the protection of Federally designated threatened or endangered species, in National or State Parks; National or State Monuments; federally designated wilderness areas; and wildlife refuge areas";[62]
- "Bilingual warning signs in English and Spanish shall be used in all areas containing M-44 devices . . . Main entrances or commonly used access points to areas in which M-44 devices are set shall be posted with warning signs to alert the public to the toxic nature of the cyanide and to the danger to pets. Signs shall be inspected weekly to ensure their continued presence and ensure that they are conspicuous and legible . . . An elevated sign shall be placed within 25 feet of each individual M-44 device warning persons not to handle the device"; and[63]
- "In all areas where the use of the M-44 device is anticipated, local medical people shall be notified of the intended use. This notification may be made through a poison control center, local medical society, the Public Health

[59] *See e.g.,* Label for EPA Registration No. 56228-15 ("Users of this product must follow all requirements of product labeling, including but not limited to, all Use Restrictions, Directions for Use, Precautionary Statements, first aid and antidotal measures, information on endangered species, requirements for posting warning signs, and Storage and Disposal instructions."). See also the labels for EPA Registration No. 35975-2, EPA Registration No. 39508-1, EPA Registration No. 13808-8, EPA Registration No. 33858-2, and EPA Registration No. 35978-1.
[60] U.S. Dep't of Agriculture, Animal & Plant Health Inspection Service, *WS Directive 2.415, M-44 Use and Restrictions* (revised June 15, 2017) [hereinafter "M-44 Use Restrictions"] *available at* https://www.aphis.usda.gov/wildlife_damage/directives/2.415_m44_use%26restrictions.pdf.
[61] 7 U.S.C. § 136j(a)(2)(G).
[62] M-44 Use Restrictions at 3.
[63] *Id.* at 10–11.

> Service, or directly to a doctor or hospital. They shall be advised of the antidotal and first-aid measures required for treatment of cyanide poisoning. It shall be the responsibility of the supervisor to perform this function."[64]

It cannot be disputed that the M-44 was placed in an "area[] where exposure to the public and family and pets is probable." Fourteen-year-old Canyon Mansfield was walking the family Labrador, Casey, on a hill just 300 yards behind their home on public land managed by the Bureau of Land Management (BLM) in the outskirts of Pocatello, Idaho.[65] (That placement also violated a November 2016 pledge by Wildlife Services in Idaho not to use M-44s on public land in Idaho.[66])

As for the requirement for conspicuous warning signs, Dan Argyle, a captain in the Bannock County Sheriff's Office, told National Geographic that "no warning signs were observed at the scene . . . ."[67] And Canyon Mansfield explains: "No signs like these were near the cyanide bomb that took my dog away from me."[68]

It has been reported that Wildlife Services made no notifications of the intended use of M-44s to local medical professionals.[69] Canyon Mansfield's father, Dr. Mark Mansfield explains: "We didn't know anything about it. No neighborhood notifications, and our local authorities didn't know anything about them . . . The sheriff deputies who went up there didn't even know what a cyanide bomb was." The Center requested, under the Freedom of Information Act, copies of written materials serving as proof that the required notifications to medical professionals were made in Idaho. Responsive records indicate that Wildlife Services notified Idaho hospitals *after* the Pocatello incident, in July 2017, and that Wildlife Services has not made these notifications on an annual basis, as the prior notification to Idaho hospitals occurred in 2013.

The incident north of Casper, Wyoming that killed two family dogs also demonstrates a violation of the requirement for warning signs.[70] A media report provides that a "few days after the dogs died in Wyoming, Daniel Helfrick returned to the area, looking for signs they might have missed to warn them of the cyanide traps. He didn't see any."[71] A personal account of the tragic incident by one of the involved family members provides further evidence that no signs were posted.[72]

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[64] *Id.* at 12.
[65] http://news.nationalgeographic.com/2017/04/wildlife-watch-wildlife-services-cyanide-idaho-predator-control/.
[66] http://fox13now.com/2017/03/21/cyanide-bomb-that-killed-dog-owner-placed-illegally-by-wildlife-services/.
[67] http://news.nationalgeographic.com/2017/04/wildlife-watch-wildlife-services-cyanide-idaho-predator-control/.
[68] https://www.predatordefense.org/docs/m44s_canyons_story.pdf.
[69] http://www.theblaze.com/news/2017/03/21/cyanide-device-explodes-killing-familys-dog-they-cant-believe-who-planted-it-behind-their-home/.
[70] http://www.wyofile.com/column/cyanide-bomb-kills-two-casper-dogs/.
[71] http://www.wyofile.com/column/cyanide-bomb-kills-two-casper-dogs/.
[72] https://www.predatordefense.org/features/m44_WY_Amy_dogs.htm.

In addition, the March 2002 incident, where an applicator was injured when he reached into a bucket of assembled M-44s, likely occurred because he was not properly trained in the safe handling of the devices.[73]

Risk Criteria Triggering Initiation of a Special Review Are Present

FIFRA's implementing regulations at 40 C.F.R. Part 154 authorize the Administrator to initiate a Special Review of a registered pesticide if any one of the risk criteria outlined in 40 C.F.R. Part 154.7 are met.[74] In relevant part, such risk criteria include the following:

1. The Administrator finds the registered pesticide "[m]ay pose a risk of serious or acute injury to humans or domestic animals";[75]
2. The Administrator finds the registered pesticide "[m]ay result in residues in the environment of nontarget organisms at levels which equal or exceed concentrations acutely or chronically toxic to such organisms, or at levels which produce adverse reproductive effects in such organisms";[76]
3. The Administrator finds the registered pesticide "[m]ay pose a risk to the continued existence of any endangered or threatened species designated by the Secretary of the Interior or the Secretary of Commerce under the Endangered Species Act of 1973, as amended";[77]
4. The Administrator finds the registered pesticide "[m]ay result in the destruction or other adverse modification of any habitat designated by the Secretary of the Interior or the Secretary of Commerce under the Endangered Species Act as a critical habitat for an endangered or threatened species";[78] and/or
5. The Administrator finds the registered pesticide "[m]ay otherwise pose a risk to humans or to the environment which is of sufficient magnitude to merit a determination whether the use of the pesticide product offers offsetting social, economic, and environmental benefits that justify . . . continued registration."[79]

As demonstrated throughout this Petition — and further elaborated upon below — several of these risk criteria are met by use of M-44s.

<u>M-44s Pose Risk of Serious or Acute Injury to Humans and Domestic Animals</u>

As explained above and demonstrated by several recent incidents involving injury to people and their companion animals, M-44s pose a risk of serious injury – and even death – to humans and domestic animals, including family dogs. For this reason alone, a Special Review should be initiated.

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73 M-44 Use Restrictions at 1.
74 *See* 40 C.F.R. § 154.1 ("The purpose of the Special Review process is to help the Agency determine whether to initiate procedures to cancel, deny, or reclassify registration of a pesticide product because uses of that product may cause unreasonable adverse effects on the environment, in accordance with sections 3(c)(6) and 6 of [FIFRA]. The process is intended to ensure that the Agency assesses risks that may be posed by pesticides and the benefits of use of those pesticides, in an open and responsive manner.").
75 40 C.F.R. § 154.7(a)(1).
76 40 C.F.R. § 154.7(a)(3).
77 40 C.F.R. § 154.7(a)(4).
78 40 C.F.R. § 154.7(a)(5).
79 40 C.F.R. § 154.7(a)(6).

M-44s Pose Harmful Risks to Protected Species

As indicated above, M-44s have killed federally protected threatened and endangered species, including a grizzly bear, wolves, and a California condor, among other ESA-protected imperiled animals. These deaths also compel initiation of a Special Review.

M-44s Pose Other Risks to Humans and the Environment Meriting Further Consideration

The Administrator may initiate a Special Review at his discretion if the registered pesticide poses any other risk to humans and the environment warranting such review. In combination with the other risk criteria, the dangers posed to unsuspecting members of the public and non-targeted wildlife are of sufficient magnitude to warrant such review for M-44 sodium cyanide capsules. Specifically, those incidents involving harm to people that do not rise to the level of "serious or acute injury" are worthy of consideration in a Special Review, especially considering that these incidents occur routinely. The deaths of thousands of non-target animals from M-44s also weigh in favor of initiating a Special Review.

V. CONCLUSION

In sum, pursuant to FIFRA, 7 U.S.C. § 136d(b), the Administrator should cancel all registrations for M-44 cyanide capsules (sodium cyanide) because the pesticide presents an unreasonable adverse impact to the environment. Further, pursuant to FIFRA § 136d(c)(1), the Administrator should suspend all sodium cyanide registrations pending cancellation proceedings because an imminent hazard exists. The Administrator should also issue a stop order, pursuant to FIFRA §§ 136k, 136j(a)(2)(G), because registered users, including Wildlife Services, are using sodium cyanide, a restricted use pesticide, in violation of the product's labeling requirements, and thereby, in violation of the law. Finally, the Administrator should initiate a Special Review proceeding for all sodium cyanide registrations because multiple risk criteria of 40 C.F.R § 154 are met.

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Exhibit 20

"My Best Friend, Kasey" - by Canyon Mansfield, March 20, 2017

A heart-wrenching, first-hand account of loss, written by Canyon Mansfield, a 14-year-old boy from Pocatello, Idaho. Canyon and his lab Kasey are pictured above in the spot where tragedy struck.

While walking on the hill behind his back yard, Canyon accidentally triggered an M-44 "cyanide bomb" that killed his dog. The device had been set by a federal wildlife agent to kill coyotes. It just missed killing Canyon as well.

WARNING: Graphic content. Reader discretion advised.

"There should have been no risk associated with a 14-year-old boy taking a stroll near his home."

"It was March 16, 2017 and I, Canyon Mansfield, was home sick for the second day with a common cold. Around noon I yearned to go outside and hike the hill behind my home. This is not an unusual endeavor for me or anyone else as the hill is a common hiking and biking location. There should have been no risk associated with a 14-year-old boy taking a stroll near his home.

I took my dog, Kasey, with me to keep me company. We walked up the hill as Kasey and I played ball, completely unaware of the traps lurking around us. We reached the top of the hill. I admired the beautiful landscape around us that I have seen many times before. I sat down and began to pray in the spirit of the nature around me. I then got up to explore the hill out of curiosity.

After throwing Kasey's toy, I spotted a metal tube sticking out between two rocks. The tube closely resembled a sprinkler head. While my dog ran around I bent down and touched the strange tube. A metal spring triggered and the device popped. Orange gas spewed around me and I found myself lying on the ground. My left arm and calf were covered with orange powder. My left eye burned. I hurried to the nearest patch of snow and irrigated my eye and washed my clothes with the snow. I heard a mumbling sound which I assumed was Kasey chewing and shaking his toy. I was surprised to see the toy sitting a few yards next to him. I felt my stomach clench into a knot because I knew instantly that something was wrong. I then called him next to me. No response came from him except mumbling. I slapped my side and called him again. Nothing.

Kasey was a well trained hunting dog, well versed in a multitude of commands and capable of understanding directions such as left and right. He continued mumbling on the ground. I quickly sprinted with worry and witnessed him start to seizure. I panicked and kept yelling his name in disbelief. I examined him thinking he might have gotten shot by the strange outburst of the metal tube, because I saw blood on the snow. The blood was coming from his mouth. His eyes were turning glassy and he was twitching with fear. I turned his head towards me and said, "Just look at me Kasey. Breathe with me….Breathe… Breathe."

He not could see me. I could not comfort him as I saw his scared, confused, suffering face. I tried to pick him up and carry him down the hill but he was too big and difficult to hold. I saw his body turn limp. I yelled in panic and sprinted down the hill falling continuously in the snow but getting up and running again.

I reached my house and yelled for my mother. I told her what had happened and we both got into the car. She says there was no way to get up there in a car. So, I called my father while my mother quickly got dressed for the journey up the hill. He hung up the phone and quickly began driving home. My mother and I rushed up the hill which was very steep. I reached the top of the hill again and went to the spot where Kasey laid.

I saw the dog that I went swimming in rivers with, the dog who would lay his head on my shoulder on car trips even though it was uncomfortable, the dog who licked my face in the morning to wake me up, the dog who placed his slobbery ball on my leg to get me to throw it, the dog who I would secretly let on my bed to sleep with, the dog who I played outside with just that day lay still and quiet. I stood there for a few seconds looking at his body. I ran over to it and placed my hand on his head. His eyes looked forward into nothing and his body laid still. I tried to give him CPR but I knew inside it was not going to work for I do not know how to do CPR. I then left him and walked towards my mother still trying to get up the hill.

“I saw the dog that I went swimming in rivers with, the dog who would lay his head on my shoulder on car trips even though it was uncomfortable, the dog who licked my face in the morning to wake me up, the dog who placed his slobbery ball on my leg to get me to throw it, the dog who I would secretly let on my bed to sleep with, the dog who I played outside with just that day lay still and quiet.”

“He’s gone”, I said crying to my mother. I saw her burst into tears and fall to her knees. She then runs towards me and looks for Kasey. She saw him and fell to his side and put her head to his chest. “It’s OK. It’s OK Kasey,” she repeated with tears, “Wake up, Kasey! Wake up!” I then heard my father yelling, “Where are you?”

I ran down the hill once again and led him to where Kasey was. I told my dad he’s gone but he refuses to believe that his buddy is gone. He got to the top and saw him on the ground. He yelled Kasey’s name in emotional pain and grabbed him. He put his head to his chest and listened to his heartbeat. We heard nothing but the strong wind against pine trees.

My father yells Kasey’s name again and again and then tries to do CPR on him. Nothing happens. My father then goes to perform mouth to mouth resuscitation but I stop him. I told him it could be poison that killed Kasey so we can’t risk ourselves being poisoned in order to attempt to save Kasey. My father ordered me to take my clothes off because the poison could enter through my skin from my clothes. I take my clothes off leaving a pair of tennis shoes and no socks on my feet and my underwear. I show the tube that killed Kasey to my parents and they are frightened and confused about the object.

We walked down the hill not talking and staring in disbelief at the ground. Our Kasey was gone. So unexpected and sudden. That’s what made it all the more painful. I just had my tennis shoes and underwear to walk through the deep, cold snow. My mother held my red backpack and my father carried the body of Kasey. Kasey’s head dangled with every step and I looked away with deep pain in my heart. When we had reached our home I was ordered by my father to shower immediately. For the poison could be on my skin and kill myself and others. My wet, orange stained clothes stayed outside to prevent any contamination and my father alerted the sheriff of what happened.

I sobbed in pain for what happened to my dog. I hated the fact that I couldn’t play fetch with my friend. The last thing Kasey saw before he died was me. I could not help him. No one could. I felt so useless when my friend was dying. It still haunts me today on how I couldn’t help him. The images that I saw will stay in my mind forever. I went downstairs slowly and waited in the kitchen staring forward. I saw police cars and a fire truck pull up into my driveway. They questioned me on what happened and I explained what I saw and experienced. They looked in disbelief because they were so confused.

When I was finished they returned to their cars and discussed what the thing that almost killed me might be. The hazmat squad pulled into the driveway and I stared through the window watching them. I saw my best friend’s body laying on the side of our driveway. He was so still laying there. “Wake up, Kasey,” I thought to myself, “Wake up and get your ball” I forced myself to look away because the pain was too great. I shed tears again because of my dog not waking up.

The police, hazmats, and firemen walked up the hill while I stayed laying on our couch. They told my father that they had found the metal tube and said they were nonplussed because they did not know what it could be. I heard from my father on his cellphone that a person not even at our house at the time said that the metal tube sounds like a coyote cyanide bomb. The men searching the top of the hill looked up coyote cyanide bombs on the internet and it was exactly what it was.

As soon as the men heard that the strange tube was a coyote cyanide bomb they told my father to take me to the hospital. I got in the car with my mother both astonished that it was cyanide and we rushed to the emergency room. We were not allowed to enter by the main doors as we were contaminated, and instead had to enter through the decontamination showers. I got my blood drawn and luckily by God's gift of wind blowing the cyanide gas out of my face I was alright. My family also were required to get their blood drawn and they were healthy as well. The entire group of men who went up the mountain to investigate were required to be tested as well. Through God's grace no one was hurt.

Today, March 20, 2017, I woke up, remembered the entire incident and regained all the sadness from the death of a family member. How different things could be in the present for my family if the man who placed the traps checked the area for any inhabitants nearby. If he could have just looked up the location on maps and saw that there was a house three hundred-fifty yards away. He could see a swing set, a slide, soccer goals, and the fields Kasey played in. He would have seen my family with their happy yellow lab. Even if he still put the cyanide bombs there knowing there was a house nearby, but would have warned my family and the others around it about it, things could have been different. Things would be much happier for my family. I would be playing catch outside with my dog. He would have been so happy playing with his toys. He would have been frolicking in our yard on a spring day. I feel great inanition right now because of the tragedy that has occurred. My mentality has suffered severely and I find it hard to be joyful again.

"I looked in dismay as I saw him pull out a little wood sign that was supposed to be on the road leading to the bomb, and just a 10- inch stake with orange tape wrapped around the tip supposed to be 25 feet away from the bomb."

I met with man who had murdered my dog earlier today and I felt anger when I saw his face. But something changed inside of me when I saw him. It was perhaps knowing that he was human just like me helped me feel more at peace. But I still was angry for what he had done to my family.

He apologized repeatedly about the incident and I questioned him on the bombs. I asked him why he thought these bombs were ethical and a good idea to put in nature but I was never given a straight answer. He only just said we have different points of view on the subject. He also asked me to see if I wanted to see the signs that were to be warning people of the bombs. These were not the signs that were guarding the bomb that killed my dog. They were just other signs that guarded other bombs. I looked in dismay as I saw him pull out a little wood sign that was supposed to be on the road leading to the bomb, and just a 10- inch stake with orange tape wrapped around the tip supposed to be 25 feet away from the bomb.

No signs like these were near the cyanide bomb that took my dog away from me. To others though these signs would have a large chance of being unuseful because of their size and placement. How absurd how USDA Wildlife Services warns people of these cyanide bombs. A sign attached to a fence on the road up the hill would only work if the person was driving up the hill, which no one usually does because the hill is regularly used for hiking. And a 10-inch wooden stake in the ground 25 feet away from it. Half of the stake would be hammered underneath the ground, so that only leaves five inches of a sign warning people of a deadly bomb. A wet floor sign warns you more about a slightly moisturized floor than the signs placed by Wildlife Services warns you about a poison gas bomb that can kill animals and people in minutes. It is also not very intelligent placement because the chances of seeing the sign first when it is 25 feet away from the bomb are not 100 percent. If we know that why don't we use better sign placement. Putting the sign 25 feet away does not help in the way that if it was near, people would read the sign first and then examine the cyanide bomb, but it is 25 feet away from the sign so there is no promise of safety.

"A wet floor sign warns you more about a slightly moisturized floor than the signs placed by [USDA} Wildlife Services warn you about a poison gas bomb that can kill animals and people in minutes."

Weapons these deadly should not use two little, wood signs to warn people of their danger and that alone. No one in our neighborhood knew that these weapons existed until this incident occurred. No phone call or letter in the mail to tell people of the traps that will sooner or later kill someone or something. Wildlife Services is very lazy by placing these traps on BLM property and saying it was someone else's, not checking for close inhabitants, not having legible signs placed around the bomb, not warning neighbors of the bombs they placed and not creating a better way of protecting livestock a long time ago because this has happened many times before.

Wildlife Services also continues to say that these coyote cyanide bombs are ethical. How are these things ethical? Wildlife Services is using chemical warfare within feet of neighborhoods and putting them by houses to use them on nature. Not a very intelligent way of protecting livestock. Cyanide is one of the most deadly poisons as well. Cyanide has been used throughout history as a quick way of killing to murder large amounts of people in a short amount of time. Cyanide works by binding to the hemoglobin, which causes the cell to not be able to hold oxygen. This causes the victim to suffocate from the inside out. How is suffocating the victim humane and ethical. This could happen to anyone. We moved out here on Buckskin Road to be able to be in nature, but now we can not. Because of Wildlife Services being lazy and cheap.

My father, Mark Mansfield, is an experienced hunter and states that it is not hard to shoot coyotes. He says he would walk by some and continue walking because hunting them is not a big achievement. The coyotes also never bother us in our home. We hear them howling and I find it pleasant to listen to them. We had five dogs and they were never bothered by any coyotes. Which one is more dangerous: the coyotes or the coyote cyanide bomb? If you bring up the fact that it is used to protect sheep and livestock then which one costs more to fix: a few sheep with some lacerations or my dead $10,000 hunting dog who I loved very much. You still can't put a price on him.

I miss my dog very much. He was my best adventuring buddy in the entire world. No amount of money or any sincere apology can replace my friend. However, my family will not be victims in this event. We will fight to make these bombs illegal because they are morally wrong. I thank you for reading my story and I hope you were affected by it. Please help me [make] these illegal because no boy should watch his dog die in his arms. Save someone else from the pain my family has suffered.

I love you Kasey."

– Canyon Mansfield, Pocatello, Idaho

"Wildlife Services is using chemical warfare within feet of neighborhoods... not a very intelligent way of protecting livestock."

M-44 "cyanide bombs" have already killed countless dogs, endangered species and non-target wildlife. But will it take the death of a child to ban them nationwide?

Not if you help prevent further tragedies by supporting the Chemical Poisons Reduction Act, federal legislation which will be introduced in 2019 by Rep. Peter DeFazio (D-Oreg). It has been nicknamed "Canyon's Law."

Learn more & meet other M-44 victims at **www.predatordefense.org.**

As of April 2019 Canyon Mansfield and his family (pictured above) have traveled to D.C. twice to urge Congress to prevent other families from suffering similar tragedies by passing legislation to ban M-44s across the nation. They are highly motivated to act. In addition to the trauma of losing their dog, they know they came close to losing their son. Canyon was not only hospitalized, but has had to be closely monitored. He suffered excruciating migraine headaches since the poisoning, a side effect he had not yet experienced when he wrote his account.

EDITOR'S NOTE: Canyon Mansfield shared this account exclusively with the national wildlife advocacy nonprofit Predator Defense, which assisted the Mansfield family in dealing with the poisoning trauma, the media barrage, the stonewalling wildlife agencies, and the politics. Predator Defense accompanied the Mansfields on their 2017 and 2019 trips to Washington, D.C., to meet with members of Congress and urge them support legislation to ban M-44s.

Exhibit 21

Wildlife Services Directive

WS 2.415
May 14, 2020

M-44 USE AND RESTRICTIONS

1. PURPOSE

To establish guidelines for the use of the M-44 device by WS personnel.

2. REPLACEMENT HIGHLIGHTS

This Directive revises WS Directive 2.415 dated 02/27/2018.

3. AUTHORITY

a. 7 U.S.C. §§ 8351 to 8353, and 16 U.S.C. § 667, authorize officers, agents, and employees of the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) to conduct a program of wildlife services and to enter into agreements with states, local jurisdictions, individuals, and public and private agencies, organizations, and institutions for the purpose of conducting such services.

b. Authority to promulgate a policy addressing employee responsibilities is pursuant to U.S. Department of Agriculture (USDA) Departmental Regulation 4070-735-001, dated October 2007.

4. POLICY

a. M-44 Sodium Cyanide Capsules labeled with EPA Registration No. 56228-15 and M-44 devices may only be used for control of coyotes, red and gray foxes, and wild dogs that are vectors of communicable diseases or suspected of preying upon livestock, poultry, or federally designated threatened and endangered (T/E) species. M-44s must be used in accordance with the U.S. Environmental Protection Agency (EPA) pesticide label including the 27 Use Restrictions (revised 1/15/2020), and the Wildlife Services Implementation Guidelines (IG) (Attachment 1). Applicators must comply with all label requirements, including those related to Personal Protection Equipment (PPE).

b. When setting M-44s, applicators must have in their possession the EPA label with the 27 Use Restrictions (URs) (revised 1/15/2020).

c. The color of M-44 marker particles shall indicate whether the applicator is APHIS WS or a non-APHIS applicator operating under a state registration. M-44 Sodium

Cyanide Capsules labeled with EPA Registration No. 56228-15 and containing blaze-orange marker particles are for WS official use only. WS is not authorized to use M-44 capsules labeled with an individual state's registration and containing light yellow marker particles.

d. All M-44 ejectors used by WS personnel must be stamped, marked, or engraved with "U.S. Gov't" or "Property of U.S."

e. All M-44 applicators must physically inventory M-44 capsules under their control at least quarterly during the year using the Controlled Material Inventory Tracking System (CMITS).

f. Supervisors must review inventory records for accuracy at least annually during yearly field inspections and physical inventory. For inventory purposes, only intact capsules that contain sodium cyanide will be reported as part of the available inventory.

g. In the event of a toxic or adverse incident, WS personnel must follow EPA's adverse incident reporting requirements specified in 40 CFR § 159.184. Suspected adverse incidents must be reported to OSS using WS Form 160. For reportable incidents, the State Director of the state where the incident occurred, or their delegate, must ensure WS Form 160 is completed accurately and submitted to the WS.FIFRA6a2@usda.gov mailbox. The Regional Director will refer all incidents to the WS Operational Support Staff Director (or their designated delegate to the Pesticide Coordinating Sub-committee).

h. In addition, Wildlife Services applicators must immediately notify the appropriate State and Regional Director of any adverse incident involving: i) any toxic or adverse human effect to WS personnel, cooperators, or the public caused by the use, storage, or disposal of sodium cyanide; or, ii) any adverse incident involving a non-target domestic animal or any mammal or bird listed as Threatened and Endangered under the Endangered Species Act or covered by the Migratory Bird Treaty Act. The Regional Director will immediately refer all incidents to the WS Operational Support Staff Director (or their designated delegate to the Pesticide Coordinating Sub-committee).

i. WS provides additional instruction on complying with the 27 Use Restrictions in the Wildlife Services Implementation Guidelines (IG) (Attachment 1).

5. SCOPE

This Directive is applicable to all WS personnel.

6. REFERENCES

a. WS Directive 2.401, Pesticide Use (12/08/09)
b. WS Directive 2.201, WS Decision Model (07/15/14)
c. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; 7 U.S.C. 136 et seq., as amended), Section 6(a)(2). 40 CFR Part 159.184 - Toxic or Adverse Effect Incident Reports (a)(1)(i) through (iii).
d. WS Guidance for Reporting Adverse Effects under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (10/04/18)
e. WS Forms 160 and 160A, B, and C, 6(a)(2) Adverse Effects Incident Information Report
f. WS (USDA-APHIS-Wildlife Services). 2019. Human Health and Ecological Risk Assessment for the Use of Wildlife Damage Management Methods by APHIS-Wildlife Services. Chapter VII: The Use of Sodium Cyanide in Wildlife Damage Management. USDA-APHIS-Wildlife Services. October 2019 49pp.

7. ATTACHMENTS

Attachment (1): APHIS Wildlife Services Implementation Guidelines for the 27 Use Restrictions for M-44 Sodium Cyanide Capsules. May 14, 2020.

JANET
BUCKNALL

Digitally signed by JANET BUCKNALL
Date: 2020.05.14 17:10:49 -04'00'

Deputy Administrator
Janet L. Bucknall

Attachment 1
APHIS Wildlife Services Implementation Guidelines for the 27 Use Restrictions for M-44 Sodium Cyanide Capsules

EPA Registration No. 56228-15

Revised: May 14, 2020

Note to Applicators: Although these guidelines contain verbiage from the EPA Label's 27 Use Restrictions for M-44 Sodium Cyanide Capsules, possession of this document in the field does not fulfill label requirements to possess the full EPA Label, which includes the 27 use restrictions, with you in the field.

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
1. Use of the M-44 device must conform to all applicable Federal, State, and local laws and regulations.	State Directors are responsible for ensuring that employees under their supervision are fully aware of all relevant federal, state, and local laws and regulations, and individual M-44 applicators are responsible for complying with these laws and regulations. Applicable laws will vary from state to state, as well as within states. WS M-44 applicators are subject to inspection by EPA or state regulatory enforcement officials to ensure compliance with applicable laws and regulations. State Directors and subordinate supervisors must ensure that all M-44 use by personnel under their jurisdiction complies with the National Environmental Policy Act (NEPA), the Endangered Species Act, and applicable documents and decisions, agreements, and federal agency work plans.
2. Applicators must be subject to such other regulations and restrictions as may be prescribed from time-to-time by the U.S. Environmental Protection Agency (EPA).	Additional regulations and restrictions prescribed by EPA will be provided by the WS Operational Support Staff through normal supervisory channels. Each State Director is responsible to ensure that all M-44 applicators in the state under their supervision are properly trained and individual M-44 applicators are responsible for complying with all Federal and State regulations regarding M-44 use.
3. Each applicator of the M-44 device must be trained in: (1) safe handling of the capsules	Applicators of pesticides must be trained and certified by the appropriate state regulatory agency. State regulatory agency training meets WS

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
and device, (2) proper placement of the device, and (3) necessary record keeping.	requirements if it includes specific M-44 requirements regarding use, safety precautions, and record keeping. In those states where generalized pesticide training lacks specific M-44 training, the State Director must supplement the training to meet specific training needs on use, safety precautions, and record keeping requirements. WS State Directors must ensure that all M-44 applicators they supervise are adequately trained and certified as often as the state pesticide agency requires. Supervisors must use the "Annual M-44 Sodium Cyanide Training Certification" form (WS Form 40) to document applicator knowledge during annual field inspections. In addition, supervisors are required to conduct and document at least one annual field inspection regarding the use of M-44's, Use Restriction #17.
4. M-44 devices and sodium cyanide capsules must not be sold or transferred to, or entrusted to the care of any person not supervised or monitored by the Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) or any agency not working under a WS cooperative agreement.	M-44 cyanide capsules and ejectors will be used only by staff under the supervision of the WS State Director who are Certified Applicators, and who have received specific M-44 training as described in Use Restriction #3. Those personnel will transfer M-44 capsules or equipment only to other staff who are certified M-44 applicators. When transfer of sodium cyanide is necessary, the capsules shall be tracked using the WS Controlled Materials Inventory Tracking System (CMITS).
5. The M-44 device must only be used to take wild canids: (1) suspected of preying on livestock or poultry; (2) suspected of preying on Federally designated threatened or endangered species; or (3) that are vectors of a communicable disease.	M-44s may not be used to protect wildlife other than Federally designated threatened or endangered species. "Livestock or poultry" includes the species listed in "Livestock" and "Commercial Game Animals (Pen-raised)" subcategories of the "Management Information System" (MIS) Resources Protected codes. "Wild canids" for which M-44s may be used include coyote, red fox, gray fox, and wild (feral) dogs (see label and WS Directive 2.340 "Feral, Free Ranging, and Hybrid Dog Damage Management"), subject to further restrictions by state or local regulations. States can restrict but cannot expand the list of

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
UR #5 Continued.	approved target species. Only EPA can designate additional target species.
6. The M-44 device must not be used solely to take animals for the value of their fur.	This restriction reinforces long-standing WS policy prohibiting the taking of animals solely for the value of their fur by M-44s or any other method.
7. The M-44 device must only be used on or within 7 miles of a ranch unit or allotment where losses due to predation by wild canids are occurring or where losses can be reasonably expected to occur based upon recurrent prior experience of predation on the ranch unit or allotment. Full documentation of livestock depredation, including evidence that such losses were caused by wild canids, will be required before applications of the M-44 are undertaken. This use restriction is not applicable when wild canids are controlled to protect Federally designated threatened or endangered species or are vectors of a communicable disease.	The 7-mile rule applies only to M-44 use for the protection of livestock or poultry. "Recurrent prior experience of predation on the ranch unit or allotment" means a history of predation that has been documented in MIS records. MIS documentation of reported or confirmed livestock or poultry losses, on a MIS Direct Control Work Task or a MIS Technical Assistance Work Task, constitutes "full documentation of livestock depredations, including evidence that losses were caused by wild canids." Personnel will place M-44s only on properties identified in "Work Initiation Document for Wildlife Damage Management" (WS Forms 12A, 12B, and 12C) signed by the property owner, manager, or lessee or in compliance with applicable Memoranda of Understanding with public land management agencies. M-44 use must be specifically authorized through a signed written agreement or through provisions in work plans with cooperating agencies. Each Specialist is responsible for determining the boundaries of properties covered by control agreements, and to place M-44s only where authorized by the agreement.
8. The M-44 device must not be used: (1) on Federal lands set aside for recreational use, (2) in areas where exposure to the public and family or pets is probable, (3) in prairie dog towns, or (4) in National or State Parks; National or State Monuments; federally designated wilderness areas; and wildlife refuge areas, except that the M-44 device may be	(1) Use of M-44s is prohibited on federal lands, in areas specifically designated for recreational use. M-44 non-use areas on public lands will be identified through interagency consultations at the WS State Office or District Office level. These areas are oftentimes specifically identified on public maps; such non-use areas will include beaches, campgrounds, and locations where specific seasonal recreation use occurs. (2) Compliance with this rule requires common sense and good judgment, as well as input from local sources regarding public use and seasonal variations in such

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
used in the areas listed above in (4) only for the protection of Federally designated threatened or endangered species. **To determine whether the applicable land management agency has set aside any area on Federal Lands for recreational use either on a permanent or temporary basis, the APHIS State Director or his/her designated representative who are considering authorizing or are responsible for ongoing use of M-44 capsules on public lands, must contact each applicable land management agency quarterly to determine whether any portions of the projected or current M-44 use areas are, or are to be, set aside for recreational use. Within 30-days of that contact, the APHIS State Director, or his/her designated representative, must provide the applicable land management agency with written documentation specifying the applicable land management agency's determinations of what projected or current M-44 use areas are to be set aside for recreational use. For purposes of this Use Restriction, areas set aside for recreational use include areas where and when there are scheduled recreational events, areas identified on maps with "recreation" in the title, areas where developed or known camping occurs, areas near**	use. Regardless of any other consideration, every effort will be made to avoid areas of heavy public use and public exposure. (3) The exclusion of M-44s from prairie dog towns is intended to protect black-footed ferrets. Consultations are not needed for types of lands where M-44s will never be used; see list in Use Restriction #8, item (4). "Wildlife refuge areas" means officially designated Federal or State wildlife refuges or wildlife management areas that are identified by appropriate signs and maps. WS will coordinate quarterly with the land management agency to determine recreational areas where M-44s may not be set. These quarterly contacts can be made through work plan meetings, telephone conversations, in person, or email. Within 30 days after each quarterly contact, WS must provide written documentation of the land management agency's determination of any identified set aside recreation areas (i.e., projected or current areas). Quarterly contacts will also allow for addressing the use of M-44s and unscheduled events that were not planned or discussed during the annual work plan meetings. For WS offices with no plans for use of M-44s on public lands, quarterly contacts are not necessary. Prior to placement of M-44s on any federal lands, WS must ensure compliance with any Pesticide Use requirements of the land management agency.

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
designated or known recreational trail heads and designated or known vehicle access sites.	This space intentionally left blank.
9. The M-44 device must not be used in areas where federally listed threatened or endangered animal species might be adversely affected. Each applicator must be issued a map, prepared by or in consultation with the U.S. Fish and Wildlife Service, which clearly indicates such areas. **(1) Except as provided in paragraph (2) below, the M-44 device must not be used in areas occupied by any federally listed threatened or endangered species or any federally listed experimental populations as set forth in the most current versions of maps that have been prepared or approved by the U.S. Fish and Wildlife Service (FWS). At the time of application, the applicator must be in possession of the most current map, if such map exists, that covers the application site. If maps covering the application site do not exist, then the M-44 applicator must, prior to application, consult with FWS to determine whether the application site is in an area occupied by listed animal species. Any use of the M-44 thereafter must be consistent with any conditions or**	Personnel will use all control methods, including M-44s, in ways that minimize adverse impacts to non-target animals and the environment, and will conduct Section 7 consultations with U.S. Fish and Wildlife Service (USFWS), as required. Before placing M-44s (see the label), applicators will consider impacts on state-listed species and federal and state species that are candidates for listing. Maps for listed threatened and endangered species or experimental populations will be obtained by each State Director from appropriate FWS Endangered Species resources, including personnel and/or on-line planning tools such as IPaC (https://ecos.fws.gov/ipac/). Alternatively, maps may be prepared jointly by WS and FWS personnel. Where FWS personnel are unavailable or unable to cooperate in this activity, the State Director will prepare appropriate maps and will provide copies to FWS Endangered Species and State wildlife agency offices whenever new or updated maps are distributed to M-44 applicators. Each applicator must be aware of specific areas closed to M-44 use, as shown in "Endangered Species Considerations" on the label. Endangered species maps are not needed in states or areas where no vulnerable threatened or endangered species exist, as determined by informal consultations between WS and federal and/or state endangered species offices.

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
limitations provided by FWS through such consultation. **(2) Notwithstanding paragraph (1), the M-44 device may be used in areas occupied by endangered, threatened, or experimental populations if use in such areas a) has been addressed by FWS in special regulations pursuant to section 4(d) of the ESA, in requirements imposed through incidental take statements or incidental take permits, or in other applicable agreements with the FWS, and b) the applicator's use of the M-44 is consistent with any conditions or limitations provided by FWS for such use.**	This space intentionally left blank.
10. At least one person within APHIS in addition to the individual applicator must have knowledge of the exact placement of all M-44 devices in the field. This includes initial placement and any subsequent changes of M-44 GPS locations as soon as possible but no later than 14 days. In the case of applications to privately owned land, the applicator must also have written permission from the landowner or lessee who has requested M-44 device use prior to their placement. When devices are placed on private land, all residences on the property must be notified of the M-44 device use.	Applicators will meet this requirement by providing their supervisors with electronic or hard copies of M-44 GPS locations including the initial placement and any subsequent changes as soon as possible, but no later than 14 days after placement. No one in addition to the certified applicator need be present during placement or replacement of M-44 devices, but at least one person within APHIS, in addition to the individual applicator must have knowledge of the exact placement of all M-44 devices in the field. In the case of applications to privately owned land, prior to placing an M-44 device, the applicator must also have written permission from the landowner, manager or lessee who has requested M-44 device use prior to their placement. A Work Initiation Document (WID) that authorizes the use of M-44s and is signed by the cooperator satisfies this requirement. When devices are placed on private land, the applicator must notify all residences on the property of the M-44 device use.

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
11. In areas where more than one governmental agency is authorized to place M-44 devices, the agencies must exchange placement information and other relevant facts to ensure that the maximum number of M-44s allowed is not exceeded.	As a general policy, WS will not use M-44s on any property where persons other than personnel under the direction of the State Director are using them. Each exception to this rule must be authorized in writing by the supervisor or State Director before any M-44s are set. In such exceptional cases where WS and other governmental agencies or private individuals are using M-44s concurrently, personnel will communicate with other users sufficiently to ensure that the maximum number of M-44s placed by all users does not exceed the totals set forth in Use Restrictions #15 and #16.
12. The M-44 device must not be placed within 200 feet of any nonfrozen lake, stream, or other body of water, provided that natural depression areas which catch and hold rainfall for short periods of time shall not be considered "bodies of water" for purposes of this restriction. M-44 devices may be set within 200 feet of frozen bodies of water only if (i) they are removed before the water body is no longer completely frozen, and (ii) are set at such elevation to prevent inundation in the event of an untimely thaw.	Dry irrigation ditches, water troughs, and completely frozen lakes, ponds, and streams are not "bodies of water" for purposes of this Use Restriction. Avoidance of hazard to humans and non-target animals may require at times that M-44 sets be more than 200 feet away from water. Wherever uncertainty exists about the suitability of specific placement locations, applicators should consult with their supervisors before placing M-44s. (See Use Restriction #14).
13. The M-44 device must not be placed in areas where food crops are planted.	This use restriction is intended to protect people who work in fields where crops are planted as well as people who consume the food products from the fields. This Use Restriction does not prohibit the placement of M-44s in: (i) areas adjacent to food crop fields; or (ii) in fields where food crops have been completely harvested, provided that M-44s are removed prior to replanting.

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
14. The M-44 device must not be placed within 300 feet of any designated public road or public pathway.	Applicators must not set M-44s closer than 300 feet to a designated public road or public pathway. "Public road or public pathway" generally means a road or trail that is designated and identified as such on maps, is open to unrestricted public access and is maintained by a government or public entity. A pickup track or livestock path is not a "designated public road or public pathway" for purposes of this use restriction. Any uncertainty about specific public roads or pathways on public lands should be resolved through informal consultation with local land management agency personnel. Personnel will not place M-44s in any location where exposure to the public and family pets is probable (Use Restriction #8).
15. The maximum density of M-44s placed in any 100-acre pasture land areas must not exceed 10; and the density in any 1 square mile of open range shall not exceed 12.	Implementation of Use Restriction 15, on its own and in combination with Use Restriction 16, creates the potential for conflicting standards for the maximum allowable density of M-44 devices that can be set in an area. In order to simplify interpretation of Use Restrictions 15 and 16, and ensure compliance with both, Applicators must not set more than 12 M-44 devices per square mile (640 acres), whether in pasture or open range. Additionally, applicators must not set more than 10 M-44s in any pasture 100 acres in size or smaller. Applicators should exercise caution when setting M-44 devices on neighboring pastures, properties, or grazing allotments to ensure that neighboring clusters of M-44 devices do not exceed these maximum densities when considered as a single area.
16. M-44 devices must not be placed within 30 feet of a livestock carcass used as a draw station. No more than four M-44 devices may be placed per draw station and no more than five draw stations may be operated per square mile.	Use Restriction 16 allows the placement of up to 5 draw stations per square mile, and limits the number of M-44s placed per draw station to 4. Additionally, applicators must not set more than 12 M-44s in a square mile. Implementation of Use Restriction 16, in combination with Use Restriction 15, creates the potential for conflicting standards for the maximum allowable number of M-44 that can be set in an area. In order to ensure compliance with both, Wildlife Services

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
UR #16 Continued.	applicators must not set more than 12 M-44 devices per square mile (640 acres), whether in pasture or open range. However, applicators must not set more than 10 M-44s in any pasture 100 acres in size or smaller. Applicators will not set M-44s within 30 feet of any livestock or other animal carcass with meat or viscera attached, regardless of whether or not the carcass is intended to be a draw station. Applicators should inspect each M-44 site to ensure that any carcass parts are at least 30 feet from the nearest M-44. Applicators should take all reasonable precautions, including staking carcasses to the ground, to prevent scavengers from dragging them to within 30 feet of any M-44s.
17. Supervisors of applicators must check the records, warning signs, and M-44 devices of each applicator at least once a year to verify that all applicable laws, regulations, and restrictions are being strictly followed.	Supervisors of applicators must conduct at least one field inspection annually to ensure records, warning signs, and M-44 devices are in compliance with all applicable laws, regulations and restrictions. These inspections will be documented on the "Field Inspection Report" (WS Form 82). Additional field inspections may be conducted as deemed necessary by the supervisor. Supervisors will also complete the "Annual M-44 Sodium Cyanide Training" form (WS Form 40) during annual field inspections to document review of applicator's knowledge of M-44 guidelines and restrictions. Additionally, supervisors will check to ensure that inventory and use records of sodium cyanide are in accordance to the CMITS requirements.
18. Each M-44 device must be visually inspected by an applicator or cooperator at least once every week, weather permitting access, to check for interference or unusual conditions; and must be serviced as required, by the applicator.	Applicators will record each required M-44 check on an MIS "Direct Control Work Task" showing the number of M-44s checked and fired (including 0 if none were fired). M-44s may be checked by cooperating ranchers. Cooperator checks will be limited to visual inspection to determine if devices have been disturbed or pulled, followed by verbal report to the applicator who will submit appropriate MIS documentation. Cooperators may not reset or handle the device and they should not disturb any animal taken with the device. Each required check prevented by adverse weather or

EPA Use Restrictions (as written on Label)	**WS Implementation Guideline**
UR #18 Continued.	for any other reason should be documented specifically for each property or agreement in MIS.
19. Damaged or nonfunctional M-44 devices must be removed from the field.	Applicators must not discard damaged or unserviceable devices (ejector, shell holder, and/or tube) in the field, and should remove or replace damaged devices with working units as appropriate. Removal or replacement of damaged or nonfunctional M-44 devices requires no special documentation beyond routine reporting in an MIS Direct Control Work Task of the numbers of units set on the property.
20. An M-44 device must be removed from an area if, after 30 days, there is no sign that a target predator has visited the site.	"Site" in this context means the property described in the Work Initiation Document (WID) for wildlife damage management (WS Form 12A, 12B, and 12C). Documentation of predator damage to livestock anywhere on the ranch unit or allotment or other physical evidence of their presence will be regarded as evidence that a target predator has visited the site. M-44s will be removed when they are no longer needed. This decision will be made consistent with Use Restriction #7.
21. All persons authorized to possess and use sodium cyanide capsules and M-44 devices must store such capsules and devices under lock and key, including when in transit.	M-44 capsules and devices must be stored under lock and key at all times when unattended, including when in transit. Personnel will use locking metal boxes for this purpose. M-44 capsules may be transported in the cab or passenger compartment of a vehicle in a locked storage box.
22. Used sodium cyanide capsules must be disposed of by deep burial or at a proper landfill site. Incineration may be used instead of burial for disposal. Place the capsules in an incinerator or refuse hole and burn until the capsules are completely consumed. Capsules may be incinerated using either wood or diesel fuel.	Applicators under the supervision of the State Director **will not** dispose of any intact, damaged or spent M-44 sodium cyanide capsules by deep burial or incineration. Wildlife Services will dispose of any intact, damaged or spent capsules in accordance with Wildlife Services Standard Operating Procedure HS/WS 003.00. (https://usdagcc.sharepoint.com/sites/aphis-ws/safetyandhealth/SitePages/Home.aspx)

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
23. Bilingual warning signs in English and Spanish must be used in all areas containing M-44 devices. All such signs must be removed when M-44 devices are removed. **a. Main entrances or commonly used access points to areas in which M-44 devices are set must be posted with warning signs to alert the public to the toxic nature of the cyanide and to the danger to pets. Install freestanding warning signs at access points or on property boundaries where no fence lines exist, as appropriate. Signs must be inspected weekly to ensure their continued presence and ensure that they are conspicuous and legible.** **b. Two elevated signs, placed in the most likely directions of approach, must be placed within 15 feet of each individual M-44 device warning persons not to handle the device.**	Warning signs are the first line of defense against accidental exposures. WS has designed "premise" signs for placement at common property access points to comply with Use Restriction 23a, and "device" signs for compliance with Use Restriction 23b. Both sign types can be acquired from the Pocatello Supply Depot. Applicators should place premise signs in a conspicuous location at all commonly used access points to the property. Additional free-standing premise signs may be placed along property boundaries where no fence lines exist if there is reason to believe people may access the property in that location. Applicators must install two WS authorized elevated signs ("device sign") as required by Use Restriction #23(b). Device signs must be securely anchored to a stake, post or wire and they must be positioned vertically above ground level. Device signs may also be hung from a low hanging tree limb in a manner that renders the sign clearly visible. Device signs must be placed within 15 feet of each device and in the most likely direction of approach by persons traversing the area. All signs must be inspected weekly to ensure they remain present, properly placed, and legible. All warning signs must be removed when M-44 devices are removed from the field. In addition to placing warning signs, applicators must advise resource/land owners of the dangers of sodium cyanide, and the potential for death or injury to people, pets, and livestock if M-44s are misused. Ranchers and landowners are responsible to inform any persons entering their property of the presence and hazards of M-44 devices.
24. In all areas where the use of the M-44 device is anticipated, local medical people must be notified of the intended use. This notification may be through a	Where local hospitals and medical centers rely on poison control centers for help in treating poisoning cases, notification of the poison control centers will meet this requirement. If hospitals in an applicator's area do not use or do not have access to a poison control

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
poison control center, local medical society, the Public Health Service, or directly to a doctor or hospital. It must be the responsibility of the supervisor to perform this function. Notifications must be made at least annually.	center, hospitals and medical clinics will be notified individually. Such written notifications will be made by State Office personnel, District Supervisors, or the designated field personnel in the local area where M-44s are to be used. Copies of written materials documenting the required notifications will be kept at the State Office. Notifications must be made at least annually.
25. Each authorized M-44 applicator must keep records dealing with the placement of the device and the results of each placement. Such records must include, but need not be limited to: **a. The number of devices placed.** **b. The location of each device placed.** **c. The date of each placement, as well as the date of each inspection and removal.** **d. The number and location of devices which have been discharged and the apparent reason for each discharge.** **e. Species of animals taken.** **f. All accidents or injuries to humans or domestic animals.**	In general, applicator's records must be detailed enough to account for the locations of all M-44 equipment and capsules, as well as for all results of M-44 use. Items under Use Restriction #25(a), (c), and (e) must be recorded in MIS "Direct Control Work Task section." To comply with Use Restriction #25(b), Wildlife Services applicators must document the GPS coordinates of each device placed. Each date of inspection (Use Restriction #25(c)) and status of M-44s set (discharged) on each property will be recorded on a separate work task. Each required check that cannot be made due to adverse weather or for any other reason must be documented specifically for each property or agreement. If a state pesticide regulatory agency requires M-44 location information to be recorded in a different format, then the applicator must also adhere to that requirement unless an exception has been granted by the regulatory agency. The apparent reason for discharge (Use Restriction #25(d)) is normally recorded only when the applicator can identify the apparent reason based on physical evidence. Applicators will not speculate about apparent reason(s) for discharge when evidence is lacking. If the reason for the discharge is unknown, the report must identify the reason as “unknown”. If the State Director or supervisor determines the reasons for discharge need to be documented in greater detail than is possible in MIS, the supervisor will direct the employee as to what report format to use. In addition to the records mandated by Use Restriction #25, WS applicators are required to provide pesticide application records to each cooperator or landowner

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
UR #25 Continued.	within 30 days of applying pesticides. WS M-44 applicators can comply with this regulation by notifying the landowner/cooperator in writing that WS will maintain these records, if the landowner agrees, and will provide copies upon request. The "Work Initiation Document for Wildlife Damage Management" form (WS Form 12A, 12B and 12C) includes the above notification.
26. The M-44 device must not be used within 600 feet of occupied residences, except those of any cooperating entity who has given APHIS written permission for M-44 device placement on their property.	M-44s will not be placed within 600 feet of occupied residences except for those belonging to a cooperator who has requested the use of M-44s and has signed a Work Initiation Document authorizing their use. Even if a cooperator authorizes M-44 use, the device must comply with all other use restrictions including 8(2) prohibiting placement in areas where exposure to the public and family or pets is probable. Personnel are responsible for accurately identifying property boundaries where M-44 devices are to be placed. If the property boundaries are not clearly posted, or if the landowner, manager or lessor is unable to accurately identify the property boundaries, WS personnel shall use electronic mapping or aerial imagery to: a) ensure devices are placed within the boundaries of property covered by the agreement; and b) identify non-cooperator residences within 0.5 mile of the device and/or residences that may require notification, per Use Restriction #27. Buildings that are obviously abandoned or not actively occupied are not considered residences. Applicators should err on the side of caution when evaluating the seasonal or periodic occupancy of hunting camps and other temporary residences.
27. Prior to device placement, APHIS must notify any occupied residence within 0.5 miles of an M-44 device of the presence of M-44s by one or more of the following methods: face-to-face communication, person to	Before placing an M-44, applicators will notify the occupants of any residence within 0.5 miles of the anticipated device location of the use of the device in the area. Buildings that are obviously abandoned or not actively occupied are not considered residences. Applicators should err on the side of caution when evaluating the seasonal or periodic occupancy of

EPA Use Restrictions (as written on Label)	WS Implementation Guideline
person telephone conversation (voice message is not acceptable), door hanger notice, certified mail.	hunting camps and other temporary residences for notification purposes. Applicators will use one or more of the following notification methods: face-to-face communication, person to person telephone conversation, door hangers, or certified mail. Voice messages are not sufficient to satisfy this requirement. The identity of the Cooperator and of the Cooperator's property will not be shared directly with the notified individuals unless the Cooperator has authorized disclosure in writing. Applicators will document notification on WS Form 205A. Completed forms will be maintained by the WS State Director or their WS designee.

Exhibit 22

Environmental Assessment: Predator Damage Management in Nebraska for the Protection of Livestock, Wildlife, Property and Public Health and Safety

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Pre-Decisional

ENVIRONMENTAL ASSESSMENT

PREDATOR DAMAGE MANAGEMENT IN NEBRASKA FOR THE PROTECTION OF LIVESTOCK, WILDLIFE, PROPERTY AND PUBLIC HEALTH AND SAFETY

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)

ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)

WILDLIFE SERVICES (WS)

In Cooperation With:

UNITED STATES DEPARTMENT OF AGRICULTURE

U.S. FOREST SERVICE (Forest Service)

NEBRASKA NATIONAL FOREST

SAMUEL R. MCKELVIE NATIONAL FOREST

OGLALA NATIONAL GRASSLAND

UNITED STATES DEPARTMENT OF INTERIOR (USDI)

BUREAU OF LAND MANAGEMENT (BLM)

NEWCASTLE RESOURCE AREA

FISH AND WILDLIFE SERVICE (USFWS)

NEBRASKA GAME AND PARKS COMMISSION (NGPC)

NEBRASKA DEPARTMENT OF AGRICULTURE (NDA)

UNIVERSITY OF NEBRASKA COOPERATIVE EXTENSION (UNCE)

Pre-Decisional

Table of Contents

ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BA&FB	Biodiversity Associates and Friends of the Bow
BLM	Bureau of Land Management
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
DOW	Defenders of Wildlife
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FSM	Forest Service Manual
FY	Fiscal Year
GAO	U.S. General Accounting Office
HSUS	Humane Society of the United States
IPM	Integrated Pest Management
IWDM	Integrated Wildlife Damage Management
LPC	Livestock Protection Collar
LRMP	Land and Resource Management Plan
MBTA	Migratory Bird Treaty Act
MFP	Management Framework Plan
MFWP	Montana Department of Fish, Wildlife, and Parks
MOU	Memorandum of Understanding
NAGPRA	Native American Graves Protection and Repatriation Act
NASS	National Agricultural Statistics Service
NDA	Nebraska Department of Agriculture
NDH	Nebraska Department of Health
NEASS	Nebraska Agricultural Statistics Service
NEPA	National Environmental Policy Act
NGPC	Nebraska Game and Parks Commission
NHPA	National Historical Preservation Act
RMP	Resource Management Plan
RNA	Research Natural Area
ROD	Record of Decision
RSN	Revised Statutes of Nebraska
SOP	Standard Operating Procedure
T&E	Threatened and Endangered Species
UNCE	University of Nebraska Cooperative Extension
USACE	U.S. Army Corp of Engineers
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
WA	Wilderness Area

ACRONYMS Cont.

WMA	Wildlife Management Area

WS	Wildlife Services (formerly Animal Damage Control (ADC))
WSR	Wild and Scenic River

CHAPTER 1: PURPOSE AND NEED FOR ACTION

INTRODUCTION

Across the United States, wildlife habitat is being substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with wildlife which increases the potential for conflicting human/wildlife interactions. In addition, segments of the public strive for protection for all wildlife; this protection can create localized conflicts between human and wildlife activities. The *Animal Damage Control* (ADC) *Programmatic Final Environmental Impact Statement* (EIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (USDA 1994):

> "*Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife is generally regarded as providing economic, recreational and aesthetic benefits . . . and the mere knowledge that wildlife exists is a positive benefit to many people. However . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and values are required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well*."

Normally, according to the Animal and Plant Health Inspection Service (APHIS) procedures for implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions are categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000, 6,003, (1995)). This Environmental Assessment (EA) has been prepared, however, to evaluate and determine if any potentially significant or cumulative impacts from the proposed and planned damage management program will occur.

Wildlife damage management is the alleviation of damage or other problems caused by, or related to, the presence of wildlife and is recognized as an integral component of wildlife management (The Wildlife Society 1992). Wildlife Services (WS) (formerly Animal Damage Control (ADC)) uses an Integrated Wildlife Damage Management (IWDM) approach, commonly known as Integrated Pest Management (IPM) in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1:1-7 of the ADC EIS (USDA 1994). These methods include practices such as habitat and behavioral modification to prevent or reduce damage or may also require that the offending animal(s) be removed or that local populations or groups of the offending species be reduced through lethal methods.

Given the Congressional directive, efficacy of the program will be evaluated as an issue rather than a need for the program. To fulfill the Congressional direction, the purpose of predator damage management is to prevent or minimize damage to the protected resources. Therefore, wildlife damage management is not based on punishing offending animals, but is a means of reducing damage and is used as part of the ADC Decision Model (Slate et al. 1992) described in the ADC EIS (USDA 1994:2-23 to 2-36). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated. The need for action is derived from the specific threats to the resources and the available methods for responding to those threats. This EA documents the analysis of the potential environmental effects of the proposed and planned predator damage management in Nebraska. This analysis relies mainly on existing data contained in published documents (Appendix A) and the ADC EIS (USDA 1994) to which this EA is tiered.

WS is a cooperatively funded, service-oriented program. Before any wildlife damage management is conducted, an agreement for control must be signed by the landowner or administrator for private lands and WS Work Plans or other comparable documents are in place for public lands. When requested, WS cooperates with land and wildlife management agencies (in accordance with any Memoranda of Understanding (MOUs)) to reduce wildlife damage effectively and efficiently according to all applicable federal, state and local laws.

All wildlife damage management that would take place in Nebraska would be undertaken in compliance with relevant laws, regulations, policies, orders, and procedures, including the Endangered Species Act (ESA). Notice of the availability of this EA will be published in newspapers, consistent with APHIS' NEPA procedures, to allow interested parties the opportunity to obtain and comment on this document.

WILDLIFE SERVICES PROGRAM

WS' mission, developed through its strategic planning process, is: 1) to provide leadership in wildlife damage management for the protection of America's agricultural, industrial, and natural resources, and 2) to safeguard public health and safety. WS' policy manual[1] reflects this mission and provides guidance for engaging in wildlife damage management through:

- close cooperation with other federal and state agencies;
- training of wildlife damage management professionals;
- development and improvement of strategies to reduce losses and threats to publics from wildlife;
- collection, evaluation and distribution of wildlife damage management information;
- cooperative wildlife damage management programs;
- informing and educating the public on how to reduce wildlife damage and;
- providing data and a source for limited-use management materials and equipment, including federal and state registered pesticides (USDA 1989).

PURPOSE

This EA analyzes predator damage management related to the protection of livestock, poultry, designated wildlife, property, and public health and safety on private and public lands within Nebraska. Nebraska encompasses an area of about 77,277 mi^2. In Fiscal Year (FY) 1998, Nebraska WS had agreements to conduct predator damage management on about 5% of Nebraska's lands[2]. In Nebraska, land is owned and managed by private individuals, counties, municipalities, American Indian Tribes, the State (e.g., the Nebraska Game and Parks Commission (NGPC)), and federal agencies (e.g., the U.S. Fish and Wildlife Service (USFWS), Army Corp of Engineers (USACE), U.S. Forest Service (Forest Service), Bureau of Land Management (BLM), etc.).

At present, Nebraska WS primarily protects livestock on land owned or managed by private individuals or the State, however, WS also sometimes protects cattle, goats, and sheep that graze on Forest Service administered lands during the summer months. Nebraska WS currently conducts predator damage management for the protection of livestock on the Nebraska National Forest and Oglala National Grassland under an EA prepared by the Forest Service (1991). Requests to assist in the protection of property, public health and safety or designated wildlife species are not addressed in the Forest Service's EA. Within Nebraska, WS has received requests to protect nesting waterfowl, pronghorn (*Antilocapra americana*), interior least terns (*Sterna antillarum*), and piping plovers (*Charadrius melodus*) from predation. In addition, Nebraska WS responds to requests for assistance with coyotes (*Canis latrans*), red foxes *(Vulpes vulpes*), mountain lions (*Puma concolor*), raccoons (*Procyon lotor*), badgers (*Taxidea taxus*), bobcats (*Lynx rufus*), opossums (*Didelphis virginiana*), mink (*Mustela vison*), weasels (*Mustela* spp.) and striped skunks (*Mephitis mephitis*) thought to be a threat to public health and safety. As proposed in this EA, Nebraska WS would protect livestock, wildlife, property, and public health and safety, as requested, on all land classes in Nebraska. Furthermore, this EA would replace the existing EA prepared by the Forest Service (1991) for the Nebraska National Forest and the Oglala National Grassland.

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[1] The WS Policy Manual provides WS personnel guidance in the form of program directives. Information contained in the WS Policy Manual and its associated directives has been used throughout this document, but has not been cited in the text or referenced in Appendix A.

[2] Information from WS' Management Information System (MIS) is used throughout this document to quantify species take, methods use, and verified and reported damage. Since information from the MIS is considered unpublished data, it has not been cited in the text or referenced in Appendix A.

1.1 NEED FOR ACTION

The need for action is based on the necessity for a program to protect livestock, wildlife, property, and public health and safety from predator damage. Livestock predation, caused primarily by coyotes, is a chronic concern of many livestock producers. A 1990 survey estimated that, of the nearly 6 million lambs born in the 16 western States, 549,000 lambs died of all causes (Connolly 1992a). Nearly 60% of these losses were the result of predation, with coyotes accounting for 70% of the predator-caused mortalities. In 1990, the economic impact of predation on Nebraska livestock producers and consumers was about $11.4 million. Despite intensive historical damage management efforts in livestock production areas, and despite sport hunting and trapping, coyotes continue to thrive and expand their range, occurring widely across North and Central America (Miller 1995).

WS is the federal agency authorized by Congress to manage wildlife damage to livestock, agricultural products, natural resources, property, and threats to public health and safety (Animal Damage Control Act of 1931 as amended (7 U.S.C. 426-426c Stat. 1468), Rural Development, Agriculture and Related Agencies Appropriation Act of 1988 (Public Law 100-202, Dec. 22, 1987. Stat. 1329-1331, 7 U.S.C. 426c)). In a 1993 District Court decision (U.S. District Court of Utah 1993), the court ruled that " . . . *the agency need not show that a certain level of damage is occurring before it implements an ADC program*" and "*Hence, to establish need for an ADC, the forest supervisors need only show that damage from predators is threatened*." WS accepts this standard as appropriate for establishing the need for a WS program in Nebraska.

WS cooperates with federal and state agencies, individuals, and public and private entities in wildlife damage management programs, as directed by law. In addition, WS has analyzed and issued a Record of Decision (ROD) on its nationwide program within the context of a programmatic EIS (USDA 1994).

1.1.1 Summary of the Proposed Action

Currently, Nebraska WS protects livestock, and when requested, designated wildlife species and public health and safety on private, state and National Forest System lands. The proposed action includes expanding the current program to include other federal lands (e.g., BLM, Bureau of Reclamation, USFWS, and USACE) or other areas where a need exists and as requested to protect various resources (livestock, wildlife, threatened and endangered (T&E) species, property, and public health and safety) in Nebraska. The Nebraska WS program intends to continue with an IWDM approach that would allow the prudent use of all legal techniques and methods, either singularly or in combination. Livestock producers would continue to be provided information on nonlethal techniques. Predator damage management methods used by Nebraska WS would include shooting, calling and shooting, aerial hunting, trapping, snaring, M-44s, denning, and the use of dogs. The Livestock Protection Collar (LPC) is not currently registered for use in Nebraska, but if it were to become registered, it could also be used when deemed appropriate. Predator damage management would be allowed, when requested, on federal and state lands where Wildlife Damage Management Work Plans or other comparable documents are in place and on private lands covered by signed agreements for control. All predator damage management would be consistent with other activities in the area and would comply with all federal, state and local laws. Nebraska WS would cooperatively develop Wildlife Damage Management Work Plans with the Nebraska Department of Agriculture (NDA), the BLM Newcastle Resource Area, the Nebraska National Forest, Samuel R. McKelvie National Forest, Oglala National Grassland, NGPC, USFWS, or any American Indian Tribe requesting assistance. These work plans or other comparable documents would be reviewed annually.

1.1.2 Need for Predator Damage Management for the Protection of Livestock and Poultry

According to the Nebraska Agricultural Statistics Service (NEASS), agriculture generated more than $10 billion in cash receipts in Nebraska in 1997 (NEASS 1998). Livestock production is one of the primary agricultural industries and accounted for 55% of all agricultural cash receipts (Table 1-1) (NEASS 1998).

Nebraska WS protects a variety of livestock including cattle, sheep, swine, poultry, goats, and horses.

Table 1-1. Cattle and Sheep Inventories by District in Nebraska (NEASS 1998).

District	Cattle			Sheep		
	1996	1997	1998	1996	1997	1998
Northwest[1]	820,000	850,000	870,000	20,000	18,000	18,000
North[2]	1,270,000	1,280,000	1,290,000	5,000	5,500	5,000
Northeast[3]	1,000,000	1,040,000	1,050,000	15,000	14,000	14,000
Central[4]	900,000	930,000	950,000	16,000	16,000	17,000
East[5]	770,000	800,000	800,000	19,000	17,000	18,000
Southwest[6]	600,000	630,000	650,000	4,000	4,000	4,000
South[7]	560,000	580,000	590,000	9,000	7,000	7,000
Southeast[8]	430,000	440,000	450,000	17,000	16,000	17,000
Total	6,350,000	6,550,000	6,650,000	105,000	95,000	100,000

[1]Banner, Box Butte, Cheyenne, Dawes, Deuel, Garden, Kimball, Morrill, Scotts Bluff, Sheridan, and Sioux Counties
[2]Arthur, Blaine, Boyd, Brown, Cherry, Garfield, Grant, Holt, Hooker, Keya Paha, Logan, Loup, McPherson, Rock, Thomas, and Wheeler Counties
[3]Antelope, Boone, Burt, Cedar, Cuming, Dakota, Dixon, Knox, Madison, Pierce, Stanton, Thurston, and Wayne Counties
[4]Buffalo, Custer, Dawson, Greeley, Hall, Howard, Sherman, and Valley Counties
[5]Butler, Cass, Colfax, Dodge, Douglas, Hamilton, Lancaster, Merrick, Nance, Platte, Polk, Sarpy, Saunders, Seward, Washington, and York Counties
[6]Chase, Dundy, Frontier, Hayes, Hitchcock, Keith, Lincoln, Perkins, and Red Willow Counties
[7]Adams, Franklin, Furnas, Gosper, Harlan, Kearney, Phelps, and Webster Counties
[8]Clay, Fillmore, Gage, Jefferson, Johnson, Nemaha, Nuckolls, Otoe, Pawnee, Richardson, Saline, and Thayer Counties

Scope of Livestock Losses

Cows and calves are most vulnerable to predation at calving time; calves are less vulnerable as they get older and larger. Sheep and lambs, however, remain vulnerable to coyote predation throughout the year; lambs are also vulnerable to red foxes and other predators in the spring when they are small.

Livestock predation causes economic loss to livestock owners (Table 1-2). Without effective predator damage management, livestock predation would be higher (Nass 1977, 1980, Howard and Shaw 1978, Howard and Booth 1981, O'Gara et al. 1983).

Studies have shown that coyotes inflict high predation rates on livestock (Henne 1977, Munoz 1977, Nass 1977, O'Gara et al. 1983). In Nebraska, coyotes are the primary predator of hoofed livestock and poultry (Table 1-3). Red foxes primarily depredated poultry (domesticated chickens, turkeys, ducks, and geese) and accounted for 11%, 29%, and 23% of the confirmed losses to this agricultural resource in Nebraska during FY96, FY97, and FY98, respectively. Raccoon depredation accounted for 31%, 5%, and 20% of the poultry predation in Nebraska during FY96, FY97, and FY98, respectively. During FY97 and FY98, skunks accounted for 9% and 13% of the domestic fowl predation in Nebraska and in FY96, badgers accounted for 10% of the domestic turkey predation. Predation of fowl was also attributed to bobcats, weasels, and badgers.

Table 1-2. Reported Livestock Losses from Predation in Nebraska (NASS 1995, 1996).

Species	Adult Sheep	Lambs	Adult Cattle	Calves
Coyotes	800	1,350	200	1,200
Feral Dogs	75	200	100	100
Red Foxes	0	0	0	0
Mt. Lions	0	0	0	0
Bobcats	0	0	0	0
Bears[1]	25	0	0	0
Eagles	0	0	0	0
All Other Predators	0[2]	50[2]	200[3]	200[3]
Total	900	1,600	500	1,500

[1]There have not been any verified sightings of bears (black or grizzly) in Nebraska in more than 100 years.
[2]Includes wolves, ravens, crows, pigs, etc.
[3]Includes all predators except coyotes, feral dogs, mountain lions, and bobcats.

Connolly (1992b) determined that only a fraction of the total predation attributable to coyotes was reported to WS. Nebraska WS personnel do not attempt to find every head of livestock reported to be killed by predators, but they do verify that a problem requiring management action exists.

Although determining the amount of livestock saved from predation by WS is impossible, it can be estimated. Scientific studies have indicated that losses of adult sheep and lambs to predators could be as high as 8.4% and 29.3%, respectively, in areas without predator damage management (Henne 1977, Munoz 1977, O'Gara et al. 1983). Areas with a damage management program in place have sustained sheep and lamb predation rates of about 0.5% and 4.3%, respectively (USDI 1979).

Table 1-3. Coyote Predation (Verified) as a Percent of Total.

Livestock	FY96	FY97	FY98
Lambs	92%	100%	90%
Adult Sheep	83%	100%	81%
Goats	100%	15%	100%
Calves	100%	100%	100%
Cattle	100%	100%	100%
Piglets	100%	NA	100%
Poultry	57%	35%	70%

Value of Livestock and Poultry Losses

Livestock are an important component of local economies in Nebraska. In 1997-1998, cash receipts for livestock and livestock-derived products totaled more than $5.5 billion or about 55% of the total cash receipts for agricultural products in Nebraska (NEASS 1998).

WS verified livestock predation losses of $41,062, $48,037, and $67,574 in FY96, FY97, and FY98, respectively. These dollar values represent data collected from only those producers that had agreements for control with WS to protect their livestock. The National Agricultural Statistics Service (NASS) estimated Nebraska sheep and lamb annual predation losses at $124,500 (NASS 1995) and Nebraska cattle and calf annual predation losses at $787,000 (NASS 1996). For reasons noted above, the predation verified by or reported to Nebraska WS represents only a small percentage of the total predator-caused losses. It must be noted that these losses occurred with a predator damage management program in place.

Livestock predation is rarely distributed equally among producers and losses may vary from year to year.

Predation on livestock can have a significant economic impact on individual livestock producers. Without effective predator damage management efforts to protect livestock, research suggests that predation losses would be higher (Nass 1977, 1980, Howard and Shaw 1978, Howard and Booth 1981, O'Gara et al. 1983). Predation was the number one reason reported by sheep producers who had gone out of business (U.S. District Court of Utah 1993).

1.1.3 Need for Wildlife Damage Management to Protect Wildlife

Revenue derived from recreation, especially recreation related to wildlife and the outdoors, is increasingly important to the economy of Nebraska. Southwick (1994) estimated the total economic impact from deer hunting in the United States in 1991 to be $16.6 billion.

In Nebraska, local economies benefit from wildlife-related recreational activities. In 1991, 834,000 (53%) of Nebraska's residents participated in wildlife-associated recreational activities (USFWS and U.S. Bureau of Census 1993) and spent a total of $103 million on hunting in Nebraska, not including the cost of licenses (Southwick 1994). Of the $103 million spent on hunting, more than $14 million was spent on deer hunting and an additional $11 million was expended on the hunting of migratory birds. In addition, hunting generated nearly 2,500 jobs (Southwick 1994).

Table 1-4. Wildlife Species that may Require Protection from Predation (D. Figgs, NGPC, Pers. Comm. 1996; W. Jobman, USFWS, Pers. Comm. 1996).

Species to be Protected	Management Agency
White-tailed Deer	NGPC
Mule Deer	NGPC
Pronghorn Antelope	NGPC
Elk	NGPC
Bighorn Sheep	NGPC
Swift Fox	NGPC
Greater Prairie Chicken	NGPC
Ring-necked Pheasant	NGPC
Wild Turkey	NGPC
Mountain Plover	NGPC
Waterfowl	USFWS
Whooping Crane	USFWS
Piping Plover	USFWS
Interior Least Tern	USFWS
Black-footed Ferret	USFWS

The maintenance of game populations is important to the NGPC, the state agency responsible for managing wildlife in Nebraska (Revised Statutes of Nebraska (RSN) 37-101, 37-204, 37-209, 37-211, 37-213, 37-215, 37-301, 37-432, 37-434). Predator damage management may periodically be requested by the NGPC and/or USFWS to protect big game, upland game, migratory birds, or T&E species. These requests may result from efforts to reintroduce species, intensively manage small critical habitats, or to temporarily assist species recovery. Long-term or widespread predator damage management for the protection of wildlife species is not an objective of the NGPC or the USFWS, but a strategy used to achieve management objectives.

Research data show that predator damage management has the potential to benefit populations of both game and nongame wildlife. Predator damage management undertaken to protect livestock could augment wildlife management objectives set by the NGPC and the USFWS (Table 1-4). Conversely, a lack of predator damage management could adversely affect certain wildlife species (Connolly 1978).

Predation on game species is well documented including its potential to adversely impact survival and recruitment, especially when environmental factors (e.g., weather influences, forage conditions, prey populations, etc.) are unfavorable (for additional discussion of predator/prey relationships, see 2.3.1). Predation has the greatest impact during the spring when prey populations are lowest. Any prey taken at this time would have likely contributed to the future population, had it survived. Prey taken in late summer and fall have a higher likelihood of dying from other causes before reproducing (NGPC 1994). Under certain conditions, predators have been documented as having a significant adverse impact on deer (*Odocoileus* spp.), pronghorn antelope, bighorn sheep (*Ovis canadensis*), game bird populations and T&E species, and this predation was not necessarily limited to sick or inferior animals (Pimlott 1970, Bartush 1978, USDI 1978, 1995, Hamlin et al. 1984, Neff et al. 1985, Wehausen 1996). Connolly (1978) reviewed 68 studies of predation on wild ungulate populations and concluded that in 31 cases, predation was a limiting factor. These cases showed that predation had a significant influence on populations of white-tailed deer (*Odocoileus virginianus*), black-tailed deer (*O. hemionus columbianus*), pronghorn antelope and bighorn sheep.

Based on research and experience, many wildlife management agencies have found that coyote damage management can increase deer, pronghorn antelope, and game bird survival where predation is affecting the ability of these populations to maintain or increase recruitment. Under an existing MOU, WS and the NGPC share a common interest and responsibility in the management of wild species to maximize their benefits while minimizing their detrimental impacts. Thus, the NGPC could request WS' assistance with predator damage management whenever predation is deemed to be detrimental to Nebraska's wildlife populations.

Deer

Mackie et al. (1976) documented high winter losses of mule deer (*Odocoileus hemionus*) due to coyote predation in north-central Montana and stated that coyotes were the cause of most overwinter deer mortalities. Hamlin et al. (1984) studied mule deer fawn mortality in Montana and observed that coyotes caused at least 90% of the summer fawn mortalities. Trainer et al. (1981) reported that heavy mortality of mule deer fawns during the late fall and winter limited recruitment to the deer population in Oregon. Garner (1976), Garner et al. (1976), and Bartush (1978) determined the mortality of radio-collared white-tailed deer fawns in the Wichita Mountains of Oklahoma to be 87.9% to 89.6% with predators being responsible for 88.4% to 96.6% of the mortality. Garner (1976) also indicated that inter-specific behavioral observations suggested that coyotes may find fawns by thoroughly searching near single does. Beasom (1974a) stated that predators were responsible for 74% and 61% of the fawn mortality for two consecutive years on his study area. In a study conducted at the Welder Wildlife Refuge, Texas, Teer et al. (1991) documented that coyote diets contained nearly 90% deer during May and June. They concluded that, "*Unequivocally coyotes take a large portion of the fawns each year during the first few weeks of life*." Cook et al. (1971) stated that, *"Apparently, the neonatal period is a critical one in the life"* of a white-tailed deer. Remains of 4 to 8 week old fawns were common in coyote scats (feces) in studies from Steele (1969), Cook et al. (1971), Holle (1977), Litvaitis (1978), and Litvaitis and Shaw (1980). Other researchers have also observed that coyotes are responsible for the majority of fawn mortality during the first few weeks of life (Knowlton 1964, White 1967, Cook et al. 1971, Salwasser 1976, Trainer et al. 1981). During other studies designed to examine coyote food habits and the impact of coyote predation on deer recruitment, similar observations were noted (Steele 1969, Cook et al. 1971, Holle 1977, Litvaitis 1978, Litvaitis and Shaw 1980).

Guthery and Beasom (1977) demonstrated that coyote damage management increased deer fawn production 70% after the first year and 43% the second year on their study area. Stout (1982) increased deer production on three areas in Oklahoma by 262%, 92%, and 167% the first summer following coyote damage management; total production was increased 154% for the three areas. Mule deer fawn survival was significantly increased and more consistent inside a predator-free enclosure in Arizona (LeCount 1977). Garner (1976), Garner et al. (1976), LeCount (1977), and Teer et al. (1991) stated that predator damage management may increase annual deer recruitment and survivability. However, impacts from other causes (drought, disease, hunting, livestock grazing, etc.) play a major role in achieving management objectives.

Knowlton and Stoddart (1992) reviewed deer productivity data from the Welder Wildlife Refuge following coyote reduction. Deer densities tripled compared with those outside the enclosure, but without harvest management, ultimately returned to original densities due primarily to malnutrition and parasitism.

Pronghorn Antelope

Nearly five decades ago, Jones (1949) believed that coyote predation was the main limiting factor of pronghorn antelope in Texas. More recently, Neff and Woolsey (1979, 1980) determined that coyote predation on pronghorn antelope fawns was the primary factor causing fawn mortality and low pronghorn antelope densities on Anderson Mesa, Arizona. After completing a 5-year radio telemetry study, Neff et al. (1985) concluded that most of the coyotes that killed pronghorn antelope fawns on Anderson Mesa were residents. Thus, most of the depredating coyotes were present during fawning. A 6-year radio telemetry study of pronghorn antelope in western Utah showed that 83% of all fawn mortality was attributed to predation (Beale and Smith 1973). Trainer et al. (1983) concluded that predation was the leading cause of pronghorn antelope fawn loss, accounting for 91% of the mortalities that occurred during a 1981-82 study in southeastern Oregon. They also stated that most pronghorn antelope fawns were killed by coyotes and that known coyote kills comprised 60% of fawn mortality. Major losses of pronghorn antelope fawns to predators have also been reported from other radio telemetry studies (Barrett 1978, Beale 1978, Bodie 1978, Von Gunten 1978, Tucker and Garner 1980).

Menzel (1991) concluded that coyotes were primarily responsible for low antelope production during a study within the Box Butte Management Unit in the central portion of Nebraska's Panhandle. Concerns for low antelope populations in Nebraska led to the development of a management plan along with area meetings to allow for public input.

Arrington and Edwards (1951) observed that pronghorn antelope populations increased to huntable levels following coyote damage management in Arizona and that similar population increases were not noted on areas without coyote damage management. Coyote damage management on Anderson Mesa, Arizona allowed the antelope population to increase from 115 animals to 350 in 3 years, peaking at 481 animals in 1971 (Neff et al. 1985). After coyote damage management was discontinued, pronghorn fawn survival dropped to 14 and 7 fawns/100 does in 1973 and 1979, respectively. Initiation of another coyote damage management program began with the removal of an estimated 22% of the coyote population in 1981, 28% in 1982, and 29% in 1983. As a result, fawn production increased from a low of 7 fawns/100 does in 1979 to 69 and 67 fawns/100 does in 1982 and 1983, respectively. Antelope population surveys on Anderson Mesa conducted in 1983 indicated a population of 1,008 antelope, exceeding 1,000 animals for the first time since 1960.

In another study, the removal of 24%, 48%, and 58% of the spring coyote population from a study area in southeastern Oregon resulted in an increase in antelope fawn survival from 4 fawns/100 does in 1984 to 34, 71, and 84 fawns/100 does in 1985, 1986, and 1987, respectively (Willis et al. 1993). Similar observations of improved pronghorn antelope fawn survival and population increases following coyote damage management have been reported by Riter (1941), Udy (1953), and Hailey (1979). Menzel (1991) conducted coyote aerial hunting operations on the Box Butte Wildlife Management Area in Nebraska and reported that fawn:doe ratios were better on the areas with coyote damage management than on areas without damage management (62:100 vs. 25:100 in 1990 and 76:100 vs 42:100 in 1991). He concluded *"that control of coyotes prior to fawning season has a beneficial effect on survival of antelope fawns."* Coyote damage management for the protection of antelope is also cost effective, as shown by Smith et al. (1986).

Upland Game Birds

Thomas (1989) and Speake (1985) reported that predators were responsible for more than 40% of nest failures of wild turkeys (*Meleagris gallopavo*) in New Hampshire and Alabama, respectively. Everret et al.

(1980) reported that predators destroyed 7 of 8 nests on his study area in northern Alabama. Lewis (1973) and Speake (1985) reported that predation was also the leading cause of mortality in turkey poults, and Kurzejeski et al. (1987) used radiotelemetry to determine that predation was the leading cause of mortality in turkey hens. Wakeling (1991) reported that the leading natural cause of mortality among older turkeys was coyote predation, with the highest mortality rate for adult females occurring in winter. Other researchers report that hen predation is also high in spring when hens are nesting and caring for poults (Speake 1985, Kurzejeski et al. 1987, Wakeling 1991).

Dumke and Pils (1973) reported that ring-necked pheasant (*Phasianus colchicus*) hens were especially prone to predation during the nest incubation period. In Minnesota, pheasant hatching success and brood production was more than doubled with an intensive reduction of predators (Chessness et al. 1968). Trautman et al. (1974) stated that during a 5-year study in South Dakota, there was a 19% increase in ring-necked pheasant populations on areas with fox-only predator damage management. During a second 5-year study in South Dakota, ring-necked pheasant populations increased 132% on areas with red fox, raccoon, badger, and skunk damage management (Trautman et al. 1974).

Migratory Birds

Predator damage management is an important tool in maintaining migratory waterfowl populations. Gilbert et al. (1996) stated that waterfowl nest losses to predators were variable with 16.6%, 33.7% and 25.1% of all nests depredated during the periods of 1964-1970, 1971-1980, and 1981-1990, respectively. Depredation rates were lowest in 1964-1970 when poison bait, trapping and aerial gunning were used to reduce predator densities (Gilbert et al. 1996). In 1994 and 1995, the Delta Waterfowl Foundation funded a predator (red fox, raccoon, striped skunk, badger, and mink) removal study on 1-2 mi ^{2} study areas in northeastern North Dakota to determine if duck nesting success could be improved (Garrettson and Rowher 1994, Garrettson et al. 1995). Predators were removed with traps and snares, and occasionally by shooting. Data from 1994 indicated that the removal of predators resulted in a duck nesting success rate of 51.7% versus a 5.5% nesting rate success on areas without predator removal (Garrettson and Rowher 1994). Data from 1995 also showed an increased duck nesting success rate (52%) on predator removal areas versus areas with no predator removal (6% nesting success).

Johnson et al. (1989) found that rates of predation on duck nests early in the nesting season increased with the abundance of red foxes, badgers, and American crows (*Corvus brachyrhynchos*) and late in the season with the abundance of red foxes and striped skunks. The red fox has also been identified as a major predator of ducks and duck eggs by Duebbert and Lokemoen (1976), Higgins (1977), Sargeant et al. (1984), Sargeant et al. (1993), and Klett et al. (1988). In the prairie pothole region, Sargeant et al. (1993) stated that coyotes, red foxes, and mink were numerous or common in one or more study areas.

Sargeant et al. (1993) stated that the abundance of red foxes has a profound effect on the survival of adult ducks in the prairie pothole region, however, coyotes probably also prey extensively on adult ducks. Additionally, coyotes, red foxes, and mink are the primary mammalian species affecting duckling survival (Sargeant et al. 1973, Sargeant et al. 1993). At the Agassiz National Wildlife Refuge in Minnesota, Korschgen et al. (1996) found predation to be the cause of mortality for 59% of the female and 60% of the male canvasback ducklings. Mink were responsible for the most mortalities; they accounted for 39%-100% of the deaths each year (Korschgen et al. 1996).

Most of the predators discussed in this EA prey extensively on duck eggs, although mink nest depredation is primarily in wetlands (Sargeant and Arnold 1984, A. B. Sargeant unpubl. data as cited in Sargeant et al. 1993). Among egg-eating mammals, the striped skunk and red fox have the greatest effect on nesting success of ducks in uplands, and raccoons have the greatest effect on nesting success of ducks that nest over water (Sargeant et al. 1993).

Balser et al. (1968) determined that predator damage management resulted in 60% greater production by waterfowl in areas with damage management as compared with areas without damage management. Williams et al. (1980) reported a 72% hatching success of eggs following a predator poisoning campaign, but only 59% hatching success when predators were not poisoned.

Nests of wading birds can be destroyed by mammalian predators, such as red foxes, gray foxes (*Urocyon cinereoargenteus*), and raccoons. These predators destroy nests by preying on nest contents and by causing the abandonment of nests (Burger and Hahn 1977, Southern and Southern 1979, Rodgers 1980, 1987, Frederick and Collopy 1989). Frederick and Collopy (1989) stated that mammals and snakes accounted for 43% of nest failures in a wading bird colony and identified raccoons as the primary mammalian predator.

Threatened and Endangered Species

Predation can have a major impact on T&E species. Massey (1971) and Massey and Atwood (1981) found that predators can prevent least terns from nesting or cause them to abandon previously occupied sites. In another study, mammalian predators were found to have significantly impacted the loss of least tern eggs on sandbars and sandpits (Kirsch 1996). Skunks (Massey and Atwood 1979), red foxes (Minsky 1980), coyotes (Grover and Knopf 1982), and raccoons (Gore and Kinnison 1991) are common predators of least terns. During one 2-year study, coyotes destroyed 25.0% to 38.5% of all interior least tern nests (Grover 1979).

In Massachusetts, predators destroyed 52%-81% of all active piping plover nests from 1985-1987 (MacIvor et al. 1990). Red foxes accounted for 71%-100% of the nests destroyed by predators at the site.

During FY95-98, Nebraska personnel were asked to remove coyotes, striped skunks, opossums, and mink from nesting sites along the Platte River in central Nebraska to protect threatened piping plovers and endangered least terns. As expected, the removal of predators increased plover and tern nesting success and chick survival rates (R. Plettner, Nebraska Public Power District, pers. comm. 1999).

Limited predator removals may also benefit black-footed ferret (*Mustela nigripes*) recovery efforts by reducing predation on newly transplanted individuals, and by supplying baseline data on disease prevalence by monitoring predators from the recovery area. Predation has affected black-footed ferret reintroductions in Wyoming, South Dakota and Montana (E. Stukel, South Dakota Game, Fish and Parks, pers. comm. 1995; USDI 1995). Predator removal may also be useful to enhance survival should ferret reintroductions occur in Nebraska (D. Figgs, NGPC, pers. comm. 1997).

Kilgore (1969) stated that coyotes are logical predators of swift foxes (*Vulpes velox*). Coyotes were implicated for reduced swift fox numbers at prairie dog towns in Colorado (Kahn and Fitzgerald 1995). Egoscue (1979) and Scott-Brown and Herrero (1985) stated that coyotes are known to kill swift foxes. Herrero et al. (1986) stated that higher coyote densities may in fact threaten the establishment and long-term survival of reintroduced swift foxes. Carbyn et al. (1994) reported that 58% of swift fox mortality was caused by predation with the coyote clearly, "*the greatest cause of (predator) mortality*." They go on to state that, *"the greatest proportion of deaths occurred within the first month of release."* Covell (1992) reported that predation and non-dramatic deaths accounted for 87% and 13% of all determined deaths, respectively, with coyotes responsible for 85% of all predation. Research by Fitzgerald and Roell (1995) on radio-collared swift foxes confirmed that predation accounted for 77% of all mortality with coyotes accounting for 100% of that predation. Research findings by Fox and Roy (1995), Rongstad et al. (1989), and Brechtel et al. (1993) have confirmed that coyote depredation is an important cause of swift fox mortality in many areas.

Badgers may also kill swift foxes. Several studies (Rongstad et al. 1989, Brechtel et al. 1993) have indicated that badgers have killed up to 13% of the swift foxes in a given area, primarily by digging them out of their dens.

Balser et al. (1968) recommended that predator damage management programs target the entire predator complex or compensatory predation may occur by a species not under control, a phenomena also observed by Greenwood (1986). Trautman et al. (1974) concluded that a single species predator damage management program showed some promise for enhancing pheasant populations, but that a multi-species predator damage management program should substantially increase ring-necked pheasant populations. Clearly, predator damage management can be an important tool for achieving and maintaining game, nongame, and T&E species production and management objectives.

1.1.4 Need for Wildlife Damage Management to Protect Public Health and Safety

According to state law, MOU, and agreement, WS has been requested to assist the NGPC, University of Nebraska, and other agencies to monitor and reduce the risk of disease transmission (e.g., rabies, tick borne diseases, plague, mange, Echinococcus multilocularis) by wild species. Potentially dangerous wildlife requests referred to Nebraska WS are given a higher priority and are scrutinized using the ADC Decision Model (Slate et al. 1992) described in Chapter 3 of this EA.

Requests for Nebraska WS to deal with public health and safety issues may be received from individuals, associations, municipal or county governments, or state, tribal, or federal agencies. In Nebraska, the Nebraska Department of Health (NDH) is responsible for the control and prevention of rabies (RSN 71-4401 to 71-4412). The NDH considers rabies to be a potentially serious public health problem (Safranek and Leschinsky 1996) and lists the following species of animals as capable of harboring and spreading the rabies virus (RSN 71-4402.01, Title 173 Nebraska Administrative Code, Chapter 5):

> *-"species amenable to rabies protection by immunization;*
> *dogs, cats, ferrets, cattle, horses, and sheep,*
>
> *-species not amenable to rabies protection by immunization;*
> *carnivorous - skunks, raccoons, foxes, coyotes, bobcats, bats, hybrids of domestic dogs and cats,*
>
> *noncarnivorous - This category includes but is not limited to the following species of animals. Regard these animals as rabid unless proven negative by the direct fluorescent antibody laboratory test; civet cats, deer, groundhogs, beavers, opossums, badgers."*

During the years 1992-1995, 31 animals tested positive for rabies in Nebraska (1% for the 4 year period); 84% were wild animals of which 38% were skunks (Safranek and Leschinsky 1996). Animal rabies occur Gin 20 year cycles; Nebraska reached its 20 year low in 1994 with no confirmed cases of rabies and began its up-swing in 1995 with 7 confirmed cases (5 bats and 2 skunks) (Safranek and Leschinsky 1996). In the State of Nebraska, all laws, codes, ordinances, or rules and regulations concerning the control of rabies are enforced by the county, township, city, and village health and law enforcement officials or those other officers with regulatory authority as specified by the governing political subdivisions (RSN 71-4412). When requests for assistance occur on public lands, the land management agency is also involved in the planning and coordination of the activities.

Nebraska WS may be requested to assist with a variety of wildlife-related public health and safety issues. Nebraska WS has responded to all such requests. In FY96, FY97, and FY98, Nebraska responded to 35, 87, and 80 requests, respectively, for protection of public safety from potentially harmful and/or diseased animals.

1.1.5 Nebraska Wildlife Services Program Objectives

The need for predator damage management in Nebraska was used by WS, with input from the NDA, NGPC, University of Nebraska Cooperative Extension (UNCE), USFWS, BLM, and the Forest Service, to define the objectives for the WS program in Nebraska. They are:

A. Livestock Protection: For cooperative agreements and agreements for control, Nebraska WS' objectives are to:

A-1. Respond to 100% of the requests for assistance with the appropriate action (technical assistance or direct control) as determined by Nebraska WS personnel, applying the ADC Decision Model (Slate et al. 1992).

A-2. Hold sheep losses due to predation to less than 3% per year and calf losses due to predation to less than 2% per year in Nebraska in counties with a federal WS operational program.

A-3. Maintain the lethal take of nontarget animals by Nebraska WS personnel during damage management to less than 2% of the total animals taken.

A-4. Monitor the implementation of nonlethal methods used by livestock producers that cooperate with the federal WS program in Nebraska.

B. Wildlife Protection coordinated with the NGPC or USFWS, tribes and private entities:

B-1. Respond to requests from the NGPC, USFWS, tribes and private entities for the protection of wildlife species dependent on funding.

B-2. Involve the NGPC and USFWS in wildlife damage management planning to consider specific wildlife to be protected and public health and safety when designating a wildlife damage management program.

C. Public Health and Safety Protection:

C-1. Respond to 100% of cooperator requests for public health and safety protection from predators using the ADC Decision Model (Slate et al. 1992).

1.2 RELATIONSHIP OF THIS ENVIRONMENTAL ASSESSMENT TO OTHER ENVIRONMENTAL DOCUMENTS

1.2.1 ADC Programmatic EIS. In 1994, WS issued a final EIS (USDA 1994) and ROD (USDA 1995) on the National APHIS-ADC program. The EIS was subsequently revised in 1997. This EA is tiered to that EIS.

1.2.2 National Forest Land and Resource Management Plans (LRMPs). The National Forest Management Act requires that each National Forest prepare a LRMP for guiding long range management and direction. LRMP documents and the decision made from this EA need to be consistent.

1.2.3 Forest Service EAs for Predator Damage Management. The Nebraska National Forest and Oglala National Grassland within Nebraska have an EA and a Decision Record addressing predator damage management (Forest Service 1991). This EA (Predator Damage Management in Nebraska for the Protection of Livestock, Wildlife, Property and Public Health and Safety) will address predator damage management on the National Grassland and Forests in Nebraska. Predator damage management would continue on the

Oglala National Grassland and the Nebraska National Forest under the current document (Forest Service 1991) until superseded by a new decision document. Work plans would be developed by WS on National Forest System lands where predator damage management activities are planned or anticipated and discussed during a work plan meeting(s) with the Forest Service, WS and NGPC. Additional NEPA documentation would be required to conduct wildlife damage management that is outside the scope of this EA, should the need arise.

1.2.4 BLM Resource Management Plans (RMPs) and Management Framework Plans (MFPs). The BLM currently uses RMPs or MFPs to guide management on lands they administer. RMPs generally replace older land use plans known as MFPs. RMP and MFP documents and the decision made from this EA need to be consistent.

1.2.5 BLM EAs for Predator Damage Management. This EA (*Predator Damage Management in Nebraska for the Protection of Livestock, Wildlife, Property and Public Health and Safety*) will address predator damage management on BLM administered lands in Nebraska. Additional NEPA documentation would be required to conduct wildlife damage management that is outside the scope of this EA, should the need arise.

1.3 DECISION TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, Nebraska WS is the lead agency for this EA, and therefore, is responsible for the scope, content and decisions made. The Forest Service, BLM, USFWS, NGPC, NDA and UNCE provided input throughout the EA preparation process to ensure an interdisciplinary approach according to NEPA and agency mandates, policies, and regulations.

Based on the scope of this EA, the decisions to be made are:

-Should predator damage management, as currently implemented, be continued in Nebraska (the No Action Alternative)?

-If not, how should WS fulfill their legal responsibilities within Nebraska?

-Would the proposal have significant impacts requiring an EIS analysis?

1.4 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

1.4.1 Actions Analyzed. This EA evaluates planned predator damage management to protect: 1) livestock and property, 2) designated wildlife species (including T&E species), and 3) public health and safety from mammalian predators within Nebraska. Additional NEPA documentation would be required to conduct wildlife damage management that is outside the scope of this EA, should the need arise.

1.4.2 Wildlife Species Potentially Protected by Nebraska Wildlife Services. The NGPC may request Nebraska WS' assistance to achieve management objectives for white-tailed and mule deer, pronghorn antelope, bighorn sheep, elk *(Cervus canadensis)*, greater prairie chickens (*Tympanuchus cupido*), wild turkeys, ring-necked pheasants, mountain plovers (*Eupoda montana*) and swift foxes. The USFWS or NGPC may request Nebraska WS' assistance in protecting black-footed ferrets, interior least terns, piping plovers, whooping cranes (*Grus americana*) and waterfowl (Table 1-4). If the NGPC, USFWS or American Indian Tribes identify additional species in need of protection, a determination regarding the need for additional NEPA analysis would be made on a case-by-case basis**.**

1.4.3 American Indian Lands and Tribes. Currently, Nebraska WS does not have MOUs with any of the tribes in Nebraska. If a tribe enters into a MOU, this EA would be reviewed to insure compliance with

NEPA.

1.4.4 Period for Which this EA is Valid. This EA would remain valid until Nebraska WS and other appropriate agencies determine that new needs for action, changed conditions or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. Review of the EA would be conducted each year at the time of the wildlife damage management work planning process by the Nebraska WS, land management agency, and the NGPC to ensure that the EA is sufficient.

1.4.5 Site Specificity. This EA addresses all lands under cooperative agreement, agreement for control, WS Work Plans or other comparable documents in Nebraska. These lands are under the jurisdiction of federal, state, tribal, county, municipal and private administration/ownership. It also addresses the impacts of predator damage management on areas where additional agreements may be signed in the future. Because the proposed action is to reduce predator damage and because the program's goals and directives are to provide services when requested, within available funding and workforce, it is conceivable that additional wildlife damage management efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever wildlife damage and resulting management occur, and are treated as such. The standard ADC Decision Model (Slate et al. 1992, USDA 1994) would be the site-specific procedure for individual actions conducted by WS in Nebraska (see Chapter 3 for a description of the ADC Decision Model and its application).

1.4.6 Public Involvement. Issues related to the proposed action were initially developed by an interdisciplinary team process involving the Forest Service, BLM, USFWS, NDA, UNCE, and the NGPC. A Multi-agency Team of WS, Forest Service, BLM, USFWS, NGPC, NDA, and UNCE personnel refined these issues, prepared objectives and identified preliminary alternatives. Due to interest in the Nebraska WS Program, the Multi-agency Team concurred that Nebraska WS include an invitation for public comment in this EA process. An invitation for public comment letter containing issues, objectives, preliminary alternatives, and a summary of the need for action, was sent to 262 individuals or organizations who had identified an interest in Nebraska WS, NGPC, Forest Service or BLM projects. Notice of the proposed action and invitation for public involvement were placed in six newspapers with circulation throughout Nebraska. Public comments were documented from 25 letters or written comments. The responses represented a wide range of opinions, both supporting and opposing the proposal or parts of the proposal. All comments were analyzed to identify new issues, alternatives, or to redirect the objectives of the program. All responses are maintained in the administrative file at the Nebraska WS State Office, P.O. Box 81866, Lincoln, Nebraska 68501-1866.

1.5 AUTHORITY AND COMPLIANCE

1.5.1 Authority of Federal[3] and State Agencies in Wildlife Damage Management in Nebraska

Wildlife Services

The primary statutory authority for the WS program is the Animal Damage Control Act of 1931, as amended, which provides that:

"The Secretary of Agriculture is authorized and directed to conduct such investigations, experiments, and tests as he may deem necessary in order to determine, demonstrate, and promulgate the best methods of eradication, suppression, or bringing under control on national

[3] Detailed discussions of WS' legal responsibilities and key legislation pertinent to wildlife damage are found in Chapter 1 of USDA (1994).

forests and other areas of the public domain as well as on State, Territory or privately owned lands of mountain lions, wolves, coyotes, bobcats, prairie dogs, gophers, ground squirrels, jackrabbits, brown tree snakes and other animals injurious to agriculture, horticulture, forestry, animal husbandry, wild game animals, furbearing animals, and birds, and for the protection of stock and other domestic animals through the suppression of rabies and tularemia in predatory or other wild animals; and to conduct campaigns for the destruction or control of such animals. Provided that in carrying out the provisions of this Section, the Secretary of Agriculture may cooperate with States, individuals, and public and private agencies, organizations, and institutions."

Since 1931, with changes in societal values, WS' policies and programs have placed greater emphasis on the part of the Act discussing "*bringing (damage) under control*," rather than "*eradication" and "suppression*" of wildlife populations. In 1988, Congress strengthened the legislative directive of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."

Nebraska Game and Parks Commission and Nebraska Department of Agriculture

The NGPC is responsible for managing all protected and classified wildlife in Nebraska, including federally listed T&E species, despite the land class the animals inhabit (RSN 37-101, 37-204, 37-209, 37-211, 37-213, 37-215, 37-301, 37-432, 37-432.01, 37-434). The NGPC is also authorized to cooperate with Nebraska WS and the NDA for controlling predatory animals. Nebraska law allows a farmer or rancher owning or operating a farm or ranch to destroy or have destroyed any predator, including raccoons and opossums, preying on livestock or poultry or causing other agricultural depredation on lands owned or controlled by him or her without a permit issued by the NGPC (RSN 37-201). The NDA is authorized to make funds available for equipment, supplies, and other expenses, including expenditures for personal services by WS, as may be necessary to execute the functions imposed upon NDA as provided by the general appropriation bill (Legislative Bill 392).

Coyotes are not protected in Nebraska and are not classified as furbearers under the RSN administered by the NGPC. The NGPC is responsible for the issuance of aerial hunting permits per the Fish and Wildlife Act of 1956, as amended, and for administering a program to reduce damage caused by predatory animals (RSN 37-232, 37-233). The NDA currently has a MOU, cooperative agreement, and work plan with the Nebraska WS. These documents establish a cooperative relationship between the Nebraska WS, NGPC, NDA, UNCE and the NDH, and outline responsibilities and set forth objectives and goals for each agency for resolving wildlife damage management conflicts in Nebraska.

Nebraska Counties

County boards may enter into cooperative agreements for the purpose of carrying on an organized wildlife damage management program within their respective counties. "*The county boards may cooperate with the Animal and Plant Health Inspection Service of the United States Department of Agriculture and state agencies . . . in the control of coyotes, bobcats, foxes, badgers, opossums,* *raccoons, skunks, and other predatory animals in this State that are injurious to livestock, poultry, and game animals and the public health. The county boards may also undertake the control of . . . other nuisance wildlife if such . . . wildlife are causing or about to cause property damage or represent a human health threat. All control efforts shall be in accordance with the organized and systematic plans of the United States Department of Agriculture and state agencies covering the management and control of animals, birds, and wildlife*" (RSN 23-358).

"*In order to support the cost of managing and controlling the animals, birds, or wildlife listed in section 23-358, each county shall match funds supplied by any resident individual or group of individuals either living within the county or owning property therein, up to a maximum of one thousand dollars annually for any specific animal damage control program, and may furnish such additional money as the county board shall deem necessary for the funding of such programs. The county board of each county is authorized to make necessary expenditures from the general fund of the county, except the portion supplied by each county shall not exceed fifty percent of the total animal damage control program cost, unless such county elects to bear the entire program cost under sections 23-358 to 23-361. A county desiring to cooperate with another county or counties for the establishment of animal damage control services as set forth in sections 23-358 to 23-361 may enter into agreements and match funds for the establishment of an area program with the state or federal government*" (RSN 23-358.01). County boards are authorized to make necessary expenditures from any funds of the county to perform animal damage control (RSN 23-359). "*The county board of each county in this state may levy upon every dollar of taxable value of all the taxable property in such county, for the use of the county board in carrying out the animal damage control program . . . The entire fund derived from such levy shall be set apart in a separate fund and expended only for animal damage control as defined by sections 23-358 to 23-360*" (RSN 23-260). Nebraska counties may also tax cattle and sheep, not to exceed twenty cents per head, to provide funding for animal damage control programs for the management and control of coyotes, bobcats, foxes, and other predatory animals destructive of cattle and sheep (RSN 23-361).

U.S. Fish and Wildlife Service

The USFWS has the statutory authority to manage federally listed T&E species through the ESA of 1973 (16 U.S.C. 1531-1543, 87 Stat. 884). Authorization under Section 10 of the ESA allows WS to assist the USFWS with damage management for species such as the gray wolf (*Canis lupus*), should the need arise.

U.S. Forest Service and Bureau of Land Management

The Forest Service and BLM have the responsibility to manage federal lands for multiple uses including livestock grazing, timber production, recreation and wildlife habitat, while recognizing the State's authority to manage wildlife populations. Both the Forest Service and BLM recognize the importance of managing wildlife damage on lands and resources under their jurisdiction, as integrated with their multiple use responsibilities. For these reasons, both agencies have entered into MOUs with WS to facilitate a cooperative relationship. BLM and National Forest System maps delineating restricted areas and areas closed to predator damage management are available at the appropriate federal office for public review.

University of Nebraska Cooperative Extension

The UNCE, through its Educators, Specialists and Assistants provides a wide range of information on the prevention and control of wildlife damage. The UNCE conducts educational programs pursuant to the Smith-Lever Act of 1914 (7 USC 341-349) and subsequent amendments.

1.5.2 Compliance with Federal Laws

Several federal laws regulate wildlife damage management. WS complies with these laws and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act

This predator damage management EA, with WS as the lead agency, is the first time that all land classes under cooperative agreements, agreements for control and WS Work Plans for Nebraska will be analyzed in a comprehensive manner. Environmental documents pursuant to NEPA must be completed before work plans, consistent with the NEPA supported decision, can be developed and implemented. Before 1993, each National Forest (or Ranger District) completed its own NEPA document. This resulted in different requirements and procedures for different agencies and omitted analysis of WS wildlife damage management on lands under other ownership or jurisdiction.

WS also coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any wildlife damage management that may affect resources managed by these agencies or affect other areas of mutual concern. Federal agency requests for WS' assistance to protect resources outside the species discussed in this EA would be reviewed, and if necessary, the agency requesting the assistance would be responsible for NEPA compliance.

Endangered Species Act

It is WS' and federal policy, under the ESA, that all federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts consultations with the USFWS, as required by Section 7 of the ESA, to utilize the expertise of the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species* . . . " (Sec.7(a)(2)). Nebraska WS completed a consultation with the USFWS and NGPC for those species listed in Nebraska and received concurrence that Alternatives 1 and 3 (No Action and Proposed Action, respectively) were unlikely to adversely affect T&E species.

Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires the registration, classification and regulation of all pesticides used in the United States. The Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All pesticides used or recommended by the WS program in Nebraska are registered with, and regulated by, the EPA and the NDA. Nebraska WS uses all chemicals according to label directions as required by the EPA and NDA.

National Historical Preservation Act of 1966 as Amended

The National Historical Preservation Act (NHPA) requires federal agencies to: 1) evaluate the effects of any federal undertaking on cultural resources, 2) consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural resources in areas of federal undertakings.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA) requires federal agencies to notify the proper authority (the Secretary of the Department that manages the federal lands) upon the discovery of Native American cultural items on federal or tribal lands. Federal projects will discontinue work until a reasonable effort has been made to protect the items and the proper notifications have been made.

1.6 A PREVIEW OF THE REMAINING CHAPTERS IN THIS EA

The remainder of this EA is composed of 4 chapters. Chapter 2 discusses and analyzes the issues and affected environment. Chapter 3 contains a description of each alternative, methods used by WS, alternatives not considered in detail, and mitigation and standard operating procedures (SOPs). Chapter 4 analyzes the environmental impacts associated with each alternative considered in detail, analyzes how well each alternative meets the objectives, and determines consistency with Forest Service LRMPs and BLM RMPs or MFPs. Chapter 5 lists this EA's preparers, reviewers and consultants.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

INTRODUCTION

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), issues that were used to develop mitigation measures and SOPs, and issues that will not be considered in detail, with the rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Additional affected environments will be incorporated into the discussion of the environmental impacts in Chapter 4 and the description of the current program (the "No Action" Alternative) in Chapter 3.

2.1 ISSUES ANALYZED IN DETAIL IN CHAPTER 4

The Multi-agency Team, consisting of representatives from the lead (WS) and cooperating agencies (BLM, Forest Service, USFWS, NGPC, NDA, and the UNCE) determined the issues to be:

Issue 1. Cumulative impacts on the viability of wildlife populations - the potential for WS' take of predators to cause long-term predator population declines, when added to other mortality.

Issue 2. Effectiveness and selectivity of damage management methods - the potential for WS' methods to take nontarget animals, need for a wide variety of damage management methods, criteria for deciding methods to be used, and use of "preventive" damage management techniques.

Issue 3. Risks posed by damage management methods to the public and domestic pets.

Issue 4. Concern about WS' impacts on T&E species.

2.2 ISSUES USED TO DEVELOP MITIGATION

2.2.1 Predator Damage Management in Special Management Areas

Many areas on federal and state managed lands within Nebraska have a special designation and/or require special management consideration. These include Wilderness Areas (WAs), Research Natural Areas (RNAs), Wild and Scenic Rivers (WSRs), Wildlife Management Areas (WMAs) and State Recreation Areas. The special management required for each of these different areas varies considerably by designation and land administrator and as directed by different legal mandates.

WS has conducted some wildlife damage activities in special management areas in the past. WS acknowledges that recreationists and others may consider these activities to be an invasion of solitude and an adverse affect on the aesthetic quality of their experience.

WS conducts predator damage management on areas with special designations only in limited instances, when and where a specific need is identified, only when allowed under the provisions of the specific management designation, and with the concurrence of the land management agency as defined by WS Work Plans. WS' activities in special management areas have historically been, and are expected to continue to be, a minor part of the overall WS program. Restrictions on WS' activities are listed in Chapter 3, Section 3.4, Mitigation and Standard Operating Procedures for Predator Damage Management Techniques.

<u>Federal Lands Special Management Areas</u>

Wilderness Areas: WAs are areas designated by Congress to be managed for the preservation of wilderness values. Wildlife and fish damage management in WAs follows direction provided in Forest Service Manual (FSM) 2151, FSM 2323, and FSM 4063 for management of wildlife or fish damage in wilderness and RNAs. Animal damage management is permitted in wilderness only when it was used before wilderness designation; when it conforms with direction in FSM 2323.33 on resources management in wilderness; and when it is needed for the recovery of federally listed T&E species. WAs in Nebraska are listed in Table 2-1.

Table 2-1. Wilderness Areas in Nebraska

WILDERNESS AREA	ACRES
Fort Niobrara	4,635
Soldier Creek	7,794

Research Natural Areas: RNAs are part of a national network of ecological areas designated in perpetuity for research and education and/or to maintain biological diversity on National Forest System lands. RNAs are managed for the protection of unusual, scientific, or special interest natural characteristics for research and education. *Establish Records* have been approved for the RNAs listed in Table 2-2 for the Nebraska National Forest. The RNAs would be managed according to the direction provided in the Nebraska National Forest Plan (Management Area). The management goal is to maintain these areas in their natural condition to be used for non-manipulative research and observation.

Table 2-2. Research Natural Areas in Nebraska

RESEARCH AREA	ACRES
Type K237 - Interior Ponderosa Pine	200
Bessey	571
Eastern Ponderosa Pine (proposed)	900

Wild and Scenic Rivers: WSRs are rivers and streams that must be free-flowing, and with their adjacent land area, must possess one or more *"outstandingly remarkable*" values. Scenic, geologic, historic, cultural, ecologic, or fish and wildlife habitat are examples of such values. *Wild Rivers* are those rivers or sections of river that are free of impoundments, generally accessible only by trail, with the watershed or shorelines essentially primitive and water unpolluted. *Scenic Rivers* are those rivers or sections of river that are free of impoundments, with shorelines and watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. *Recreational Rivers* are those rivers or sections of rivers that are readily accessible by roads, have some development along their shorelines and may have some history of impoundment or diversion. Nebraska's WSRs are listed in Table 2-3.

TABLE 2-3. Nebraska's Wild and Scenic Rivers

WATERBODY	CLASS	MILES
Niobrara River (Borman Bridge to Hwy 137)	Scenic	76 miles
Niobrara River (Knox County)	Recreational	25 miles
Verdigre Creek (Verdigre to Niobrara River)	Recreational	6 miles

2.2.2 Humaneness of Methods Used by Wildlife Services

The issue of humaneness, as it relates to the killing or capturing of wildlife, is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest control for societal benefits could be compatible with animal welfare concerns, if *" . . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."*

Suffering has been described as a *" . . . highly unpleasant emotional response usually associated with pain and distress*." However, suffering *" . . . can occur without pain . . . ,*" and *" . . . pain can occur without suffering . . . "* (AVMA 1987). Because suffering carries with it the implication of a time frame, a case could be made for *" . . . little or no suffering where death comes immediately . . . "* (CDFG 1991).

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would *" . . . probably be causes for pain in other animals . . . "* (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991). Thus, WS' damage management methods, such as leghold traps and body snares, may cause varying degrees of pain in different animal species captured for varying lengths of time. The point at which pain diminishes or stops under these types of restraint has not been measured by the scientific community.

Pain and suffering, as it relates to a review of WS' damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would both be better served to recognize the complexity of defining suffering, since *" . . . neither medical or veterinary curricula explicitly address suffering or its relief"* (CDFG 1991).

Therefore, humaneness appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The issue of humaneness has two aspects in relation to the proposed action:

1. Animal welfare organizations and individuals are concerned that some wildlife damage management methods expose animals to unnecessary pain and suffering. Kellert and Berry (1980), in a survey of American attitudes toward animals, related that 58% of their respondents *" . . . care more about the suffering of individual animals . . . than they do about species population levels."*

   Research suggests that the blood chemistry of trapped animals indicates "*stress.*" However, similar blood measurements from foxes chased by dogs for about five minutes indicated comparable levels of stress, even though the fox was not physically restrained as it would have been in a trap (USDA 1994). Unfortunately, research has not yet progressed to the development of objective, quantitative measures of pain or stress for use in evaluating humaneness.

2. Humaneness, as perceived by the livestock industry and pet owners, requires that domestic animals be protected from predators because humans have bred the natural defense capabilities out of domestic animals. It has been argued that man has a moral obligation to protect these animals from predators (Glosser 1993). Predators frequently do not kill large prey animals quickly, and will often begin feeding on them while they are still alive and conscious (Wade and Bowns 1982). The suffering apparently endured by livestock or pets damaged in this way is unacceptable to many livestock producers and pet owners.

Thus, the decision-making process involves tradeoffs between pain and humaneness. An objective analysis of this issue must consider not only the welfare of a wild animal caught in a leghold trap, but also the welfare of the domestic animals that may continue to be injured or killed if the leghold trap were not being used. The challenge in coping with this issue is to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management devices through research and the development of modifications such as pan-tension devices, electronic trap monitors and breakaway snares. Research is continuing to bring new findings and products into practical use, however, a certain amount of animal suffering may occur whenever nonlethal methods are impractical or ineffective. Furthermore, it is possible that the net amount of animal suffering would be less under the proposed action (or any other alternative involving the use of lethal methods) than under the No Action Alternative, since the suffering endured by livestock and pets would be reduced if the action is successful.

Nebraska WS personnel are experienced and professional in their use of management methods and are as humane as possible under the current constraints of technology, workforce, and funding. Mitigation measures and SOPs used to maximize humaneness are listed in Chapter 3.

2.2.3 Cultural and Historical Resources

2.2.3.1 American Indian Concerns

The NHPA of 1966, as amended, requires federal agencies to evaluate the effects of any federal undertaking on cultural resources and to consult with appropriate American Indian Tribes to determine whether they have concerns for cultural properties in areas of federal undertakings. The NAGPRA of 1990 provides for protection of American Indian burials and establishes procedures for notifying tribes of any new discoveries.

In consideration of American Indian cultural and archeological interests, the Nebraska WS program solicited input from the following tribes:

Ogallala Sioux Tribe
Omaha Tribe
Ponca Tribe of Nebraska
Santee Sioux Tribe
Winnebego Tribe
Sac and Fox Tribe of Missouri
Iowa Tribe of Kansas and Nebraska

Each tribe was asked to identify concerns relating to the proposed WS program through an *invitation for public comment* letter. No tribe responded with concerns.

2.2.3.2 Other Cultural and Historical Resources

Concurrence of no impact to properties on or eligible for the National Registry of Historical Places relative to the current program and the proposed action has been received from the Nebraska State Historical Preservation Office (Puschendorf 1997). In most cases, predator damage management has little potential to cause adverse effects to sensitive cultural resources. The areas where predator damage management would be conducted are small and damage management activities cause minimal ground disturbance. Mitigation measures developed to avoid impacts to these sites are listed in Chapter 3.

2.2.4 Environmental Justice and Executive Order 12898 - *"Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"*

Environmental Justice (EJ) is a movement promoting the fair treatment of people of all races, income and culture with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Fair treatment implies that no person or group of people should endure a disproportionate share of the negative environmental impacts resulting either directly or indirectly from the activities conducted to execute this country's domestic and foreign policies or programs. EJ has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. (The EJ movement is also known as Environmental Equity -- which is the equal treatment of all individuals, groups or communities regardless of race, ethnicity, or economic status, from environmental hazards).

EJ is a priority both within USDA/APHIS and WS. Executive Order 12898 requires federal agencies to make EJ part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies and activities on minority and low-income persons or populations. A critical goal of Executive Order 12898 is to improve the scientific basis for decision-making by conducting assessments that identify and prioritize environmental health risks and procedures for risk reduction. APHIS-WS developed a strategy that: 1) identifies major programs and areas of emphasis to meet the intent of the Executive Order, 2) minimize any adverse effects on the human health and environment of minority and low-income persons or populations, and 3) carries out the APHIS mission. To that end, APHIS operates according to the following principles: 1) promote outreach and partnerships with all stakeholders, 2) identify the impacts of APHIS activities on minority and low-income populations, 3) streamline government, 4) improve the day-to-day operations, and 5) foster nondiscrimination in APHIS programs. In addition, APHIS plans to implement Executive Order 12898 through its compliance with the provisions of NEPA.

All APHIS-WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to insure EJ. WS personnel use wildlife damage management methods as selectively and environmentally conscientiously as possible. All chemicals used by APHIS-WS are regulated by the EPA through FIFRA, by the NDA, by MOUs with federal land management agencies, and by program directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used following label directions, they are selective to target individuals or populations and such use has negligible impacts on the environment (USDA 1994, Appendix P). The APHIS-WS operational program, discussed in this document, properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

2.2.5 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

WS prioritizes the identification and assessment of environmental health and safety risks that may disproportionately affect children. Children may suffer disproportionately from environmental health and safety risks for many reasons, including their physical and mental status. WS has concluded that the proposed management program would not create an environmental health or safety risk to children because the program would only make use of legally available and approved damage management methods applied where such methods are highly unlikely to adversely affect children.

2.3 Issues Not Considered in Detail, With Rationale

2.3.1 Wildlife Services' Impact on Biodiversity and Predator/Prey Relationships (Potential for WS' take of predators to result in population increases of rodents and rabbits, which might then increase agricultural damage)

No WS wildlife damage management is conducted to eradicate a native wildlife population. WS conducts activities according to international, federal and state laws and regulations enacted to ensure species viability. Several state statutes direct agencies to consider biological sustainability when making management decisions. Nebraska's Natural Areas Register legislation states that quality of life is enhanced by the protection of natural diversity and that the protection of species and genetic diversity through habitat protection benefits humans (RSN 37-1401). In addition, ecosystem management goals are provided in two strategic plans adopted by the NGPC: the Stewardship Strategic Plan and the Nongame, Threatened and Endangered Species Strategic Plan. Nebraska's endangered species act, entitled the Nongame and Endangered Species Conservation Act, covers all plant and animal species (RSN 37-430 et. seq.). NGPC consultation is required and was completed by WS.

Rabbit and rodent populations normally fluctuate substantially in multi-year cycles. There are two basic schools of thought as to the factors responsible for these fluctuations. One is that rodent and rabbit populations are self-regulated through behavior, changes in reproductive capacity due to stress, or genetic changes (Chitty 1967, Myers and Krebs 1983). The other is that populations are regulated by environmental factors such as food and predation (Pitelka 1957, Fuller 1969).

Keith (1974) concluded that: 1) during cyclic declines in prey populations, predation has a depressive effect and as a result, the prey populations may decline further and be held for some time at relatively low densities, 2) prey populations may escape this low point when predator populations decrease in response to the reduced food base, and 3) since rabbit and rodent populations increase at a faster rate than predator populations, factors other than predation must initiate the decline in populations. Wagner and Stoddart (1972) and Clark (1972) independently studied the relationship between coyote populations and jackrabbit *(Lepus californicus)* populations in northern Utah and southern Idaho. Both noted that coyote populations increased as jackrabbit numbers increased, but with a 1-2 year delay, suggesting that the prey population controlled the predator population, rather than the reverse.

Any reduction of a local population or group would be temporary because migration from adjacent areas or reproduction would replace the animals removed (Connolly and Longhurst 1975, Henke 1992). In two studies conducted in south Texas (Beasom 1974b, Guthery and Beasom 1977), intensive short-term predator removal was employed to test the response of game species to reduced coyote abundance. At the same time, rodent and rabbit species were monitored. A marked reduction in coyote numbers did not appear to affect the populations of rabbits or rodents in either study. Similarly, Neff et al. (1985) noted that reducing coyote populations on their study area in Arizona to protect pronghorn antelope fawns did not affect the rodent or rabbit population. The impacts of the current WS program on biodiversity are not significant nationwide or state-wide (USDA 1994, Chap 4). Furthermore, WS' take of wildlife species in Nebraska is insignificant and does not impact the viability and health of any state-wide population (Andelt 1997). Thus, at the levels of predator removal currently being sustained (see Section 4.4.1), it is unlikely that overall rodent or rabbit populations would increase.

2.3.2 The Public's Concern about the Use of Chemicals and Toxicants and that Toxicants/Chemicals Should be Banned

Much of the public's concern over the use of toxicants for predator damage management is based on an erroneous perception that WS uses nonselective, outdated chemical methodologies. In reality, however, the chemical methods currently employed by WS have a high degree of selectivity (see section 4.4.2). WS' use of toxicants is regulated by the EPA through the FIFRA, by MOUs with other agencies, and by program directives. In addition, APHIS conducted a thorough risk assessment and concluded that chemicals used according to label directions are selective for target individuals or populations, and therefore, have negligible impacts on the environment (USDA 1994, Appendix P).

A decision to ban toxicants is outside the scope of WS' authority. WS could elect to discontinue its use of toxicants, but those registered in Nebraska are an integral part of IWDM and their selection for use follows criteria in the ADC Decision Model (see Chapter 3:3.2.3, Slate et al. 1992).

2.3.3 No Wildlife Damage Management at Taxpayer Expense; Wildlife Damage Management Should be Fee-Based

During public involvement, some respondents felt that wildlife damage management was a government subsidy and should be fee-based and not be provided at the expense of the taxpayer. Funding for WS comes from a variety of sources besides federal appropriations. In counties that have cooperative agreements with WS, general tax dollars are used to provide all residents equal access to the WS program. In addition, the NGPC, Forest Service, Omaha Airport Authority, U.S. Air Force, Nebraska Public Power District, and several municipalities currently provide funds to WS for special projects. The NDA and livestock associations also provide funds to WS to protect livestock and other resources. All of these funds are applied to the WS program under cooperative agreements as requested by the cooperator.

WS was established by Congress as the program responsible for providing wildlife damage management to the people of the United States. Federal, state and local officials have decided that funds should be appropriated to WS. Additionally, wildlife damage management is an appropriate sphere of activity for government programs, since wildlife management is a government responsibility. The protection of livestock will always be conducted by someone; a federal WS program conducts an environmentally and biologically sound program in the public interest (Schueler 1993).

2.3.4 Need for Public Awareness and Education

Some individuals suggested that there was a need to educate the public regarding WS activities and the need for wildlife damage management. Although this is a recognized need, WS does not require each state-administered program to undertake efforts to promote public understanding of this issue. Nebraska WS personnel, however: 1) make presentations to elementary and high school classes on wildlife damage management, 2) conduct informational and instructional sessions as requested by individuals or organizations, 3) assist in the teaching of formal wildlife management courses at the University of Nebraska, 4) participate in wildlife damage management workshops with the UNCE and/or other groups or agencies, and 5) participate in Project Wild with the NGPC. In addition, WS maintains information and literature on the use of effective nonlethal methods and livestock guarding animals and provides this information upon request.

2.3.5 Livestock Losses are a Cost of Doing Business and the Need to Consider a Threshold of Loss

Some individuals believe that livestock producers should expect some level of loss as a cost of doing business and that WS should not initiate any damage management actions until economic losses reach some predetermined *"threshold"* level. Although some losses of livestock and poultry can be expected and tolerated by livestock producers, WS has a legal responsibility to respond to requests for wildlife damage management and it is program policy to aid each requester to minimize losses. If damage management efforts are not initiated soon after a damage problem is detected, losses may sometimes escalate to excessive levels before the problem is solved.

In the Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied plaintiffs' motion for a preliminary injunction. In part, the court found that a Forest Supervisor need only show that damage from predators is threatened to establish a need for wildlife damage management (U.S. District Court of Utah 1993).

2.3.6 Management Agencies Should Use Hunters/Trappers to Conduct Wildlife Damage Management

The NGPC has the option of increasing hunting quotas, and thus, opportunities for sportsmen and women. However, most of the predator damage management conducted by WS involves coyote damage and currently there is no regulated season or limit on the coyote take in Nebraska. Bounty systems have also been tried in the U.S. and have generally proved ineffective. A bounty system encourages harvest of the bountied species at times and places when they are easiest and cheapest to harvest and many damage problems occur at times and in places where removing offending animals is difficult.

2.3.7 Appropriateness of Using Rancher-Supplied Data to Quantify Livestock Losses

Some individuals believe that ranchers often intentionally overestimate the extent of their livestock losses to justify more damage management work. Pearson (1986), however, reported that several studies indicated little or no bias in rancher reported losses and Shelton and Klindt (1974) found that some ranchers underestimated their losses due to some husbandry practices. Schaefer et al. (1981) investigated sheep predation and determined that: 1) producers correctly assessed the cause of livestock deaths more than 94% of the time, and 2) the results of two types of loss surveys yielded similar results. Losses attributed to predation by Nebraska sheep producers in 1994 amounted to about 14% of the total reported death loss (NASS 1995). Through intensive monitoring conducted during a study on three typical range sheep operations in southern Idaho, Nass (1977) found that predators were responsible for 56% of the total death losses. This data suggests that attributing an average of 40% of total death losses to predation is realistic and in some cases, losses may be underestimated.

2.3.8 Wildlife Services' Predator Damage Management on Private Versus Public Lands

Some individuals expressed concern about how WS activities would be conducted on private versus public lands. WS activities on private lands are carried out only after the landowner/lessee has requested services from WS and after an *Agreement for Control* has been signed. This agreement stipulates which methods may be used on the property. WS activities on public lands are only implemented after development of site-specific work plans or other comparable documents between WS and the respective management agency. These plans stipulate any restrictions that may be deemed necessary to ensure public safety or resource protection. WS activities on public lands are typically carried out under more restrictions than on private land to mitigate the likelihood of conflicts with users of public lands.

2.3.9 Rancher Responsibility to Protect Their Own Livestock Through Use of Husbandry Methods

Although no law or policy requires livestock producers to employ good husbandry practices to protect their livestock, most Nebraska sheep producers do employ a variety of husbandry practices as a matter of good business. On average, farmers and ranchers spent $1.24 per breeding sheep on nonlethal damage management and $0.68 on lethal damage management (NASS 1995).

Livestock producers in Nebraska employed many nonlethal damage management measures to protect their livestock from predation. In 1996, 406 livestock producers reported 2,946 occurrences in the use of 20 different nonlethal methods (Nebraska WS unpubl. data). Therefore, requests for WS assistance to protect livestock from predation in Nebraska in 1996 came from producers who were already using an average of 7.2 nonlethal methods on each operation, but still experienced predation problems in spite of these practices. The most frequently used nonlethal methods were: 1) husbandry (1,323 occurrences), 2) harassment (878 occurrences), 3) fencing (461 occurrences), and 4) guard animals (290 occurrences). WS' policy is to respond to all requests for assistance within program authority and responsibility. If improved husbandry practices would likely reduce a predation problem, WS makes recommendations regarding these practices.

2.3.10 Compensate Livestock Producers for Wildlife Damage Losses

This issue would be impossible for Nebraska WS or any other federal or state agency to execute. Nebraska WS is charged by law to protect American agricultural and natural resources, property and public health and safety (Animal Damage Control Act of 1931, as amended; and the Rural Development, Agricultural and

Related Agencies Appropriation Act of 1988). Analysis of this issue as an alternative in the ADC EIS (USDA 1994) shows that it has many drawbacks: 1) it would require larger expenditures of money to investigate and validate all losses and to determine and administer appropriate compensation, 2) timely responses to all requests to assess and confirm losses would be difficult and most likely many losses could not be verified, 3) compensation would most likely be below full market value, 4) compensation would give little incentive to livestock owners to limit predation through improved animal husbandry practices and other management strategies, 5) not all livestock owners would rely completely on a compensation program and unregulated lethal control of predators would probably continue and escalate, and 6) neither Congress nor the State of Nebraska has appropriated funds to compensate for livestock predation or to administer a compensation program.

2.3.11 Compensate Livestock Producers to Change the Class of Livestock

Compensating livestock producers to change the class of livestock would be impossible for the Nebraska WS program or any other federal or state agency to do. Nebraska WS is charged by law to protect American agricultural and natural resources, property and public health and safety (Animal Damage Control Act of 1931, as amended; and the Rural Development, Agricultural and Related Agencies Appropriation Act of 1988). Analysis of this issue shows that it has many drawbacks: 1) it would require larger expenditures of money to compensate livestock owners to change the class of livestock, 2) WS has no authority to tell livestock producers to change their class of livestock, 3) not all pasture conditions, equipment used by livestock producers, and education or experience of the livestock producers lend themselves to changing the class of livestock, 4) changing the class of livestock would probably not eliminate all predation, and 5) neither the U.S. Congress or the State of Nebraska has appropriated funds to compensate producers for changing the class of livestock or to administer a compensation program.

2.3.12 Use of the Livestock Protection Collar

The LPC is registered with the EPA (Reg. No. 56228-22) for producer or WS use nationwide. Registrants must also receive approval from the state agency that oversees pesticide usage before using the LPC in individual States, however. Use of the LPC would follow EPA registration and the state agency requirements and would be restricted to specially trained and certified WS employees.

Sodium fluoroacetate (Compound 1080), the chemical in the LPC, has been used since World War II. Sodium fluoroacetate has been the subject of much research in the United States and elsewhere and has been widely used as a toxicant in pest management programs in many countries. Fluoroacetic acid and related chemicals occur naturally in plants in many parts of the world and are not readily absorbed through intact skin (Atzert 1971). Sodium fluoroacetate is discriminantly toxic to predators, being many times more lethal to them than to most nontarget species (Atzert 1971, Connolly and Burns 1990). Sodium fluoroacetate would only be used in the LPC. Many EPA imposed restrictions apply to the use of LPCs.

The LPC is worn around the neck of lambs and kills only the animal attacking collared lambs (Johnson 1984, Burns et al. 1988). In this usage, sodium fluoroacetate is very selective and poses virtually no risk of secondary poisoning (USDA 1994, Appendix P). A decision to ban the use of the LPC is outside the scope of WS' authority. WS could elect not to use the LPC, but its use could be an integral part of IWDM in Nebraska and its selection for use would follow criteria in the ADC Decision Model (see Chapter 3:3.2.3).

2.3.13 Eagle Damage Management and Impacts from Wildlife Services' Activities to Eagles

Some individuals expressed concern about eagle damage and want WS to conduct eagle damage management. The Bald and Golden Eagle Act declares that both bald and golden eagles are protected species and that no person can *" take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or in any manner . . . alive or dead, or any part, nest or egg"* of these eagles. However, the law does permit the *"taking, possession and transportation of specimens for scientific or exhibition purposes of public museums, scientific societies and zoological parks, or for religious purposes of Indian tribes, or that it is necessary to permit the taking for the protection of wildlife or of agricultural or other interests in any particular locality."* Nebraska WS conducted an informal Section 7 Consultation with the USFWS and a consultation with the NGPC to use their expertise to determine if WS would have any adverse impacts on bald eagles in Nebraska or elsewhere. If a depredation complaint is received by WS, an investigation is conducted to determine if losses have occurred. If losses are verified, WS could capture and relocate an eagle that is causing livestock or wildlife depredations as coordinated with the USFWS or a permit could be issued by the USFWS to the individual experiencing the loss.

When WS responds to such requests for assistance, the USFWS is informed of the incident and consultation is initiated. Nebraska WS has never used lethal methods to resolve eagle damage/hazard complaints. If operational assistance is necessary, WS obtains the necessary approval from the USFWS and nonlethal methods are employed. However, the 1992 USFWS Biological Opinion stipulates that WS is allowed an incidental take of 2 bald eagles nationwide each year, with the exception of the southwestern population. The Biological Opinion also indicates that this level of impact is not likely to result in jeopardy to the species and thus, no cumulative impacts on bald eagles would be expected.

2.3.14 Appropriateness of Preparing an Environmental Assessment Instead of an Environmental Impact Statement and an Environmental Impact Statement has to be Prepared Because of Controversy

Some individuals questioned whether preparing an EA for an area as large as the State of Nebraska would meet the NEPA requirements for site specificity and suggested that an EIS be prepared because of the controversy of the WS program. Council on Environmental Quality (CEQ) regulations state that a significant impact may be determined depending on the degree to which the *effects* on the quality of the human environment are likely to be highly controversial. The effects of WS' predator damage management *are not highly controversial* among wildlife biologists: this is supported by the interagency review process employed during the preparation of this EA. If a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA covering the entire analysis area would provide a better analysis than multiple EAs covering smaller zones within the analysis area. This EA assesses cumulative and significant impacts within the analysis area from an ecosystem perspective. The proposed action would not have an impact on historic properties (Puschendorf 1997) or unique characteristics such as historical or cultural resources, park lands, prime farmlands, wetlands, WSRs, or ecological critical areas, and it will not adversely affect public health and safety. No accidents associated with WS' predator damage management are known to have occurred in Nebraska. The effects on the quality of the human environment are not highly controversial. Although there is opposition to predator damage management, this action is not controversial in relation to size, nature, or effects. Mitigation measures adopted as part of the proposed action minimize any risk to the public, prevent adverse effects on the human environment, and reduce uncertainty and risks.

2.3.15 Wildlife Services Must Consider Cumulative Impacts from Surrounding States

The Nebraska WS Program coordinates its activities with the Forest Service, BLM, USFWS and the NGPC to insure no cumulative effects to any wildlife populations or other resources managed by these agencies. Nebraska WS conducted a Section 7 Consultation with the USFWS and the NGPC to insure no adverse or cumulative impacts to listed and T&E species and has consulted with the Nebraska Historical Preservation Office and American Indian Tribes to insure no adverse impacts to historical or cultural resources. The intent of this coordination and consultation is to draw on the expertise of other agency and tribal personnel to insure there are no cumulative impacts, in Nebraska or surrounding States, from WS' predator damage management.

2.3.16 Wildlife Services Causes Genetic Loss in the Subspecies of Coyotes Found in Nebraska

To assess the concern about coyote subspecies and loss of genetic material, it is necessary to understand what a "subspecies" is. A subspecies is a morphologically distinguishable group whose members are at least partially isolated geographically, but interbreed successfully with members of other subspecies of the same species where their ranges overlap. Scientists often use other terms, such as race and variety, as synonyms for the word "subspecies" (Connolly 1994). If crossbreeding occurs in nature in places where the geographic ranges of two kinds of mammals meet, the two kinds are considered to be subspecies of one species. If no crossbreeding occurs, the two kinds are regarded as two distinct, full species.

Coyotes are regarded as predators with generalized food habits that allow them to inhabit a wide variety of habitat types. They are considered widely distributed throughout most of North America and are highly mobile, migrating over large areas. Migration facilitates interbreeding of subspecies, invalidating subspecies classifications (Voigt and Berg 1987). In other words, coyotes are morphologically indistinguishable and so much alike that trained wildlife biologists cannot tell one subspecies from another (Connolly 1994). Young and Jackson (1951) wrote of the great amount of individual variation in color, size and cranial characteristics of coyotes and stated that the actual limits of the geographic range of any subspecies cannot be indicated by distinct boundaries. They also suggested that, within the range of one subspecies, individual coyotes will be found that are typical of other subspecies. Dispersal of *"surplus"* animals is the main factor that keeps coyote populations distributed throughout their habitat. Such dispersal of subdominant animals removes surplus animals from higher density areas and repopulates areas with lower densities.

There is one subspecies of coyote found in Nebraska, *Canis latrans latrans* (plains coyote) (Young and Jackson 1951). Young and Jackson (1951) stated that, *"in its* (plains coyote) *peripheral range there is the usual broad band of intergradition with the adjacent subspecies and subspecific determination of specimens from these borders may be difficult* (to determine) *or a matter of personal judgment."* This means that the average person looking at a coyote on or near the edges of the published geographic range of the plains coyote would find it difficult or impossible to tell if the animal was, in fact, a plains coyote or a member of another subspecies.

WS' take of coyotes is limited to areas where cooperative agreements or work plans are in place in specific livestock grazing areas. Nebraska WS' removal of coyotes, as analyzed in Chapter 4 of this EA, does not and has not impacted genetic variability of the coyote population. Furthermore, there is no indication that the plains coyote in Nebraska is scarce or rare.

2.3.17 Removing Coyotes in an Area Causes Younger, More Aggressive Coyotes to Inhabit the Area, Thus Causing Greater Livestock Losses

Two studies (Connolly et al. 1976, Gese and Grothe 1995) investigated the predatory behavior and social hierarchy of coyotes and determined that the more dominant (alpha) animals were the ones that initiated and killed most of the prey items. Connolly et al. (1976) concluded from pen studies, with known-aged coyotes, that the proclivity of individuals that attacked livestock seemed related to their age and relationship with conspecifics. The dominant males and females attacked sheep most frequently, with the males responsible for most of the attacks and kills. Gese and Grothe (1995) concluded from observing wild coyotes that the dominant pair was involved in the vast majority of predation attempts. The alpha male was the main aggressor in all successful kills, even when other pack members were present. Submissive, younger, and less dominant animals scavenged on carcasses of animals killed by the dominant pair, other carcasses, or had diets that, in part, consisted of other small food items. Windberg et al. (1997) demonstrated that coyotes from unexploited coyote populations readily killed livestock and selectively preyed on smaller goat kids. They determined that 41% of the kid goats exposed during the study were killed by predators. This remarkably high predation rate occurred despite no recent (>7 years) exposure to goats or sheep as prey on their study area. Thus, it appears the above concern is unfounded because removal of local territorial (dominant) coyotes removes the individuals that are most likely to kill livestock and generally results in the immigration of subdominant coyotes that are less likely to kill livestock.

2.3.18 Increased Coyote Damage Management will Increase Red Fox Densities and Increase Waterfowl Predation

Predator damage management, as analyzed in this EA, would not impact predator populations (Andelt 1997) except possibly in localized areas in the short-term. The take of coyotes is well below the level that would impact any existing wildlife populations, and therefore, fox or other mesopredator populations would not increase unchecked because of WS' predator damage management (Andelt 1997).

Red foxes have been the subject of many studies during the last 20 years and investigations have revealed that red foxes are extremely adaptive and diverse in their behavior and selection of habitats (Sargeant et al. 1984). Voigt and Earle (1983) and Gese et al. (1996) showed that red foxes avoided coyotes but coexisted in the same area and habitats. In the prairie pothole region, Sargeant et al. (1993) stated that coyotes, red foxes, and mink were numerous or common in one or more study areas. Sargeant et al. (1993) stated that the abundance of red foxes has a profound effect on the survival of adult ducks in the prairie pothole region, however, coyotes probably also prey extensively on adult ducks. In their study of the prairie pothole region, Sargeant et al. (1973) and Sargeant et al. (1993) determined that coyotes, red foxes, and mink are the primary mammalian species affecting duckling survival.

2.3.19 Lethal Methods May Actually Increase Predation by Changing Coyote Pack Structure Through Compensatory Reproduction

Mortality in coyote populations can range from 19%-100%, with 40%-60% mortality most common. Several studies of coyote survival rates, which include calculations based on the age distribution of coyote populations, show typical annual survival rates of only 45% to 65% for adult coyotes. High mortality rates have also been shown in four telemetry studies involving 437 coyotes that were older than 5 months of age; 47% of the marked animals are known to have died. Mortality rates of "unexploited" coyote populations were reported to be between 38%-56%. Thus, most natural coyote populations are not stable (USDI 1979). In studies where reported coyote mortality was investigated, only 14 of 326 recorded mortalities were due to WS' activities.

Dispersal of "surplus" young coyotes is the main factor that keeps coyote populations distributed throughout their habitat. Such dispersal of subdominant animals removes surplus animals from higher density areas and repopulates areas where artificial reductions have occurred. As noted in 2.3.17, two studies (Connolly et al. 1976, Gese and Grothe 1995) investigated the predatory behavior of coyotes and determined that the more dominant (alpha) animals (adult breeding pairs) were the ones that initiated and killed most of the prey items. Thus, it appears the above concern is unfounded because the removal of local territorial (dominant, breeding adult) coyotes actually removes the individuals that are most likely to kill livestock and generally results in the immigration of subdominant coyotes that are less likely to prey on livestock.

Coyotes in areas of lower population densities may reproduce at an earlier age and have more offspring per litter, however, these same populations generally sustain higher mortality rates. Therefore, the overall population of the area does not change. The number of breeding coyotes does not substantially increase without exploitation and individual coyote territories produce one litter per year independent of the population being exploited or unexploited. Connolly and Longhurst (1975) demonstrated that coyote populations in exploited and unexploited populations do not increase at significantly different rates and that an area will only support a population to its carrying capacity.

2.3.20 Concerns Over the Cost Effectiveness of WS' Activities

The cost-effectiveness of WS' activities was a common concern of many respondents during the public involvement process. However, NEPA does not require preparation of a specific cost-benefit analysis and consideration of this issue is not essential to making a reasoned choice among the alternatives being considered.

It is currently difficult to prepare a cost-benefit analysis of the Nebraska WS predator damage management program because WS cooperates with individual counties, associations or other entities and services are not equally available in all locations. In addition, most livestock statistics (i.e., inventories, loss information, etc.) are gathered on a district or state-wide basis. As there is no direct correlation between these districts and WS' activity areas, any reasonable and reliable economic analysis would currently be impossible.

In addition, it is important to remember that any economic analysis must be limited to quantifiable values and variables that would be difficult to measure often cannot be considered. For example, when sheep on rangelands are repeatedly harassed by predators, they become *nervous* and do not disperse and feed normally. Thus, they graze inefficiently and do not gain as much weight as they would have, had they not been stressed. This is a recognized form of indirect predator damage that would be difficult to quantify in dollars and cents. Jahnke et al. (1987) and Wagner (1988) discussed additional examples of indirect predator damage, including increased labor costs to find sheep scattered by predators, increased producer efforts, and range damage related to the tighter herding required in response to the presence of predators. In addition, any analysis based solely on economics probably would not consider the esthetic value that some individuals associate with the opportunity to see or hear coyotes when they visit Nebraska rangelands, nor would it consider the unintentional harm or indirect benefits predator control has on certain wildlife species.

It is also important to remember that a cost-benefit analysis of WS' activities during the decades of widespread toxicant use would likely show a much higher benefit per unit cost than for predator damage management programs as currently practiced. Although toxicants were cheap and very effective at keeping predator numbers and livestock losses low, concerns were expressed about some of the environmental impacts associated with their wide-spread application. Thus, our social value system has essentially established limits on how cost-effectively predator damage management can be conducted. As other considerations, (i.e., humaneness, selectivity, and safety to humans and animals) are incorporated into a damage management strategy, the use of certain damage management methods often increases and the cost-effectiveness of predator control is reduced.

2.4 ADDITIONAL ISSUES NOT CONSIDERED BECAUSE THEY ARE OUTSIDE THE SCOPE OF THIS ANALYSIS

1. Issue more Deer Permits
2. Establishing/Increasing Hunting Quotas
3. Grazing on Public Lands
4. Prairie Dog Control

CHAPTER 3: ALTERNATIVES

INTRODUCTION

This chapter consists of five parts: 1) an introduction, 2) a description of alternatives considered and analyzed in detail including the Proposed Alternative (Alternative 3), 3) a description of methods used by Nebraska WS personnel, 4) a description of alternatives considered, but eliminated from detailed analysis, and 5) a table of mitigation measures and SOPs. Six alternatives were recognized, developed, and analyzed in detail by the Multi-agency Team (WS, BLM, Forest Service, USFWS, NGPC, NDA, and UNCE); three alternatives were considered but not analyzed in detail. The six alternatives analyzed in detail were:

1) Alternative 1 - Continue the Current Nebraska WS Program (No Action). This alternative consists of the current program of technical assistance and operational integrated wildlife damage management by Nebraska WS on the Nebraska National Forest and Oglala National Grassland, as well as state, county, municipal, and private lands under cooperative agreement and agreement for control. The current program primarily protects agricultural resources and public health and safety.

2) Alternative 2 - No Federal Nebraska WS Program. This alternative would terminate the federal predator damage management program in Nebraska.

3) Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative). This alternative would allow for predator damage management based on the needs of multiple resources (livestock, wildlife, property, and public health and safety) and would be implemented following consultations with the NGPC, NDA, federal agencies and tribes, as appropriate. This alternative would allow Nebraska WS to protect multiple resources on lands owned or managed by federal or state agencies and tribal, county, municipal and private lands as requested and after the appropriate cooperative agreement, agreement for control, MOU, wildlife damage management work plan or other comparable document is in place.

4) Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control. This alternative would require that livestock owners conduct nonlethal damage management before Nebraska WS could implement lethal control.

5) Alternative 5 - Corrective Damage Management Only. This alternative would require that livestock depredations occur before Nebraska WS could implement control. No preventive lethal management would be allowed.

6) Alternative 6 - Technical Assistance Only. Under this alternative, Nebraska WS would not conduct operational predator damage management in Nebraska. The entire program would consist of only technical assistance.

3.1 DESCRIPTION OF THE ALTERNATIVES (Table 3-1)

3.1.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action)

The No Action Alternative is a procedural NEPA requirement (40 CFR 1502.14(d)), is a viable and reasonable alternative that could be selected, and serves as a baseline for comparison with the other alternatives. The No Action Alternative, as defined here, is consistent with CEQ's definition (CEQ 1981).

The No Action Alternative would continue the current predator damage management program that relies on cooperation between Nebraska WS and other federal, state and local agencies, private individuals, and associations to protect livestock, wildlife, property, and public health and safety (as described in Chapter 1). Nebraska WS conducts technical assistance, operational preventive predator damage management (based on historic loss data) and corrective predator control (in response to current losses, hazards or threats to public safety) as allowed by MOUs, cooperative agreements and agreements for control. All wildlife damage management is based on interagency relationships which require close coordination and cooperation because of overlapping authorities. Nebraska WS has a MOU with the NDA, NGPC, NDH and UNCE. At present, predator damage management for the protection of wildlife is conducted as requested and as separate projects.

3.1.2 Alternative 2 - No Federal Nebraska WS Program

This alternative would eliminate all Nebraska WS predator damage management (operational and technical assistance) on all land classes in Nebraska. However, state and county agencies and private individuals could conduct wildlife damage management. Nebraska WS would not be available to provide technical assistance or make recommendations to livestock producers.

Due to interest in this alternative, an analysis has been included. A "No Program" Alternative was also evaluated in the ADC EIS (USDA 1994).

3.1.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Action)

This alternative proposes to combine Nebraska WS' livestock protection program with damage management activities for the protection of designated wildlife resources, property, and public health and safety on all land classes. Management would be conducted following consultation with the NGPC and USFWS for T&E and migratory bird species. In addition, the appropriate land management agency would be consulted before any action would occur on lands under their jurisdiction. Damage management strategies would be selected based on the combined needs of multiple resources and would be mitigated to prevent any potentially adverse impacts to wildlife. This strategy provides for more of an ecosystem management approach for areas where Nebraska WS conducts predator damage management. For any specific area of public land, the NGPC and USFWS could attend the wildlife damage management work plan meeting between Nebraska WS and the land or wildlife management agency. In addition, the tribes residing in Nebraska are responsible for management of wildlife species on tribal lands and could request Nebraska WS' assistance. At that time, a work plan or other comparable document consistent with this EA would be developed. Nebraska WS would identify areas where requests for assistance to protect livestock have been received or are anticipated (based on historic loss data). The cooperating agency or tribe would identify areas where protection of wildlife may be necessary to achieve their management objectives and where mitigation is necessary to protect resources under their jurisdiction. The appropriate predator damage management strategy would be developed based on the combined resource needs and mitigation requirements.

Legal mechanical and chemical management methods (including the LPC, if registered) would be applied where appropriate, under this alternative. In addition, predator damage management could be conducted in designated special management areas when requested, necessary, allowed by legislation, and coordinated with the land management agency. However, predator damage management in designated areas is expected to comprise a small segment of the program under Alternative 3.

For federal lands, Nebraska WS Work Plans would describe the predator damage management that could occur. These plans would be developed in cooperation with the BLM, Forest Service or other federal land management agency and would include maps and other information that describe and delineate where predator damage management would be conducted, the methods to be used, and any management considerations. Before management would be conducted on private lands, agreements for control would be signed with the landowner or manager. These agreements would describe the methods to be used and the species to be managed. Management would be directed toward localized predator populations or groups and/or individual offending animals, depending on the circumstances.

3.1.4 Alternative 4 - Nonlethal Control Required Prior to Lethal Control

This alternative would require livestock producers to implement nonlethal management before Nebraska WS could conduct lethal control. Producers could employ techniques such as livestock husbandry and/or animal behavior or habitat modification methods. Nebraska WS would be responsible for verifying producer-employed methods. At present, no standard exists to determine producer diligence in applying these methods, nor are there any standards to determine how many nonlethal applications are necessary before lethal control is initiated. Thus, only the presence or absence of nonlethal methods could be evaluated (Table 4-1). The mechanical and chemical methods available in Alternatives 1 and 3 would apply, where appropriate, once the criteria for nonlethal control has been met. The producers would not be required to consider mitigation measures before implementing nonlethal methods, nor would Nebraska WS base predator damage management strategies on the needs of designated wildlife or T&E species.

3.1.5 Alternative 5 - Corrective Control Only

This alternative would restrict predator damage management to places where livestock depredations are occurring and would require Nebraska WS to verify losses and the species responsible. Producers could still implement practical and effective nonlethal methods. Lethal management would be limited to the immediate area surrounding the damage to maintain the integrity of the corrective-only situation. All mechanical and chemical damage management methods available in Alternatives 1 and 3 could be used once losses have occurred and were verified.

3.1.6 Alternative 6 - Technical Assistance Only

This alternative would eliminate WS' operational predator damage management in Nebraska. WS would only provide technical assistance and make recommendations as requested. Private landowners, contractors, or others, however, could conduct their own predator damage management on federal, state, county, and private lands.

The *"Technical Assistance Only"* Alternative would place the burden of operational control on state or county agencies, property owners and livestock producers. Individuals experiencing predator damage would, independently or with Nebraska WS' recommendations, carry out and fund control activities. Individual producers could implement predator damage management as part of the cost of doing business or a state or county agency could assume a more active role in providing operational predator damage management. If this alternative were selected, Nebraska WS could not direct how state agencies or individuals would implement damage management. Some agencies or individuals could choose not to take action to resolve predator damage, while other situations could be addressed using all legally available methods. Methods and control devices could be applied by people with little or no training or experience and with no professional oversight or monitoring for effectiveness.

Table 3-1. Comparison of WS' Predator Damage Management Alternatives

	Alt 1 Current Program	**Alt 2** No Program	**Alt 3** Proposed Program	**Alt 4** Nonlethal	**Alt 5** Corrective Only	**Alt 6** Technical Assistance
Nonlethal	Yes	NA	Yes	Yes	Yes	Yes
Lethal	Yes	NA	Yes	No	Yes	Yes
M-44s	Yes	NA	Yes	No	Yes	No
Traps	Yes	NA	Yes	Yes	Yes	No
Neck Snares	Yes	NA	Yes	No	Yes	No
Foot Snares	Yes	NA	Yes	Yes	Yes	No
Gas Cartidge	Yes	NA	Yes	No	Yes	No
Aerial Hunting	Yes	NA	Yes	No	Yes	No
Dogs	Yes	NA	Yes	No	Yes	No
Calling/ Shooting	Yes	NA	Yes	No	Yes	No
Preventive	Yes	NA	Yes	Yes	No	Yes
LPC[1]	Yes	NA	Yes	No	Yes	Yes

[1] The LPC would not be used on BLM or Forest Service lands, nor on private lands until registered in Nebraska.

3.2 PREDATOR DAMAGE MANAGEMENT STRATEGIES AND METHODOLOGIES USED BY WS IN NEBRASKA

The strategies and methodologies described below are common to Alternatives 1, 3, 4 and 5 of this EA. Under Alternative 6, WS personnel would only make technical assistance recommendations, as requested, based on practical and legal strategies supported by the ADC Decision Model (Slate et al. 1992, USDA 1994). Alternative 2 would eliminate WS' predator damage management in Nebraska.

3.2.1 Integrated Wildlife Damage Management

For more than 80 years, WS has considered, developed, and used numerous methods of managing wildlife damage problems (USDA 1994:3). WS' efforts have included the research and development of new methods and the implementation of effective strategies to resolve and prevent wildlife damage.

Usually, the most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. IWDM is the implementation and application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses and the informed judgement of trained personnel.

The philosophy behind IWDM is to implement effective management techniques in a cost-effective manner[4] while minimizing the potentially harmful effects to humans, target and nontarget species, and the environment. IWDM draws from the largest possible array of options to create a combination of appropriate techniques for the specific circumstances.

3.2.2 Integrated Predator Damage Management Strategies Used by WS in Nebraska

Technical Assistance (implementation is the responsibility of the requester): Nebraska WS personnel provide information and conduct demonstrations on the use of predator damage management devices and techniques (propane exploders, electronic guards, cage traps, guarding animals, wildlife habitat management, animal behavior modification, etc.). Technical assistance is usually provided during an on-site visit or verbal consultation when several management strategies are prescribed as short and long-term solutions. Technical assistance may require substantial effort by WS personnel during the decision making process, but the requester is ultimately responsible for implementing the management techniques.

Direct Assistance (management conducted or supervised by WS personnel): Direct assistance is implemented when the problem cannot be resolved through technical assistance and when cooperative agreements, work plans, or other comparable documents provide for WS' operational management. The initial investigation defines the nature and history of the problem, extent of damage, and the species responsible. WS personnel are often required to resolve problems effectively and safely, especially if restricted use pesticides are required; they consider the biology and behavior of the damaging species and other factors using the ADC Decision Model (Slate et al. 1992). The recommended strategy(ies) may include any combination of preventive and corrective actions.

1. **Preventive Damage Management.** Preventive damage management is the application of damage management strategies before damage occurs (based on historic problems and data). WS personnel provide information and conduct demonstrations or take direct action to prevent losses from occurring.

   Preventive predator damage management differs little in principle from holding controlled hunts for deer in areas where agricultural crop damage has been a historic problem. By reducing the number of deer near agricultural fields or the number of predators near a protected resource, the likelihood of damage is reduced.

   Shelton and Klindt (1974) documented a correlation between coyote densities and levels of sheep loss in Texas, and Robel et al. (1981) found a similar correlation in Kansas. In southeastern Idaho, Stoddart and Griffiths (1986) documented an increase followed by a decrease in lamb losses as coyote populations rose and fell. Gantz (1990) concluded that late winter removal of territorial coyotes from mountain grazing allotments would reduce predation on sheep pastured on those allotments the following summer.

   Wagner (1997) determined that aerial hunting implemented 3 to 6 months before sheep are grazed on an area was cost-effective when compared with areas without aerial hunting. She also determined that when preventive aerial hunting was conducted, fewer hours of subsequent ground work were required and concluded that, *"The reduction of device nights as a result of aerial hunting represents a potentially significant reduction in the risk to non-target species because species other than coyotes can fall prey to traps, snares and M-44s."*

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[4]The cost of management may be secondary because of over-riding environmental, legal, public health and safety, or animal welfare concerns.

2. **Corrective Damage Management.** Corrective damage management occurs when predator damage management is implemented to stop or reduce current losses. WS personnel may provide information and conduct demonstrations or take direct action to prevent additional losses. For example, WS personnel may use traps, snares, calling and shooting, M-44s or aerial hunting to alleviate or reduce depredations. Coyotes and other predators are highly adaptable and damage-causing individuals sometimes need to be removed from the population as soon as possible to avoid additional losses. The U.S. General Accounting Office (GAO) acknowledged the need for corrective control when they concluded that, according to available research, localized lethal damage management is effective in reducing predator damage (GAO 1990).

3.2.3 WS Decision Making

The ADC EIS (USDA 1994, Appendix N) describes the procedures used by WS' personnel to determine specific damage management strategies. For example, this source provides detailed examples of how WS implements its decision process when coyotes depredate sheep on public and private lands. The ADC Decision Model (Figure 3-1) (Slate et al. 1992) facilitates consideration of the following factors:

- Species responsible for the damage
- Magnitude, geographic extent, frequency, history and duration of the problem
- Status of target and nontarget species, including T&E species
- Local environmental conditions
- Potential biological, physical, economic, and social impacts
- Potential legal restrictions
- Costs of damage management options

WS personnel are frequently contacted after requesters have tried nonlethal techniques and found them to be inadequate for reducing damage to an acceptable level. WS personnel assess the problem and methods are evaluated for their availability (legal and administrative) and suitability based on biological, economic and social considerations. Following this evaluation, practical methods are formed into a management strategy. After implementation, the strategy is monitored and evaluated to assess its effectiveness. If the strategy is effective, management is reduced or terminated.

On most farms and ranches, predator damage may occur whenever vulnerable livestock are present because no cost-effective method(s) are 100% effective in preventing predator problems. When intermittent damage continues, WS personnel and the producer monitor and reevaluate the situation frequently. If a method or combination of methods fail to stop the damage, a different strategy is implemented. Most damage management efforts consist of a continuous feedback loop between receiving the request and monitoring the results, with the strategy reevaluated and revised periodically.

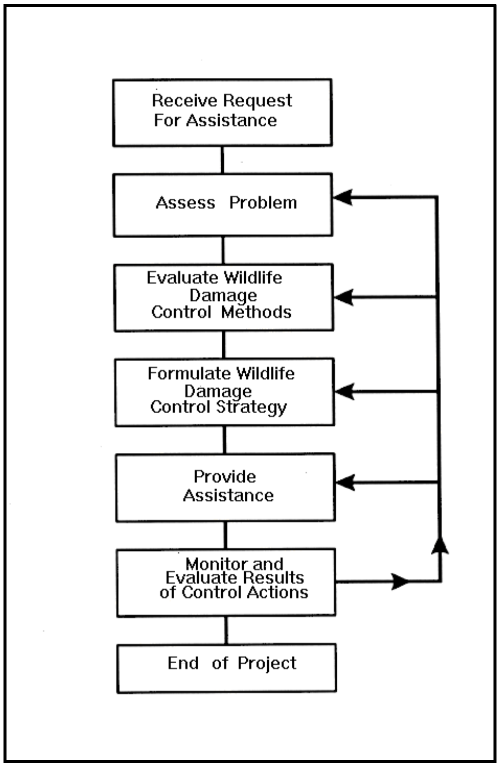


Figure 3-1
APHIS ADC Decision Model

3.2.4 Predator Damage Management Methods Recommended or Used by WS in Nebraska

Producer-Implemented Methods

Producer-Implemented Methods generally consist of nonlethal preventive techniques such as the use of animal husbandry and animal behavior and habitat modification. Producers are encouraged to use these methods based on the level of risk, need, and practicality.

- **Animal husbandry** practices include modifications in the level of care or attention given to livestock (depending on the age and size of the livestock). Animal husbandry practices include, but are not limited to, the use of:
  - guard animals
  - herders
  - shed lambing
  - carcass removal
  - temporary fencing
  - pasture selection

- **Habitat modification** is used whenever practical to attract or repel certain wildlife species or to separate livestock from predators. For example, WS may recommend that a producer clear brush from lambing or calving pastures to reduce available cover for predators.

- **Animal behavior modification** refers to tactics that deter or repel predators and thus, reduce predation. Unfortunately, many of these techniques are only effective for a short time before wildlife habituate to them (Pfeifer and Goos 1982, Conover 1982). Devices used to modify behavior include:
  - predator-proof fences
  - electronic guards (siren strobe-light devices)
  - propane exploders
  - pyrotechnics

Nebraska WS personnel maintain and distribute information on livestock guarding dogs and other nonlethal techniques. In FY96, those Nebraska sheep producers that requested WS' assistance used fencing (89.5%), night penning (86.8%), guard dogs (56.6%), and harassment (71.0%) to protect their animals, while Nebraska cattle producers used fencing (81.4%), carcass removal (80.5%), harassment (66.7%) and habitat manipulation (53.1%) to protect their cows and calves (Nebraska WS unpubl. data). On average, each Nebraska livestock producer that requested WS' assistance used 7.2 nonlethal methods while attempting to protect their livestock.

Mechanical Damage Management Methods

Mechanical management methods consist primarily of tools or devices used to repel, capture or kill a particular animal or local population of wildlife to alleviate resource damage. Mechanical methods may be nonlethal (e.g., fencing, frightening devices, etc.) or lethal (e.g., M-44 devices, snares, etc.). If WS personnel apply mechanical methods on private lands, an *Agreement for Control on Private Property* must be signed by the landowner or administrator authorizing the use of each damage management method. On BLM and National Forest System lands, a work plan would be in place that identifies where and when damage management requests may be expected based on livestock use and historic information. Federal land managers are responsible for identifying areas where other multiple use priorities may conflict with predator damage management activities. Mechanical methods used by WS include:

- **Leghold traps** can be utilized to live-capture a variety of mammals, but are most often used within Nebraska to capture coyotes and red foxes. Two advantages of the leghold trap are: 1) they can be set under a wide variety of conditions, and 2) pan-tension devices can be used to reduce the probability of capturing smaller nontarget animals. Effective trap placement and the use of appropriate lures by trained WS personnel also contribute to the leghold trap's selectivity. In addition, leghold traps allow for the release or relocation of animals.

  Leghold traps are difficult to keep operational during inclement weather and they lack selectivity where nontarget species are of a similar or heavier weight than the target species. The use of leghold traps also requires more time and labor than some methods, but they are indispensable in resolving many depredation problems.

- **Cage traps**, typically constructed of wire mesh or plastic, are sometimes used or recommended to capture smaller animals like raccoons or skunks. Cage traps pose minimal risks to humans, pets and nontarget wildlife and allow for on-site release or relocation of animals. Cage traps, however, cannot be used effectively to consistently capture wary predators such as coyotes and red foxes.

- **Snares** may be used as either lethal or live-capture devices. They are placed wherever an animal moves through a restricted area (e.g., crawl holes under fences, trails through vegetation, etc.) and are easier to keep operational during periods of inclement weather than leghold traps. Snares set to catch an animal by the neck are usually lethal, while snares positioned to capture an animal around the body or leg can be a live-capture method. Careful attention to details when placing snares and the use of a *"stop"* on the cable can also allow for live-capture of neck-snared animals. Nebraska WS is incorporating some *"break-away"* snares that allow larger nontarget animals to break the snare and escape (Phillips 1996). In addition, spring-activated foot snares could be used to capture depredating mountain lions, if necessary.

- **Ground shooting** is selective for a target species and may involve the use of spotlights, decoy dogs, and predator calling. Removal of one or two specific animals by calling and shooting in the problem area can sometimes provide immediate relief from a predation problem. Calling and shooting is often tried as one of the first lethal damage management options because it offers the potential of solving a problem more quickly and selectively than some other methods. Shooting is sometimes the only predator damage management option available if other factors preclude the setting of equipment such as traps and snares.

- **Hunting dogs** are sometimes trained and used for coyote damage management to alleviate livestock depredation (Rowley and Rowley 1987, Coolahan 1990). Trained dogs are used primarily to find coyotes and dens and to pursue or decoy problem animals. Dogs could be essential to the successful tracking and capture of problem mountain lions to alleviate livestock depredation problems or public health and safety threats.

- **Denning** is the practice of finding coyote or red fox dens and eliminating the young, adults, or both to stop an ongoing predation problem or prevent future depredation on livestock. Till and Knowlton (1983) documented denning's cost-effectiveness and high degree of efficacy in resolving predation problems due to coyotes killing lambs in the spring. Coyote and red fox depredations on livestock often increase in the spring and early summer due to the increased food requirements associated with feeding and rearing litters of pups. Removal of pups will often stop depredations even if the adults are not taken (Till 1992). Pups are typically euthanized in the den using a registered gas fumigant cartridge (see discussion of gas cartridge under *Chemical Management Methods*).

- **Aerial hunting**, the shooting of coyotes or red foxes from an aircraft, is used on all lands where authorized and deemed appropriate. Aerial hunting consists of visually sighting target animals in the problem area and shooting them with a shotgun from an aircraft. Local depredation problems (particularly lamb and calf predation by coyotes) can often be resolved quickly through aerial hunting.

  Cain et al. (1972) rated aerial hunting as *"very good"* in effectiveness for problem solving, safety, and lack of adverse environmental impacts. Smith et al. (1986) cited cost-effectiveness and efficacy as benefits of aerial hunting for the protection of pronghorn antelope from coyote predation. Connolly and O'Gara (1987) documented the efficacy of aerial hunting in taking confirmed sheep-killing coyotes. Wagner (1997) found that aerial hunting may be an especially appropriate tool as it reduces risks to nontarget animals and minimizes contact between damage management operations and recreationists. She also stated that aerial hunting was an effective method for reducing livestock predation and that aerial hunting 3 to 6 months before sheep are grazed on an area was cost-effective when compared with areas without aerial hunting.

  Good visibility and relatively clear and stable weather conditions are required for effective and safe aerial hunting. Summer conditions limit the effectiveness of aerial hunting as heat reduces coyote activity and visibility is greatly hampered by vegetative ground cover. Air temperature, which influences air density, affects low-level flight safety and may also restrict aerial hunting activities.

Chemical Management Methods

All chemicals used by WS are registered under the FIFRA and administered by the EPA and NDA. All WS personnel in Nebraska that use pesticides are certified as restricted-use pesticide applicators by the NDA; the NDA requires pesticide applicators to adhere to all certification requirements set forth in the FIFRA. No chemicals are used on public or private lands without authorization from the land management agency or property owner or manager. The chemical methods used and/or available for use in Nebraska are:

- **Sodium cyanide in the M-44 device** - The M-44 can be used effectively during winter months when leghold traps are difficult to keep in operation and M-44s are typically more selective for target canid species than leghold traps. The M-44 is a spring-activated ejector device developed specifically to kill coyotes, although it is also registered with the EPA (EPA Reg No. 56228-15) to kill red foxes and feral dogs. The M-44 consists of a capsule holder wrapped in an absorbent material, an ejector mechanism, a capsule containing about 0.9 grams of a powdered sodium cyanide mixture, a fluorescent marker, and a 5-7 inch hollow stake. To set a M-44, a suitable location is found, the hollow stake is driven into the ground, and the ejector unit is cocked and fastened into the stake by a slip ring. The wrapped capsule holder containing the cyanide capsule is then screwed onto the ejector unit and a coyote attractant is applied to the capsule holder. A canine attracted to the bait will try to bite and pick up the baited capsule holder. When the M-44 capsule holder is pulled, the spring-activated plunger propels sodium cyanide into the animal's mouth, resulting in death within seconds. Coyotes killed by M-44s present no secondary poisoning risks (USDA 1994, Appendix P, pgs. 269-271). Bilingual (English-Spanish) warning signs are posted at major entries into the area where M-44s are placed, and two bilingual warning signs are placed within 25 feet to warn of each device's presence.

  The M-44 is very selective for canids because of the attractants used and because the device is triggered by pulling upward. Connolly (1988), in an analysis of M-44 use by the WS program from 1976-1986, documented about a 99% selectivity rate for target species (excluding skunks) in Nebraska. Domestic dogs are susceptible to M-44s, and this limits the areas where the devices can be safely used. In addition, the 26 EPA use restrictions preclude the use of M-44s in areas where they may pose a danger to T&E species.

M-44s are used for corrective and preventive damage management on all land classes where authorized. WS personnel comply with the EPA label and 26 use restrictions (see USDA 1994, Appendix Q).

- The **gas cartridge** is registered as a fumigant by the EPA (Reg. No. 56228-21) and is used in conjunction with denning operations in Nebraska. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the den. Carbon monoxide euthanasia is recognized by the AVMA as an approved and humane method to kill animals (AVMA 1987).

- **Chemical immobilization/euthanasia -** Several chemicals are authorized for immobilization and euthanasia by WS. Nebraska WS personnel have received and will continue to receive training in the safe use of authorized immobilization/euthanasia chemicals and are certified by WS. This training involves classroom and hands-on application of state-of-the-art techniques and chemicals.

Telazol™ , Ketaset™, Rompun™, and Capture-All 5™ are the immobilizing agents that may be used by WS, and are approved by the Food and Drug Administration (FDA). Telazol, Ketaset, and Capture-All 5 are rapid-acting, nonnarcotic, nonbarbituate, injectable, anesthetic agents, having a wide margin of safety. All three drugs produce unconsciousness known as "dissociative" whereby protective reflexes needed to sustain life (breathing, coughing, swallowing, etc.) are not affected by the drugs. These agents are used to immobilize live-trapped animals for relocation or they are administered before euthanasia. They may also be used in tranquilizer darts to capture predators. As other drugs are approved by the FDA and WS, they could be incorporated into the Nebraska WS program.

Telazol is a combination of equal parts of tiletamine hydrochloride and zolazepam hydrochloride. The product is generally supplied sterile in vials, each containing 500 mg of active drug, and when dissolved in sterile water has a pH of 2.2 to 2.8. Telazol produces a state of unconsciousness in which protective reflexes, such as coughing and swallowing, are maintained during anesthesia. Before using Telazol, the weight, age, temperament, and health of the animal are considered. Following a deep intramuscular injection of Telazol, onset of anesthetic effect usually occurs within 5 to 12 min. Muscle relaxation is optimum for about the first 20 to 25 min after the administration, then diminishes. Recovery varies with the age and physical condition of the animal and the dose of Telazol administered, but usually requires several hours (see Schobert (1987) for the dosage rates for many wild and exotic animals).

Ketaset (ketamine) is supplied as a slightly acidic solution (pH 3.5 to 5.5) for intramuscular injection. Ketaset also produces a state of unconsciousness that interrupts association pathways to the brain and allows for the maintenance of the protective reflexes, such as coughing, swallowing, and pedal and corneal activity. Ketaset is detoxified by the liver and excreted by the kidney. Following administration of recommended doses, animals become immobilized in about 5 min with anesthesia lasting from 30 to 45 min. Depending on dosage, recovery may be within 4 to 5 hrs or may take as long as 24 hrs. Recovery is generally smooth and uneventful.

Rompun (xylazine) is a sedative which produces a transitory hypertension followed by prolonged hypotension and respiratory depression. Recommended dosages are administered through intramuscular injection allowing the animal to become immobilized in about 5 min and lasting from 30 to 45 min.

Capture-All 5 is a combination of ketaset and rompun and is regulated by the FDA as a new investigational animal drug. The drug is available, through licensed veterinarians, to individuals sufficiently trained in the use of immobilization agents. Capture-All 5 is administered by intramuscular injection; it requires no mixing and has a relatively long shelf life without refrigeration which make it ideal for the sedation of animals by wildlife professionals working in field conditions.

Potassium chloride is approved by the AVMA as an euthanizing agent (AVMA 1987). It is a common laboratory chemical which could be injected by WS personnel after an animal has been anesthetized.

Beuthanasia-D[R] (sodium pentobarbital) is approved by the AVMA as an euthanizing agent. It is regulated by the Drug Enforcement Agency (DEA) and the FDA for euthanization of dogs, but legally may be used on other animals if the animal is not intended for human consumption.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL, WITH RATIONALE

Several alternatives were considered, but not analyzed in detail. These alternatives included:

3.3.1 The Humane Society of the United States Alternative

The Humane Society of the United States (HSUS) proposed an alternative that requires: 1) "*permittees evidence sustained and ongoing use of nonlethal/husbandry techniques aimed at preventing or reducing predation prior to receiving the services of the ADC Program*", 2) "*employees of the ADC Program use or recommend as a priority the use of appropriate nonlethal techniques in response to a confirmed damage situation*", 3) "*lethal techniques are limited to calling and shooting and ground shooting, and used as a last resort when use of husbandry and/or nonlethal controls have failed to keep livestock losses below an acceptable level*", and 4) "*establish higher levels of acceptable loss levels on public lands than for private lands*."

The components of this proposed alternative by the HSUS have been analyzed in detail in the alternatives contained in this EA and through court rulings. The HSUS Alternative would not allow for a full range of IWDM techniques to resolve predator damage management problems. In addition, WS is directed by Congress to protect American agriculture, natural resources, property, and to safeguard public health and safety, despite the cost of damage management, and it is program policy to aid each requester to minimize losses. Furthermore, in the Southern Utah Wilderness Society et al. vs. Hugh Thompson et al. U.S. Forest Service (U.S. District Court of Utah 1993), the court clearly states that, "*The agency need not show that a certain level of damage is occurring before it implements an ADC program. . . .Hence, to establish need for an ADC, the forest supervisors need only show that damage from predators is threatened.*" In other words, it is not necessary to establish a criterion, such as percentage of loss of a herd to justify the need for wildlife damage management. If damage management efforts are not initiated soon after a damage problem is detected, losses may sometimes escalate to excessive levels before the problem is solved. The alternatives and option selected for detailed analysis in this EA include many of the suggestions in the HSUS proposal. It is believed that inclusion of this alternative would not contribute new information or options for consideration and analysis that are not already being considered and available in IWDM as used by WS.

3.3.2 Defenders of Wildlife Alternative

The Defenders of Wildlife (DOW) proposed an alternative that requires: *1) "use of lethal methods only* *after the onset of depredation occurs and only once all practical non-lethal controls have been attempted and shown to be ineffective at meeting the program goals, 2) same as above, but with lethal controls initiated only once the level of predator damage to livestock has surpassed a specified threshold of damage. This threshold would be higher on public lands than on private lands, and 3) a policy by which livestock producers who use non-lethal controls receive priority service from ADC when they do experience loss, and/or policy whereby livestock producers who have chronic losses yet do not utilize non-lethal approaches or best management practices do not qualify for ADC services. These policies would provide an incentive for producers to use the best available management practices."*

The components of this proposed alternative by the DOW have been analyzed in detail in the alternatives contained in this EA and through court rulings. The DOW Alternative would not allow for a full range of IWDM techniques to resolve predator damage management problems when they occur. In addition, WS is directed by Congress to protect American agriculture, natural resources, property, and to safeguard public health and safety, despite the cost of damage management, and it is program policy to aid each requester to minimize losses. Further, in the Southern Utah Wilderness Society et al. vs. Hugh Thompson et al. U.S. Forest Service (U.S. District Court of Utah 1993) the court clearly states that, "*The agency need not show that a certain level of damage is occurring before it implements an ADC program. . . .Hence, to establish need for an ADC, the forest supervisors need only show that damage from predators is threatened*." In other words, it is not necessary to establish a criterion, such as percentage of loss of a herd to justify the need for wildlife damage management. If damage management efforts are not initiated soon after a damage problem is detected, losses may sometimes escalate to excessive levels before the problem is solved. The alternatives and option selected for detailed analysis in this EA include many of the suggestions in the DOW proposal. It is believed that inclusion of this alternative would not contribute new information or options for consideration and analysis that are not already being considered and available in IWDM as used by WS.

3.3.3 Biodiversity Associates and Friends of the Bow Alternative

The Biodiversity Associated and Friends of the Bow (BA&FB) proposed an alternative that requires: *1) "Require livestock owners to implement non-lethal methods as a condition of ADC support,"* and *2) "conduct no ADC activities on private lands; include economic analysis of costs to taxpayers of ADC work on private land.*"

The components of this proposed alternative by the BA&FB have been analyzed in the issues discussion in Chapters 2 and 4, in the alternatives contained in this EA, and through court rulings. WS is directed by Congress to protect American agriculture, natural resources, property, and to safeguard public health and safety, despite the cost of damage management, and it is program policy to aid each requester to minimize losses. Additionally, wildlife damage management is an appropriate sphere of activity for government programs, since wildlife management is a government responsibility. The protection of livestock will always be conducted by someone; a federal WS program not only provides a service to the livestock producers but also protects property, natural resources, and public health and safety and conducts an environmentally and biologically sound program in the public interest (Schueler 1993). Further, in the Southern Utah Wilderness Society et al. vs. Hugh Thompson et al. U.S. Forest Service (U.S. District Court of Utah 1993), the court clearly states that, "*To establish need for an ADC, the forest supervisors need only show that damage from predators is threatened*." In other words, it is not necessary to establish a criterion, such as requiring implementation of nonlethal methods, to justify the need for wildlife damage management. WS' activities on private lands are carried out only after the landowner/lessee has requested services from WS and after an *Agreement for Control* has been signed. This agreement stipulates which methods may be used on the property.

The issues and alternatives selected for analysis in this EA include the suggestions in the BA&FB proposal.

It is believed that inclusion of this alternative would not contribute new information or options for consideration and analysis that are not already being considered and available in IWDM as used by WS.

3.4 MITIGATION AND STANDARD OPERATING PROCEDURES FOR PREDATOR DAMAGE MANAGEMENT TECHNIQUES

3.4.1 Mitigation Measures

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in Nebraska, uses many such mitigation measures and these are discussed in detail in Chapter 5 of USDA (1994).

3.4.2 Additional Mitigation Measures and SOPs Specific to the Issues

Following is a summary of additional mitigating measures and SOPs that are specific to the issues found in Chapter 2 and the alternatives found in Chapter 3 of this document:

Mitigation Measures	Alternatives				
	1	3	4	5	2/6
WS' Activities in Special Management Areas (BLM and National Forest System Lands)					
M-44s, the LPC and gas cartridges would not be used on federal lands without authorization of the BLM or Forest Service.	X	X	X	X	
Predator damage management would follow guidelines as specified and agreed upon in WS Work Plans.	X	X	X	X	
Vehicle access would be limited to the same restrictions and regulations as those imposed upon the land management agency.	X	X	X	X	
Predator damage management would be conducted only with the concurrence of the land management agency.	X	X	X	X	
Predator damage management would be conducted only when and where a need exists.	X	X	X	X	
No toxicants would be used in any WA or other special management area unless authorized by the land management agency.	X	X	X	X	
No preventive control work would be conducted in any WA unless authorized by the land management agency.	X	X	X	X	
Should any of the Forest Service's existing Wildlife Study Areas (WSAs) be officially designated as WAs, predator damage management would be performed according to the Forest Service Wilderness Management Policy.	X	X	X	X	
Animal Welfare and Humaneness of Methods Used by WS					
Research would continue to improve the selectivity and humaneness of management devices.	X	X	X	X	X

	1	3	4	5	2/6
Pan-tension devices would be used to reduce the incidence of nontarget animal captures in leghold traps.	X	X	X	X	
Break-away snares have been developed and would continue to be implemented into the program. (Break-away snares are designed to break open and release under the tension exerted by larger nontarget animals such as deer, antelope and livestock.)	X	X	X	X	
Chemical immobilization/euthanasia procedures that minimize pain would be used.	X	X	X	X	
All Nebraska WS personnel who use restricted chemicals and immobilization/euthanasia drugs would continue to be trained and certified by program personnel or others who are experts in the safe and effective use of these materials.	X	X	X	X	
Safety Concerns Regarding WS' use of Toxicants, Traps and Snares					
All pesticides used by WS would be registered with the EPA and NDA.	X	X	X	X	
EPA-approved label directions would be followed by WS personnel for all chemicals used in Nebraska.	X	X	X	X	
The use of traps and snares would conform to current rules and regulations administered by the NGPC.	X	X	X	X	
Traps and snares would not be set within 30 feet of exposed carcasses to prevent the capture of scavenging birds. Foot snares set to capture mountain lions would be exempted from this policy because the weight of these target animals allows foot snare tension adjustments to exclude the capture of smaller nontarget animals.	X	X	X	X	
Leghold trap pan-tension devices would be used throughout the program, as appropriate, to reduce capture of nontarget wildlife that weighs less than the target species.	X	X	X	X	
Nontarget animals captured in leghold traps or foot snares would be released unless WS personnel determine that the animal would not survive.	X	X	X	X	
All WS damage management would be conducted in areas with signed agreements for control, work plans, cooperative agreements, or MOUs.	X	X	X	X	
The ADC Decision Model (Slate et al. 1992), designed to identify the most appropriate wildlife damage management strategies and their impacts, would be used for WS activities.	X	X	X	X	
WS employees that use pesticides would be trained to use each specific material and would be certified to use pesticides under EPA approved certification programs.	X	X	X	X	

	1	3	4	5	2/6
WS employees who use pesticides would participate in continuing education programs to keep abreast of developments and to maintain their certifications.	X	X	X	X	
Traps and snares would be placed so that captured animals would not be readily visible from any designated recreation road or trail shown on Forest Transportation Maps or from federal, state, or county roads.	X	X	X	X	
Bilingual (English-Spanish) warning signs would be posted on main roads and/or trails leading into any areas where traps, snares or M-44s would be used. These signs would be removed at the end of the control period.	X	X	X	X	
In addition to area warning signs, two (English-Spanish) warning signs would be placed within 25 feet of each M-44 device.	X	X	X	X	
A Pesticide Use Proposal would be completed by WS and approved by the Forest Service authorizing pesticide use on National Forest System lands, if appropriate.	X	X	X	X	
Traps, snares, or M-44s would not be allowed within ¼ mile of any residence, community, or developed recreation site, unless requested by the owner of a privately-owned property or an official from the appropriate land management agency.	X	X	X	X	
Concerns about Impacts of WS' Activities on T&E Species, Other Species of Special Concern, and Cumulative Effects					
WS has consulted with the USFWS regarding the nationwide program and would continue to implement all applicable measures identified by the USFWS to ensure protection of T&E species.	X	X	X	X	
WS consulted with the USFWS on the impacts of the program to T&E species in Nebraska and adopted reasonable and prudent measures.	X	X	X	X	
WS consulted with the NGPC on the impacts of the program to State listed T&E species and adopted NGPC reasonable and prudent measures.	X	X	X	X	
WS personnel are directed to resolve depredation problems by taking action against individual problem animals, local populations, or groups.	X	X	X	X	
Animals taken by WS would be considered with the statewide *"Total Harvest"* (WS' take and sport harvest) when estimating the impact on a wildlife species. This data would be used to maintain a magnitude of harvest below the level that would affect the viability of a population.	X	X	X	X	
No leghold traps or snares would be set within 30 feet of any exposed bait or animal carcass (except when attempting to catch mountain lions) to preclude capture of eagles or other birds.	X	X	X	X	
Leghold traps or foot snares set near exposed baits to capture mountain lions would incorporate tension devices to preclude capture of nontarget species.	X	X	X	X	

	1	3	4	5	2/6
WS personnel would contact the NGPC to determine where existing populations of T&E species occur.	X	X	X	X	
If nesting bald eagles are encountered during aerial gunning operations, the aircraft would leave the vicinity immediately.	X	X	X	X	
If wintering big game are encountered during aerial hunting operations and begin reacting to the aircraft, the aircraft would leave the area.	X	X	X	X	
The use of nonlethal methods, such as guard dogs, scare devices, and llamas, would be encouraged when appropriate.	X	X	X	X	X
Cultural Resources/American Indian Concerns					
WS solicited input from American Indian Tribes in Nebraska.	X	X	X	X	X
This EA was provided to the American Indian Tribes in a Pre-Decisional form to determine if all cultural issues had been addressed.	X	X	X	X	X
The Nebraska State Historical Preservation Office has reviewed WS' activities in relationship to archeological interests.	X	X	X	X	X

3.4.3 Consultation with Other Agencies

The WS program in Nebraska consults with the USFWS, federal land management agencies, NGPC, and other appropriate agencies regarding program impacts. Frequent contact is maintained with the Forest Service when WS is conducting predator damage management on public lands administered by this agency. The BLM and Forest Service are interested in the numbers of livestock killed, injured, and harassed by predators and the predator damage management methods used to limit or stop losses. In addition, the WS program maintains close coordination with the NGPC to manage indigenous and non-migratory wildlife species that cause damage.

The WS program in Nebraska is conducted under cooperative agreements and MOUs with federal and state agencies. National MOUs with the BLM and Forest Service delineate expectations for wildlife damage management on public lands administered by these agencies. WS Work Plans are developed with BLM and National Forest Districts to detail damage management activities, target species and mitigation measures to be implemented on lands where predator damage management is needed.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

Chapter 4 provides information needed for making informed decisions on the predator damage management objectives outlined in Chapter 1 and the issues and affected environment discussed in Chapter 2. This chapter: 1) analyzes how each alternative meets the objectives, 2) assesses the consistency of the alternatives with existing management plans, and 3) analyzes the environmental consequences of each alternative.

4.1 OBJECTIVE ANALYSIS AND CONSISTENCY DETERMINATION

4.1.1 Objective A-1 - Respond to 100% of the requests for assistance with the appropriate action (technical assistance or direct control) as determined by Nebraska WS personnel applying the ADC Decision Model (Slate et al. 1992).

4.1.1.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

The current Nebraska WS predator damage management program responds to requests for livestock protection on the Nebraska National Forest, Oglala National Grassland, and state, county, and private lands covered by signed cooperative agreements, agreements for control or wildlife damage management work plans.

Fully meeting Objective A-1 would be impossible because Nebraska WS could not protect designated wildlife and T&E species on Forest Service lands under the current program as requested by the NGPC or USFWS. Furthermore, implementation of the ADC Decision Model (Slate et al. 1992) on federal lands is compromised under the current program. Alternative 1 only partially allows Nebraska WS to meet Objective A-1.

4.1.1.2 Alternative 2 - No Federal Nebraska WS Program:

Under Alternative 2, no operational or technical assistance would be provided by WS in Nebraska. State agencies, individuals, livestock producers or other entities would be responsible for conducting all predator damage management without support or advice from Nebraska WS.

Based on these restrictions, Alternative 2 would not allow Nebraska WS to meet Objective A-1.

4.1.1.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

Alternative 3 would allow Nebraska WS to coordinate with other resource management agencies to develop an integrated predator damage management program based on the needs of livestock, wildlife (including T&E species), property, and public health and safety. Other resource needs would be considered during the development of a livestock protection program and integrated into the program using the ADC Decision Model (Slate et al. 1992). Ultimately, the program would be based on both the needs of the livestock producers and the management objectives of the responsible management agency (i.e., NGPC, USFWS, Forest Service, BLM, and/or tribes).

Alternative 3 would allow Nebraska WS to fully meet Objective A-1, since WS could respond to all requests with the appropriate action on all land classes, as mitigated by other concerns.

4.1.1.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

Alternative 4 would limit lethal damage management of predators to situations where nonlethal predator damage management had been practiced. In reality, most livestock producers practice some measure of nonlethal predator damage management. In 1994, the top four nonlethal techniques used by Nebraska sheep producers were husbandry (38.6%), guard animals (24.3%), fencing (20.0%), and fright tactics (8.1%) (NASS 1995). Nebraska sheep producers spent an average of $0.68 per breeding animal for nonlethal measures in 1994 (NASS 1995).

Nebraska WS' data indicates that 99% of sheep and 89% of goat producers with signed cooperative agreements practice at least one nonlethal measure and 86% of sheep and 78% of goat producers use three or more nonlethal methods (Table 4-1) (Nebraska WS unpubl. data). Nonlethal options for cattle producers are more limited, however, 95% of cattle producers with signed cooperative agreements practice one nonlethal measure and 74% use three or more nonlethal methods (Table 4-1) (Nebraska WS unpubl. data).

Alternative 4 is similar to Alternative 1 with all the nonlethal usage. Alternative 4 would require Nebraska WS' documentation of nonlethal method use, in effect reducing the workforce available for damage management. In addition, implementation of the ADC Decision Model (Slate et al. 1992) would be compromised under Alternative 4. Thus, Nebraska WS would only partially meet Objective A-1.

4.1.1.5 Alternative 5 - Corrective Damage Management Only:

Alternative 5 would limit lethal damage management to situations where livestock losses from predators have been verified. This alternative would preclude Nebraska WS' preventive damage management in areas where losses have historically occurred. Many sheep and cattle producers have documented predictable historic patterns of depredations which result in requests for damage management before damage begins.

Alternative 5 would not allow Nebraska WS to fully meet Objective A-1 and the ADC Decision Model (Slate et al. 1992) would be compromised.

4.1.1.6 Alternative 6 - Technical Assistance Only:

Alternative 6 would limit Nebraska WS to providing technical assistance to livestock producers concerning the use of available and legal methods, making recommendations, and providing instructional information on predator damage management. Nebraska WS would not provide any operational predator damage management on federal, state, tribal, county, city or private lands within Nebraska. State agencies, individuals, livestock producers or other entities would be responsible for conducting all predator damage management. In addition, Nebraska WS could not provide operational assistance to protect public health and safety.

Based on these restrictions, Alternative 6 would not always allow Nebraska WS to respond with the appropriate predator damage management strategies and methods, and Objective A-1 could not be met.

4.1.2 Objective A-2 - Hold sheep losses due to predation to less than 3% per year and calf losses due to predation to less than 2% per year in the State in counties with a federal WS operational program.

4.1.2.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

Table 4-1. Nonlethal methods used by cattle, sheep, and goat producers having cooperative agreements with Nebraska WS.

Method	Cattle Producers		Sheep Producers		Goat Producers	
	Number	Percent	Number	Percent	Number	Percent
Carcass removal	256	80.5	67	88.1	5	55.5
Fencing, conventional	259	81.4	68	89.5	7	77.8
Fencing, electric	92	28.9	32	42.1	3	33.3
Confinement	63	19.8	48	63.1	2	22.2
Night penning	137	43.1	66	86.8	5	55.5
Husbandry	229	72.0	59	77.6	5	55.5
Herding	133	41.8	41	53.9	2	22.2
Guard burro	6	1.9	3	3.9	0	0
Guard dog	149	46.8	43	56.6	4	44.4
Guard llama	2	0.1	2	2.6	1	11.1
Habitat manipulation/ brush cutting	169	53.1	33	43.4	3	33.3
Harassment, electrical devices	85	26.7	30	39.5	2	22.2
Harassment, guns	195	61.3	53	69.7	1	11.1
Harassment, vehicle	212	66.7	54	71.0	2	22.2
Exploders, gas	0	0	5	6.6	0	0
Lights, all types	118	37.1	47	61.8	4	44.4
Flags, all types	16	5.0	8	10.5	1	11.1
Radios	18	5.7	17	22.4	3	33.3
Scarecrows, all	4	1.2	2	2.6	1	11.1
Total Producers	318		76		9	

The Nebraska WS program has limited the average annual sheep losses to less than 3% and calf losses to less than 2%. The Nebraska 1994 loss data from sheep producers showed that of the 95,000 sheep in Nebraska, 1,500 (1.5%) were reported to be killed by predators (NASS 1995). The Nebraska loss data for calf producers showed that of the 100,000 calves in Nebraska, 1,500 (1.5%) were reported to be killed by predators (NASS 1996). However, losses to individual producers could, at times, exceed the 3% for sheep and the 2% for calves criteria established in Objective A-2. Loss of sheep and calves to predators in some areas may vary for several reasons including: 1) terrain, weather, and vegetative cover that restricts access and limits the array of available methods, 2) too few WS personnel for the work load, 3) restrictions on method use, and 4) insufficient funding.

We believe that Alternative 1 could meet the criteria of Objective A-2 for the average sheep and calf losses, but may not be met for every producer in Nebraska.

4.1.2.2 Alternative 2 - No Federal Nebraska WS Program:

Alternative 2 would eliminate the federal Nebraska WS program and place the responsibility for predator damage management with the state, tribal and/or local governments or individual producers. Without an effective predator damage management program, lamb losses could be 3 to 6 times higher than those currently being experienced (Gee et al. 1977, O'Gara et al. 1983). In addition, under Alternative 2, no agreements for control would be maintained. These documents and their unique numbers are the mechanisms for collecting and managing most of the information assembled by Nebraska WS; without them, no comprehensive program information could be compiled.

Alternative 2 would not allow Nebraska WS to meet Objective A-2.

4.1.2.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

Alternative 3, an integrated predator damage management program with considerations for multiple resources, would best permit Nebraska WS to meet Objective A-2. By considering all resources, Nebraska WS could vary the timing, areas, and methods of damage management to better achieve multiple resource needs and objectives.

We believe that Alternative 3 would best meet the criteria of Objective A-2 for the average sheep and calf losses, including those livestock pastured on BLM and Forest Service lands, but may not meet the criteria for each individual producer in Nebraska for reasons stated under 4.1.2.1.

4.1.2.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

As stated in 4.1.1.4, 99% of sheep and 95% of cattle producers in Nebraska implement nonlethal predator damage management measures. Therefore, Alternative 4 is similar to the current program and the impacts on sheep and calf losses would be the same as those for Alternative 1.

We believe that Alternative 4 would meet the criteria of Objective A-2 for the average sheep and calf losses, but may not meet the criteria for each individual producer in Nebraska.

4.1.2.5 Alternative 5 - Corrective Damage Management Only:

Without preventive damage management for coyote and red fox damage, losses from these species could increase, although not to the extent under Alternative 2. We believe that with corrective control only, it is feasible that sheep and calf losses from coyote and red fox predation could double. The overall sheep loss rate could increase from 1.5% to an estimated 3.0% and the overall calf loss rate could increase from 1.5% to an estimated 3.0%.

Alternative 5 would not allow Nebraska WS to meet Objective A-2.

4.1.2.6 Alternative 6 - Technical Assistance Only:

The impacts of Alternative 6 would be similar to those for Alternative 2. Alternative 6, a technical assistance only program, would not allow Nebraska WS to meet Objective A-2.

4.1.3 Objective A-3 - Maintain the lethal take of nontarget animals by Nebraska WS personnel during damage management to less than 2% of the total animals taken.

4.1.3.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

The WS program in Nebraska killed 12 nontarget animals in FY96, representing 0.28% of the total animals killed by Nebraska WS in the State. Nebraska WS killed 43 nontarget animals in FY97, representing 1.08% of the total animals killed by WS in Nebraska. And in FY98, Nebraska WS killed 24 nontarget animals, representing 0.67% of the total animals killed by WS in Nebraska.

Alternative 1, the Current Program, is currently meeting Objective A-3.

4.1.3.2 Alternative 2 - No Federal Nebraska WS Program:

Under Alternative 2, no federal program would be maintained and therefore no target or nontarget animals would be killed by Nebraska WS.

Alternative 2 would allow Nebraska WS to meet Objective A-3.

4.1.3.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

Alternative 3 could increase predator damage management activities in Nebraska by allowing Nebraska WS to design a predator damage management program to protect multiple resources on all land classes. These activities could increase the take of nontarget animals, however, we do not believe that the increase would be different from the current ratio of nontarget to target animals.

Alternative 3 would meet Objective A-3.

4.1.3.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

As noted in 4.1.1.4, most livestock producers currently use nonlethal predator damage management and the current level and type of predator damage management would not change substantially under this alternative. Therefore, Alternative 4 would allow Nebraska WS to meet Objective A-3.

4.1.3.5 Alternative 5 - Corrective Damage Management Only:

Under Alternative 5, Nebraska WS' lethal damage management could only be implemented following documented losses of livestock and poultry or to protect public health and safety from coyote, red fox, raccoon, bobcat, mountain lion, weasel, striped skunk, badger or mink predation. Following documented losses, Nebraska WS could employ the same methods currently available. We believe that the ratio of nontarget to target captures would remain about the same as under the current program and the analysis is similar to Alternative 1.

Alternative 5 would allow Nebraska WS to meet Objective A-3.

4.1.3.6 Alternative 6 - Technical Assistance Only:

Under Alternative 6, no operational predator damage management would occur, and therefore, no target or nontarget animals would be killed by Nebraska WS.

Alternative 6 would allow Nebraska WS to meet Objective A-3.

4.1.4 Objective A-4 - Monitor the implementation of nonlethal methods used by livestock

producers that cooperate with the federal WS program in Nebraska.

4.1.4.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

The Nebraska WS program collects data on nonlethal methods employed by producers. Thus, Alternative 1 would allow Nebraska WS to meet Objective A-4.

4.1.4.2 Alternative 2 - No Federal Nebraska WS Program:

Alternative 2 would not allow Nebraska WS to meet Objective A-4 as no program or personnel would be available to accumulate and evaluate data.

4.1.4.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

The analysis for Alternative 3 is the same as that for Alternative 1. Alternative 3 would allow Nebraska WS to meet Objective A-4.

4.1.4.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

Nothing in Alternative 4 precludes the monitoring of producer-implemented nonlethal methods and the analysis is the same as for Alternative 1.

Alternative 4 would allow Nebraska WS to meet Objective A-4.

4.1.4.5 Alternative 5 - Corrective Damage Management Only:

Nothing in Alternative 5 precludes the monitoring of producer implemented nonlethal methods and the analysis is the same as for Alternative 1.

Alternative 5 would allow Nebraska WS to meet Objective A-4.

4.1.4.6 Alternative 6 - Technical Assistance Only:

Nebraska WS would continue to provide information, demonstrations and training to livestock producers on lethal and nonlethal methods for resolving wildlife damage. However, under a technical assistance program, monitoring would be limited to the number of demonstrations and training sessions conducted within a county and not the methods implemented by producers.

Alternative 6 would allow Nebraska WS to only partially meet Objective A-4.

4.1.5 Objective B-1 - Respond to requests from the NGPC, USFWS, tribal and private entities for the protection of wildlife species dependent on funding.

4.1.5.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

The WS program in Nebraska has responded to requests from the NGPC and the USFWS to protect specific wildlife species. To date, none of the NGPC or USFWS requests have required WS to conduct predator damage management on Forest Service or BLM lands. Under the Current Program (No Action) Alternative, WS must complete individual NEPA documents and issue separate decisions for each management project to be completed on Forest Service or BLM lands.

Alternative 1 would allow Nebraska WS to only partially meet Objective B-1.

4.1.5.2 Alternative 2 - No Federal Nebraska WS Program:

Under Alternative 2, no Nebraska WS program would be available, therefore, Alternative 2 would not allow Nebraska WS to meet Objective B-1.

4.1.5.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

Alternative 3 would permit predator damage management to protect designated wildlife species when requested by the NGPC and USFWS.

Alternative 3 would allow Nebraska WS to fully meet Objective B-1.

4.1.5.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

Nonlethal methods that effectively protect wildlife species from predation are currently limited. Alternative 4 pertains to predator damage management to protect livestock and would not permit the protection of wildlife or T&E species.

Alternative 4 would not allow Nebraska WS to meet Objective B-1.

4.1.5.5 Alternative 5 - Corrective Damage Management Only:

As with Alternative 4, Alternative 5 basically directs predator damage management for the protection of only livestock.

Alternative 5 would not allow Nebraska WS to meet Objective B-2.

4.1.5.6 Alternative 6 - Technical Assistance Only:

Under Alternative 6, no operational Nebraska WS program would be available.

Alternative 6 would not allow Nebraska WS to meet Objective B-1.

4.1.6 Objective B-2 - Involve the NGPC and USFWS in wildlife damage management planning to consider specific wildlife to be protected and public health and safety when designing a wildlife damage management program.

4.1.6.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

The current Nebraska WS program involves the NGPC and USFWS in the design of a wildlife damage management program and the implementation of mitigation to preclude adverse impacts to target and nontarget wildlife. It does not, however, allow for the consideration of wildlife resources to be protected in conjunction with livestock, nor does it allow protection of wildlife on BLM or Forest Service administered lands.

Alternative 1 would allow Nebraska WS to partially meet Objective B-2.

4.1.6.2 Alternative 2 - No Federal Nebraska WS Program:

Under Alternative 2, no federal predator damage management would be available, therefore there would be no opportunity to coordinate with the NGPC and USFWS on other resources to be protected. Producer-implemented control programs would give less consideration to wildlife resources and probably would be less target-animal specific.

Alternative 2 would not allow Nebraska WS to meet Objective B-2.

4.1.6.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes:

Alternative 3 provides for NGPC and USFWS involvement in wildlife damage management planning to consider specific wildlife to be protected and public health and safety when designing a wildlife damage management program.

Alternative 3 would allow Nebraska WS to fully meet Objective B-2.

4.1.6.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

Alternative 4 basically directs Nebraska WS' actions toward livestock programs where nonlethal methods have already been implemented. Therefore, the analysis is similar to Alternative 1. This alternative would not provide for predator damage management planning with other agencies to achieve multiple resource protection objectives.

Alternative 4 does not allow Nebraska WS to meet Objective B-2.

4.1.6.5 Alternative 5 - Corrective Damage Management Only:

As with Alternative 4, Alternative 5 directs Nebraska WS' action for the protection of livestock after a documented loss to predators has occurred. This alternative would not allow predator damage management planning with other agencies to achieve multiple resource objectives. The analysis is the same as for Alternative 1.

Alternative 5 does not allow Nebraska WS to meet Objective B-2.

4.1.6.6 Alternative 6 - Technical Assistance Only:

Under Alternative 6, no operational Nebraska WS program would be available, therefore there would be no opportunity to coordinate with the NGPC, USFWS, or other agencies regarding the protection of wildlife resources. The analysis is the same as for Alternative 2.

Alternative 6 would not allow Nebraska WS to meet Objective B-2.

4.1.7 Objective C-1 - Respond to 100% of cooperator requests for public health and safety protection from predators using the ADC Decision Model (Slate et al. 1992).

4.1.7.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

Under Alternative 1, Nebraska WS would continue to respond to 100% of cooperator requests for public health and safety protection from predators using the ADC Decision Model (Slate et al. 1992).

Alternative 1 would permit Nebraska WS to meet Objective C-1.

4.1.7.2 Alternative 2 - No Federal Nebraska WS Program:

Under Alternative 2, no federal Nebraska WS program would be available. Alternative 2 would not permit Nebraska WS to meet Objective C-1.

4.1.7.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

Under Alternative 3, Nebraska WS would respond to requests to manage wildlife damage to protect public health and safety using the ADC Decision Model (Slate et al. 1992) to determine the appropriate course of action. Alternative 3 would permit Nebraska WS to meet Objective C-1.

4.1.7.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

Alternative 4 directs predator damage management to protect livestock.

Alternative 4 allows Nebraska WS to only partially meet Objective C-1.

4.1.7.5 Alternative 5 - Corrective Damage Management Only:

As with 4.1.7.4, under the strictest interpretation, Alternative 5 would only allow Nebraska WS to respond to public health and safety complaints after public health or safety has been jeopardized. Under a more conventional interpretation, Alternative 5 directs corrective predator damage management to protect livestock.

Alternative 5 would not allow Nebraska WS to meet Objective C-1.

4.1.7.6 Alternative 6 - Technical Assistance Only:

Under Alternative 6, no operational Nebraska WS program would be available.

Alternative 6 would not allow Nebraska WS to meet Objective C-1.

4.1.8 Summary

Table 4-2 summarizes how each alternative addresses each objective.

Table 4-2. Objectives/Alternatives Comparison

Program Objectives	Alternative 1 *No Action*	Alternative 2 *No Program*	Alternative 3 *Proposed*	Alternative 4 *Nonlethal*	Alternative 5 *Corrective*	Alternative 6 *Technical*
A-1 *Requests*	Partially Meets	Does not Meet	Meets	Partially Meets	Partially Meets	Does not Meet
A-2 *Losses*	Meets	Does not Meet	Meets	Partially Meets	Does not Meet	Does not Meet
A-3 *Nontarget*	Meets	Meets	Meets	Meets	Meets	Meets

Program Objectives	Alternative 1 *No Action*	Alternative 2 *No Program*	Alternative 3 *Proposed*	Alternative 4 *Nonlethal*	Alternative 5 *Corrective*	Alternative 6 *Technical*
A-4 *Monitor*	Meets	Does not Meet	Meets	Meets	Meets	Partially Meets
B-1 *Wildlife*	Partially Meets	Does not Meet	Meets	Does not Meet	Does not Meet	Does not Meet
B-2 *Design*	Partially Meets	Does not Meet	Meets	Does not Meet	Does not Meet	Does not Meet
C-1 *Safety*	Meets	Does not Meet	Meets	Partially Meets	Does not Meet	Does not Meet

4.2 ALTERNATIVE CONSISTENCY WITH FOREST SERVICE LRMPS AND BLM RMPS

Before an alternative can be considered for implementation on Forest Service or BLM lands, it must be consistent with land management and/or resource management plans. In the Forest Service, these are LRMPs or more commonly *"Forest Plans."* On BLM lands, the equivalent documents are called RMPs or MFPs. If the selected alternative is consistent with LRMPs, RMPs, or MFPs, no further action would be necessary by the Forest Service, BLM or WS. If an alternative that is inconsistent with the LRMPs, RMPs, or MFPs is selected in the decision process, the Forest Service or BLM could amend their plans to be consistent with the EA. The decision would not be implemented on Forest Service or BLM lands until the inconsistency is resolved either through amendment of the plans or modification of the selected alternative(s).

4.2.1 Nebraska National Forest LRMP

The Forest Service is responsible for: 1) managing land to maintain viable populations of existing native and desirable nonnative vertebrate species, 2) to promote the conservation of federally listed T&E species, and 3) to coordinate and cooperate with appropriate federal, state, and private agencies to assure all management aspects of wildlife species are considered (Forest Service 1984). Predator damage management, within Nebraska, will be provided by the Nebraska WS program (Forest Service 1984). The proposed action is consistent with the direction in the Nebraska National Forest LRMP.

4.2.2 Newcastle Resource Area Resource Management Plans

Livestock grazing is permitted under the Newcastle Resource Area RMP, however, predator damage management is not specifically addressed. Predator damage management would be considered as support for livestock grazing management, unless otherwise prohibited, but would be mitigated wherever it could jeopardize any federally listed T&E species. The RMP requires Endangered Species Act, Section 7 Consultation with the USFWS, which has been completed by WS for Nebraska. The proposed action conforms with the intent of the Newcastle Resource Area RMP. All the predator damage management methodologies discussed in Chapter 3 of this EA are available for use.

4.3 ENVIRONMENTAL CONSEQUENCES

This section analyzes the environmental consequences using Alternative 1 (The Current Program) as the baseline for comparison. Table 4-12 summarizes the issues and impacts.

The following resources within Nebraska would not be significantly impacted by any of the alternatives analyzed; soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

Social and Recreational Concerns: Social and recreational concerns identified during public involvement are discussed throughout this EA and the ADC EIS (USDA 1994).

Cumulative and Unavoidable Impacts: Cumulative and unavoidable impacts to key wildlife species are discussed and analyzed in this chapter. This EA recognizes that the total annual removal of individual animals from wildlife populations by all causes is the cumulative mortality. Analysis of Nebraska WS' "*take*" during FY96 through FY98, combined with other mortality, indicates that cumulative impacts were not significant. The Nebraska WS program is not expected to have any adverse cumulative impact on T&E species, WSAs, or WAs. Furthermore, predator damage management would not jeopardize public health and safety.

Target and Nontarget Wildlife Species: Cumulative impacts to wildlife species are addressed in section 4.4.1.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and electrical energy for office maintenance, there are no irreversible or irretrievable commitments of resources. Based on these estimates, the Nebraska WS program produces very negligible impacts on the supply of fossil fuels and electrical energy.

4.4 ISSUES ANALYZED IN DETAIL

4.4.1 Cumulative impacts on the viability of wildlife populations.

The species evaluated in this chapter were selected for analysis because they are taken by Nebraska WS in response to livestock and wildlife predation, property damage, or threats to public health and safety. The "*Magnitude*" analysis for this EA follows the process described in the ADC EIS (USDA 1994, Table 4-2). Magnitude is defined in the ADC EIS as *". . . a measure of the number of animals killed in relation to their abundance."* Magnitude may be determined either quantitatively or qualitatively. Quantitative analysis is used whenever possible as it is more rigorous and is based on allowable harvest levels, population estimates and harvest data. Qualitative analysis is based on population trends, harvest data or trends, and modeling. Allowable harvest levels were determined from research studies cited in the ADC EIS (USDA 1994, Table 4-2) and from NGPC data. The NGPC is the state agency charged by law with the responsibility for protecting, preserving and perpetuating fish, game, furbearer, and nongame wildlife populations within Nebraska (RSN 37-101, 37-204, 37-209, 37-211, 37-213, 37-215, 37-301, 37-432, 37-434).

For purposes of this EA, "*Other Harvest*" includes the known fur harvest, sport harvest, and other information obtained from the NGPC. "*Total Harvest*" is the sum of Nebraska WS' kill and the "*Other Harvest*." The principle of sustained yield suggests that wildlife populations produce an annual increment of animals that can be harvested without causing the population to decline. The size of the annual surplus fluctuates considerably from year to year and varies by species and according to local conditions. Annual harvest is managed at a level corresponding to the capacity of the population to compensate (via reproduction and recruitment) (D. Figgs, NGPC, per. commun. 1997).

4.4.1.1 Alternative 1. - Continue the Current Nebraska WS Program (No Action):

In FY96, 97 and 98, coyotes were responsible for about 81%, 69%, and 79% of the verified and 63%, 84% and 80% of the reported statewide livestock losses to predators, respectively. NASS (1995, 1996) indicated that the coyote is the primary predator on sheep (89%), lambs (84%), cattle (40%), and calves (80%). In 1995, the total reported loss to coyotes in Nebraska was $116,800 for cattle, $396,000 for calves, $55,207 for sheep, and $52,666 for lambs (NASS 1995, 1996).

Coyote Population Information

The cost to accurately determine absolute coyote densities over large areas would be prohibitive (Connolly 1992b) and would not appear to be warranted for this EA given the coyote's relative abundance. Because determinations of absolute coyote densities are frequently limited to educated guesses (Knowlton 1972), many researchers have estimated coyote populations throughout the west and elsewhere (Pyrah 1984, Camenzind 1978, Knowlton 1972, Clark 1972, USDI 1979). The presence of unusual food concentrations and non-breeding helpers at the den can influence coyote densities and complicate efforts to estimate abundance (Danner and Smith 1980). Coyote densities range from 0.2/mi^2 when populations are low (pre-whelping) to 3.6/mi^2 when populations are high (post-whelping) (USDI 1979, Knowlton 1972). Knowlton (1972) concluded that coyote densities may approach a high of 5-6/mi^2 under extremely favorable conditions with densities of 0.5 to 1.0/mi^2 possible throughout much of their range, while Roy and Dorrance (1985) identified a positive relationship between coyote densities in mid to late winter and the availability of dead livestock.

The literature on coyote spatial organization is confusing (Windberg and Knowlton 1988, Messier and Barrette 1982). Coyotes are highly mobile animals with home ranges that vary by sex, age of the animal, and season of the year (Pyrah 1984, Althoff 1978, Todd and Keith 1976). Coyote home ranges may vary from 2.0 to 21.3 mi^2 (Andelt and Gipson 1979, Gese et al.1988[5]). Ozoga and Harger (1966), Edwards (1975), and Danner (1976) observed overlap between coyote home ranges and did not consider coyotes to be territorial. Other studies have shown that coyotes occupy territories and that each territory may have several non-breeding helpers at the den during whelping (Allen, et al. 1987, Bekoff and Wells 1982). Therefore, each coyote territory may support more than just a pair of coyotes. Gese et al. (1988) reported that coyote groups of 2, 3, 4, and 5 comprised 40%, 37%, 10% and 6% of the resident population, respectively, and Messier and Barrette (1982) reported that during November through April, 35% of the coyotes were in groups of 3 to 5 animals.

Coyote Population Impact Analysis

Currently, *"Total Harvest"* estimates derived by combining WS' take with *"Other Harvest"* figures represent some of the best information available on the viability of coyote populations in Nebraska (Figure 4 -1), even though *"Total Harvest"* is affected by factors such as snow cover, prey base, and the number of sport trappers. In Nebraska, the coyote population appears to fluctuate in a cyclical pattern. Nebraska coyote densities

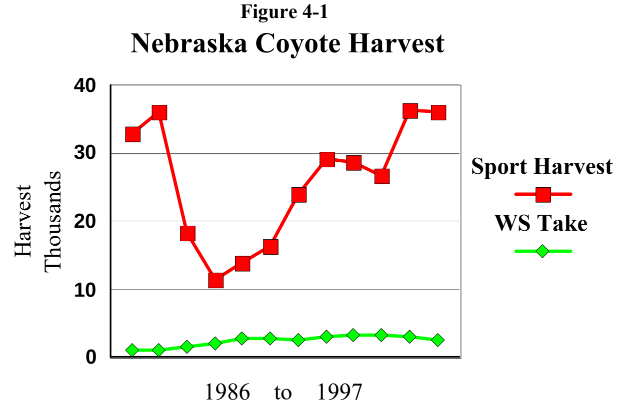
Table 4-3. Coyote Harvest for Nebraska (NGPC unpubl. data, MIS data).

Coyote Harvest Statistics	1996	1997
Estimated Other Take	36,443	36,213
WS Kill	3,060	2,683
WS Kill (% of harvest)	7.7%	6.9%

(Figure 4-1) are higher today than they were in the late '80s and early '90s, suggesting that coyote numbers are stable or increasing.
In FY96 and FY97, WS took an average of 2,872 coyotes annually in Nebraska, while private individuals killed 36,443 and 36,213, respectively (Table 4-3). Additional coyotes were undoubtedly taken by the public, but were not reported and could not be included in this analysis. Harvest information suggests that the coyote population in Nebraska is viable and healthy (Figure 4-1) and WS' take of coyotes has remained relatively consistent from 1986 to 1997.

The unique resilience of the coyote, its ability to adapt, and its perseverance under adverse conditions is commonly recognized among biologists and rangeland managers. Despite intensive historical damage management efforts in livestock production areas and despite sport hunting and trapping for fur, coyotes continue to thrive and expand their range, occurring widely across North and Central America (Miller 1995). Connolly and Longhurst (1975) determined that, *"if 75% of the coyotes are killed each year, the population would be exterminated in slightly over 50 years."* However, the authors go on to explain that their *"model suggests that coyotes, through compensatory reproduction, can withstand an annual population mortality of 70%"* and that coyote populations would regain pre-control densities (through recruitment, reproduction and migration) by the end of the fifth year after control was terminated even though 75% mortality had occurred for 20 years. In addition, other researchers (Windberg and Knowlton 1988) recognized that immigration, (not considered in the Connolly and Longhurst (1975) model) can result in rapid occupancy of vacant territories, which helps to explain why coyotes have thrived in spite of early efforts to exterminate them (Connolly 1978). Thus, WS does not impact the Nebraska coyote population even if *"Other Harvest"* is under-reported (Andelt 1997) and evaluation of the data using standards established in USDA (1994) to determine the *Magnitude* to which *"Total Harvest"* impacts the species, results in a determination of "low magnitude."

Figure 4-1



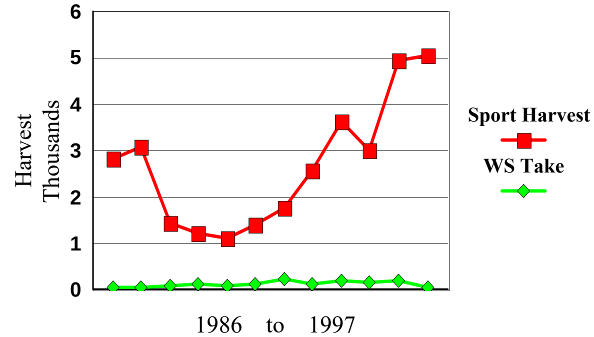
Red Fox Population Information

In Nebraska, red foxes have killed poultry, kid goats, and lambs. In FY96, red foxes were responsible for 4.2% of the Nebraska WS verified and 2.1% of the reported statewide livestock losses. In FY97 and FY98, red foxes were responsible for 2.0% and 2.0% of the Nebraska WS verified and less than 1.0% and 1.3% of the reported statewide livestock losses, respectively. In addition, red fox predation on waterfowl, ring-necked pheasants, and prairie chickens concerns the NGPC and USFWS.

Red foxes are the most common and well-known species in the genus *Vulpes* and are the most widely distributed nonspecific predators in the world (Voigt 1987). Red foxes are regarded as nuisance predators in many regions, preying on wildlife and livestock, and have become notorious in many areas of the world as carriers of diseases (Ables 1969, Andrews et al. 1973, Tabel et al. 1974, Tullar et al. 1976, Pils and Martin 1978, Sargeant 1978, Voigt 1987, Allen and Sargeant 1993). Red foxes have been the subject of many studies during the last 20 years and investigations have revealed that foxes are extremely adaptive and diverse in their behavior and use of habitats. For example, Voigt and Earle (1983) and Gese et al. (1996) showed that red foxes were adaptive enough to avoid coyotes while coexisting in the same area and habitats.

Figure 4-2

Nebraska Red Fox Harvest



Red fox densities are difficult to determine because of the species' secretive and elusive nature. However, researchers have documented that the red fox has high reproductive and dispersal rates and thus, can withstand high mortality (Allen and Sargeant 1993, Voigt 1987, Voigt and MacDonald 1984, Harris 1979, Pils and Martin 1978, Storm et al. 1976, Andrews et al. 1973, Phillips and Mech 1970). Storm et al. (1976) stated that 95% of red fox females (44% were less than 1 year old) bred successfully in a population in Illinois and Iowa. Rowlands and Parkes (1935) and Creed (1960) reported that male red foxes successfully bred females during their first year. Red foxes average 4.7 pups per litter with litters of 14 to 17 pups documented (Storm et al. 1976, Voigt 1987). Ables (1969) and Sheldon (1950) reported that more than 1 female was observed at the den and suggested that red foxes have *"helpers"* that assist with raising pups, a phenomena observed in coyotes and other canids. Red fox population densities ranged from more than 50/mi^{2} (Harris 1977, Harris and Rayner 1986, MacDonald and Newdick 1982) where food was abundant, to 2.6/mi^{2} in Ontario (Voigt 1987), and to 1 fox den/3 mi^{2} in Nebraska (Sargeant 1972).

Dispersal serves to equalize fox densities over large areas. Annual harvests in localized areas in 1 or more years will likely have little impact on the overall population in subsequent years, but may reduce localized predation (Allen and Sargeant 1993). Phillips (1970) stated that fox populations are resilient and in order for fox control (by trapping) to be successful, pressure on the population must be almost continuous. Phillips (1970) and Voigt (1987) also concluded that habitat destruction affects fox populations to a greater extent than short-term over-harvest.

Red Fox Population Impact Analysis

The NGPC reported that 4,941 and 5,053 red fox were harvested by fur trappers and hunters in 1996 and 1997, respectively (NGPC, unpubl. data). In comparison, WS' take of fox has remained relatively consistent from 1986 to 1997; Nebraska WS captured 195 red fox in FY96 and 69 red fox in FY97 (Table 4-4). Harvest information suggests that the red fox population in Nebraska is viable and healthy (Figure 4-2).

Table 4-4. Red Fox Harvest for Nebraska (NGPC unpubl. data, MIS data).

Red Fox Harvest Statistics	1996	1997
Estimated Other Take	4,941	5,053
WS Kill	195	69
WS Kill (% of harvest)	3.8%	1.3%

Raccoon Population Information

In FY96, raccoons were responsible for 26.5% of the Nebraska WS verified poultry and other fowl losses in Nebraska. In addition, raccoons caused losses of $6,355 in grains, crops, and livestock feed, $4,976 to property, and were responsible for a damage threat to least terns and piping plovers. Raccoons were also responsible

for
10.5% and 17.3% of the verified, and 6.2% and 8.1% of the reported poultry and other fowl losses documented by WS in FY97 and FY98, respectively.

The raccoon is a member of the family *Procyonidae* that includes ringtails and coatis in North America. Raccoons are highly omnivorous, feeding on carrion, garbage, birds, mammals, insects, crayfish, mussels, other invertebrates, a wide variety of grains, various fruits, other plant materials, and foods prepared for human or animal consumption (Sanderson 1987).

Sanderson (1987) stated that absolute population densities of raccoons are difficult, if not impossible, to determine. Twichell and Dill (1949) reported one of the highest densities after they removed 100 raccoons from a winter denning area on 101 acres of a waterfowl refuge in Missouri. Other studies have documented raccoon densities that ranged from 9.3 to 80/mi^2 (Yeager and Rennels 1943, Urban 1970, Sonenshine and Winslow 1972, Hoffman and Gottschang 1977, Rivest and Bergeron 1981).

Table 4-5. Raccoon Harvest for Nebraska (NGPC unpubl. data; MIS data).

Raccoon Harvest Statistics	1996	1997
Estimated Other Take	232,000	252,525
WS' Take	664	539
WS' Take (% of population)	0.29%	0.21%

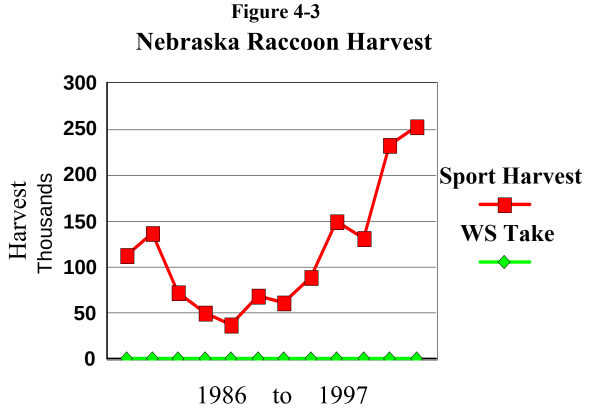
Raccoon Population Impact Analysis

The allowable harvest level for raccoons in USDA (1994) was established at 49% of the total population. In FY96 and FY97, Nebraska WS' kill was 0.29% and 0.21% of the *"Total Harvest"*, respectively (Table 4-5). Harvest information suggests that the raccoon population in Nebraska is viable and healthy (Figure 4-3), and that WS' take of raccoons has remained relatively consistent from 1986 to 1997.

Striped Skunk Population Information

Skunks primarily cause odor problems around homes, transmit diseases such as rabies to humans and domestic animals, and prey on poultry. Twenty-eight, 65 and 54 public health and safety requests for assistance were received by Nebraska WS in FY96, FY97, and FY98, respectively. In FY96, skunks were responsible for 63 incidences of property damage, 15 threats to public health and safety, 12 incidences of poultry and egg damage, eight incidences of pet damage/harassment, and two incidences of crop damage with an associated verified damage loss value of $3,907. In FY97, skunks were responsible for $5,746 in damage to property and poultry, and in FY98 they damaged resources worth $5,812.

Figure 4-3



The striped skunk is the most common member of the *Mustelidae* family. Striped skunks have increased their geographic range in North America with the clearing of forests, however there is no well-defined land type that can be classified as skunk habitat (Rosatte 1987). Striped skunks are capable of living in a variety of environments, including agricultural lands and urban areas.

The home range of striped skunks is not sharply defined over space and time, but is altered to accommodate life history requirements such as raising young, winter denning, feeding activities, and dispersal (Rosatte 1987). Home ranges averaged 0.85 to 1.9 mi^2 for striped skunks in rural areas (Houseknecht 1971, Storm 1972, Bjorge et al. 1981, Rosaette and Gunson 1984) and skunk densities ranged from 0.85 to 67/mi^2 (Jones 1939, Ferris and Andrews 1967, Verts 1967, Lynch 1972, Bjorge et al. 1981). Many factors (including diseases, season of the year, geographic area, and the availability of suitable foods and habitats) contribute to the differing population densities (Storm and Tzilkowski 1982).

Spotted Skunk Population Information

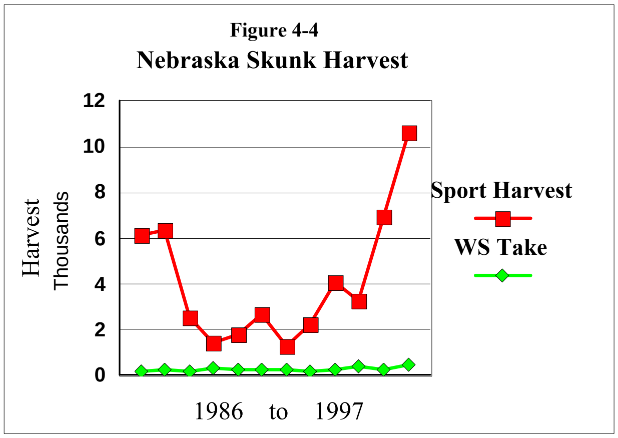
The geographic range of the western spotted skunk extends from central Mexico through the western United States to British Columbia (Rosatte 1987). The spotted skunk is only an occasional visitor to the southeastern part of Nebraska (Adams 1961). They prefer open lowlands but are equally at home in mountainous country and in a variety of habitats including farmyards, wastelands and chaparral (Orr 1943, Baker and Baker 1975). Few studies have been published on the home range, population density and mortality of spotted skunks. Crabb (1948), however, found that the western spotted skunk in Iowa occupied a home range of about 160 acres at densities of 5.7/mi^2. He also stated that spotted skunks are nomadic, traveling up to 3 mi/night, and do not defend a territory.

Table 4-6. Striped Skunk Harvest Data for Nebraska (NGPC unpubl. data; MIS data).

Skunk Harvest Statistics	1996	1997
Estimated Other (Harvest) Take	6,753	10,643
WS' Take	286	473
WS' Take (% of harvest)	4.1%	4.3%

Striped and Spotted Skunk Population Impact Analysis

During FY96 and FY97, Nebraska WS personnel killed 286 and 473 striped skunks, respectively (Table 4-6). Furthermore, "*Other Harvest*" of skunks by the public occurred, but reliable estimates of harvest totals are not available. Best "*Total Harvest*"estimates, however, suggest that the striped skunk population in Nebraska is viable and healthy (Figure 4-4), and that WS' take of striped skunks has remained relatively consistent from 1986 to 1997. Nebraska WS has not verified any damage caused by spotted skunks nor taken any spotted skunks during the last 7 years.



Mink Population Information

During FY94, mink killed 20 endangered least terns and were a damage threat to piping plovers in Nebraska. In FY95, mink were a damage threat to endangered least terns and threatened piping plovers. During FY96, WS verified and had reported that mink killed domestic fowl valued at $200 and were a damage threat to endangered least terns and threatened piping plovers. In FY97 no mink damage was verified or reported to WS, and in FY98, mink only caused $30 in damage to domestic fowl.

Mink are a semiaquatic mustelid and are associated with semipermanent and permanent wetlands, streams, and rivers. Mink are distributed throughout North America, except the desert southwest where stream flows are irregular (Jones et al. 1985).

Mink are opportunistic predators that feed primarily on birds and mammals including waterfowl, grebes (*Podicipedidae*), blackbirds (*Icterinae*), gulls (*Larinae*), partridges (*Perdix* spp.), ground squirrels (*Sciuridae*), and muskrats (*Ondatra zibethica*) (Sargeant et al. 1973, Yeager 1943). They have also been found to prey on tiger salamanders (*Ambystoma tigrinum*) (Sargeant et al. 1973), crayfish (Decapod), and fish (Osteichthyes).

During the spring of the year, territorial males occupy large areas and females occupy small areas (Gerell 1970, Whitman 1981, Eagle and Whitman 1987, Eagle 1989). Female mink with kits restrict their activities to an average of one wetland (Eberhardt and Sargeant 1977, Eagle 1989), while in the prairie pothole region, male mink tend to occupy circular habitats that may encompass many wetlands (Sargeant et al. 1993). Home ranges of adult male mink during May through July in pothole habitats in Manitoba averaged 2.5 mi^2 (range = 1.2-6.3 mi^2) and included all or parts of 285 wetlands (Arnold 1986).

Mink lead a precarious existence in prairie habitats because annual fluctuations in water levels affect abundance of food and availability of shelter. Eberhardt (1974) stated that the frequent widespread and local droughts characteristic of the prairie pothole region lowered reproductive performance by mink. However, Sargeant et al. (1993) found that mink were common in two study areas in southeastern Nebraska during the drought years of the mid to late 1980s.

Mink Population Impact Analysis

No mink were taken by WS in Nebraska during FY94, but fur harvesters reported taking 2,809 animals (NGPC unpubl. data). The Nebraska WS program took one mink each in FY95 and FY96, no mink in FY97 and one mink in FY98, while fur harvesters reported taking 4,442, 2,218, 5,188, and 4,236, or less than 0.05% of the *"Total Harvest"* (MIS data; NGPC unpubl. data). Because Nebraska WS' take is less than 0.05% of the *"Total Harvest",* the magnitude of impact is determined to be low.

Badger Population Information

In Nebraska, badgers typically damage cemeteries, pastures, croplands, shrubs, property, and livestock, and occasionally threat public health and safety. In FY96, badgers caused two incidents of crop damage and 30 incidents of property damage amounting to $7,760 in damages. During FY97, WS verified 46 incidences of badger damage valued at $4,640 and received seven reported incidents of badger damage valued at $1,285. During FY98, WS verified 28 incidences of badger damage valued at $2,925 and received four reported incidents of badger damage valued at $750. Nebraska WS primarily takes badgers as a target species, but they are also occasionally captured as a nontarget species in leghold traps set to capture coyotes.

Badgers are members of the *Mustelidae* family. The badger is a large, broad-bodied animal with strong legs and long claws adapted for digging. Male badgers average 19 lbs and females average 14 lbs (Hegdal and Harbour 1991). Badgers are inhabitants of grassland communities, but can also be found inhabiting forest edges. Badgers are opportunistic feeders preying on a wide variety of birds, mammals, eggs, reptiles, amphibians, invertebrates, and even plant material (Long and Killingley 1983).

Little is known about badger densities. Lindzey (1971) estimated that the Curlew Valley on the Utah-Idaho border supported 1 badger/mi^2, while Messick and Hornocker (1981) believed that the Snake River Birds of Prey Natural Area and adjacent lands in southwestern Idaho supported badger densities of up to 13/mi^2.

Badger Population Impact Analysis

Table 4-7. Badger Harvest Data for Nebraska (NGPC unpubl. data; MIS data).

Badger Harvest Statistics	1996	1997
Estimated Other Take	2,224	3,093
WS' Take	74	80
WS' Take (% of harvest)	3.2%	2.5%

Badger populations are reported to be able to sustain harvest rates of about 30-40% annually (Boddicker 1980). The NGPC reported 2,224 badgers purchased by fur buyers statewide during the 1995-1996 season (NGPC unpubl. data). Nebraska WS removed 74 badgers during FY96 (Table 4-7). The combined private and Nebraska WS harvest of badgers was about 2,298 badgers in FY96 with the Nebraska WS take being 3.3% of the *"Total Harvest"*. The NGPC also reported 3,093 badgers purchased by fur buyers statewide during the 1996-1997 season (NGPC unpubl. data). Nebraska WS removed 80 badgers during FY97. The combined private and Nebraska WS harvest of badgers was about 3,173 badgers in FY97 with the Nebraska WS take being 2.6% of the "Total Harvest". Because Nebraska WS' take is minimal in comparison to the *"Total Harvest"* and substantially less than the allowable state harvest, the magnitude of impact is determined to be low.

Bobcat Population Information

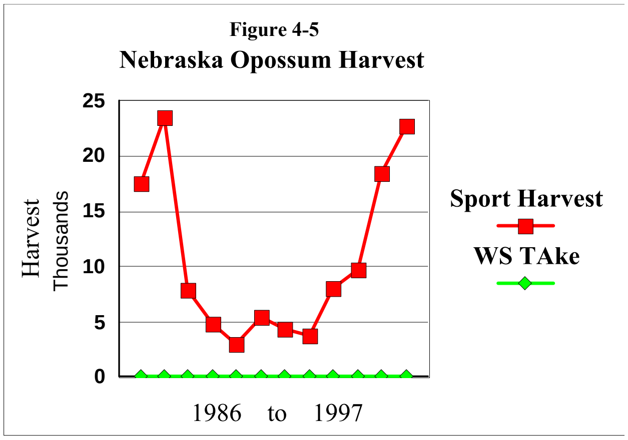
Bobcats reach reproductive maturity at approximately 9 to 12 months of age and give birth to one to six kittens following a 2-month gestation period (Crowe 1975, Koehler 1987). In Oklahoma, bobcat densities range from 0.1 to 7.0/mi^2. Bobcats live up to 14 years, but annual mortality is as high as 47% (Rolley 1985).

The NGPC manages bobcats as furbearing animals with a regulated and controlled trapping season. Each harvested bobcat is tagged so that the disposition of each animal can be monitored.

In Nebraska, bobcats infrequently depredate poultry and domestic rabbits and Nebraska WS typically removes fewer than five annually. The NGPC has stated that the number of bobcats taken by WS is insignificant with regard to local and/or statewide population viability (Andelt 1997).

Virginia Opossum Population Information

In Nebraska, Virginia opossums most often damage property, consume livestock feed or poultry, or become a nuisance. During FY96, opossums were responsible for three incidents of damage valued at \$9. In FY97, they were responsible for five incidents valued at \$210, and in FY98 they were responsible for eight incidents valued at $200.



The opossum is the only native marsupial in North America. Adults weigh from < 1 kg to 6 kg depending on the sex and time of year, with males being larger than females (Seidensticker et al. 1987). Opossums are omnivorous, feeding on insects, fruits, crustaceans, and mammals (Gardner 1982, Seidensticker et al. 1987). Female opossums are capable of breeding from five to seven times throughout the season (Reynolds 1952, Jurgelski and Porter 1974) which extends from January through November (Gardner 1982). If the female loses her young, she will go into estrus two to eight days later (Reynolds 1952). Female opossums are capable of raising two litters per year (Gardner 1982, Seidensticker et al. 1987) with a mean litter size of 8.5 for earlier litters and 6.6 for later litters (Llewellyn and Dale 1964). The female has functional nipples for 13 young (Gardner 1982) and it is capable of producing 15 (Seidensticker et al. 1987), 16 or even 17 young (Gardner 1982). Opossums are primarily associated with three habitats: 1) wet, shrubby thickets with small trees and abundant ground cover, 2) forest edges removed from water sources with a variety of trees and tree sizes, and 3) areas near water with many small trees, a few large ones, and an open canopy (Seidensticker et al. 1987). Densities of opossums vary from 3.8/mi^2 for mixed pasture and woodlands in Iowa (Wiseman and Hendrickson 1950) and 6.5/mi^2 for cultivated farmland in Illinois (Verts 1963), to a high of 166/mi^2 at the Montezuma National Wildlife Refuge (VanDruff 1971). High mortality and rapid population turnover are characteristic of Virginia opossums (Hunsaker 1977, Gardner 1982). The life expectancy of an opossum is one year with only 8% of the males and 5% of the females surviving for longer (Seidensticker et al. 1987). Other accounts have stated that only 3% of opossums survive longer than one year in Maryland (Llewellyn and Dale 1964), none were older than 15 months in Illinois (Sanderson 1961), and none survived beyond one year in Wisconsin (Gillette 1980). Longevity records for the wild are 3 years for males (Llewellyn and Dale 1964) and 28 months for females (Seidensticker et al. 1987).

Virginia Opossum Population Impact Analysis

Harvest data alone will not predict future population trends of Virginia opossums; environmental conditions during the reproductive season preceding the harvest must also be considered (Seidensticker et al. 1987). Because the reproductive season is limited to one year for >90% of females, the survival of the species in an area primarily depends on how predictable the availability of food resources will be from one year to the next (Seidensticker et al. 1987).

WS removed 53 opossums in FY 96, 110 in FY97, and 96 in FY98. It is recognized that "*Other Take*" of opossums occurs, but no reliable system exists for recording this information. Harvest information suggests that the opossum population in Nebraska is viable and healthy (Figure 4-5), and that WS' take of opossums has remained relatively consistent from 1986 to 1997. WS' take of opossums in Nebraska has no impact on the viability of the statewide population.

Weasel Population Information

WS does not distinguish between species of weasels in the collection of MIS data. In Nebraska, weasels infrequently kill poultry and Nebraska WS typically removes fewer than two weasels annually. In FY96, seven chickens worth $35 were killed by weasels. Weasels also caused $35 and $25 in damages in Nebraska in FY97 and FY98, respectively.

Three species of weasels potentially occur in Nebraska; the long-tailed weasel (*Mustela frenata*), the ermine, stoat or short-tailed weasel (*M. erminea*), and the least weasel (*M. nivalis*). The long-tailed weasel is found throughout Nebraska and the least weasel is found in the eastern two-thirds of Nebraska (Jones et al. 1983). Hall and Kelson (1959) speculated that the ermine could be found in the northwest corner of Nebraska, because populations of ermines occur in eastern Wyoming and the Black Hills of South Dakota.

Svendson (1982) reported reproductive maturity for long-tailed weasels at 3-4 months, but Gamble (unpubl. data as cited in Fagerstone 1987) suggests that females do not produce litters until they are 2 years old. Long-tailed weasels have only one litter per year, during April or May, and produce 4 to 9 young (Fagerstone 1987). Heidt (1970) found that captive weasels produced an average of 6-8 young. In Michigan, long-tailed weasels were documented to have home ranges in mixed habitat that ranged from 79 to 395 acres (Quick 1944). In mixed habitat in Colorado, long-tailed weasels maintained home ranges of 198-297 acres (Quick 1951), while male long-tailed weasels had home ranges of 15 to 59 acres on farmland in Kentucky (DeVan 1982). Population densities of long-tailed weasels vary due to a variety of factors including habitat and prey availability. Population densities range from a high of 65/mi^2 in chestnut oak (*Quercus prinus*) forest in Pennsylvania, to 3 to 30/mi^2 on Kentucky farmland, and to a low of 0.6 to 1.3/mi^2 in western Colorado and lower Michigan (Quick 1951, Craighead and Craighead 1956).

Ermine also have only one litter of young per year which are usually born in the spring (Deanesly 1935). Litter sizes range from 4 to 13 young (Stubbe 1973) with the average being six young in North America (Hamilton 1933). The females mate during their first summer, sometimes before they are weaned or their eyes are open (Hamilton 1958, Muller 1970, Rowlands 1974). There is a rapid turnover of resident males and at times the young mate with the same adult male with which their mothers mated (Erlinge 1979, Simms 1979). Almost all females are pregnant by the end of summer (Wright 1963) due to an extended estrus period (Ternovsky 1983). The life expectancy of an ermine is 1.0-1.5 yrs with an annual survival rate of 40% (Sandell 1984) and longevity record of seven years (Fagerstone 1987). The majority of home range studies for ermine come from Europe where the species is much larger (Nyholm 1959, Erlinge 1977). Male home ranges overlap female home ranges by 2-3 times (Simms 1979) and can be as large as six times the size of the female home range (Erlinge 1979). In Ontario, male home ranges averaged 49 to 62 acres and female home ranges averaged 25 to 37 acres (Simms 1979). California winter home ranges averaged 8.6-17.0 acres (Fitzgerald 1977). Home ranges for Eurasian ermines are reportedly larger; 627 acres for males and 282 acres for females on farmland in Scotland (Pounds 1981), 20 to 32 acres during the winter for males and 5 to 17 acres for females on Swedish pastures and marshes (Erlinge 1977), 20 to 99 acres for males and 5 to 17 acres for females on Swiss alpines (Debrot and Mermod 1983), and 72 to 99 acres for males and 10 to 42 acres for females in Finland (Nyholm 1959). In Russia, males and females had a home range of 27 to 170 acres for meadows and scrub and both sexes had a home range of 296 to 306 acres in forests (Vaisfeld 1972). Ermine populations in North America typically range from 7/mi^2 (Soper 1919) to 10/mi^2 with populations reaching a high of 18/mi^2 in preferred habitat (Simms 1979).

The least weasel is the smallest mustelid and the smallest member of the Order Carnivora in North America. Least weasels are capable of breeding year round (Hall 1951) and they can reach sexual maturity at 3 to 4 months (Hartmann 1964, East and Lockie 1964, Svendson 1982). The number of litters per year and the rate of development of the young is strongly influenced by prey availability (Fagerstone 1987). If prey species are abundant, a female can produce up to three litters per year (Heidt et al. 1968). Litter sizes range from 1 to 10 with an average of 4 to 5 young (Hall 1951, Heidt 1970). The life expectancy of least weasels is 1 year with a 20% survival rate for males and a 25% survival rate for females (King 1990, Fagerstone 1987). During a long term study conducted from 1925-1957, Polder (1968) found that the home ranges for least weasels on Iowa farmland ranged from 4-10 ha. In a Finnish study, where least weasels are larger than North American least weasels, male weasels had a home range of 0.6-3.0 ha and females had a home range of 0.2-2.1 ha (Nyholm 1959).

Weasel Population Impact Analysis

During the late 1800s and early 1900s, one half of Britain was under an intensive predator management program that included the use of trapping, shooting, and poisoning (King 1990). Although targeted by the predator elimination program, weasels were resilient because of their opportunistic life style, variable productivity, and constantly high natural mortality, which enabled the species to compensate for sudden population decreases due to predator management (King 1990).

Stuttard (1986) stated that weasels generally do not need protection, because of their high recovery rates. Consequently, the lack of food may be the most important mortality issue for long-tailed weasels, ermine, and least weasels (Fagerstone 1987). Nebraska removed no weasels in FY97 and one weasel in FY98.

Mountain Lion Population Information

Nebraska WS personnel began receiving mountain lion depredation complaints in FY91 when they first responded to two individual complaints involving damage to agriculture and natural resources, respectively. In FY92, mountain lions were reported to be responsible for three agriculture-related damage complaints and one incident involving the death of a mule deer.

Since FY91, the number of mountain lion-caused livestock depredations reported to Nebraska WS has increased. In FY94, mountain lions were reported to have killed calves valued at $800; in FY95, lions reportedly killed an elk worth $250 and several calves valued at $1,500; and in FY96, lions killed a foal worth $500 and were involved in one threat to human health and safety. No damages were verified or reported in FY97, however, in FY98, five incidents of mountain lion damage were reported including the death of two calves valued at $1,000.

Mountain lion attacks on humans in the western United States and Canada have increased markedly in the last two decades, primarily due to increased mountain lion populations and human use of mountain lion habitats (Beier 1992). Since 1986, there have been nine verified attacks on humans with two fatal attacks on adult women in California (Torres et al. 1996). Within Nebraska, human interactions with mountain lions could occur wherever humans and mountain lions coexist.

Mountain lions are widely distributed across North America (Anderson 1983). They inhabit many habitat types from desert to alpine environments, suggesting a wide range of adaptability. Female mountain lions typically breed for the first time between 22 and 29 months of age (Ashman et al. 1983), but initial breeding may be delayed until a territory has been established (Hornocker 1970). Mountain lions breed and give birth year-round, but most births occur during late spring and early summer following a 92-day gestation period (MFWP 1996, Ashman et al. 1983, Seidernsticker et al. 1973, Robinette et al. 1961). Mountain lions average two to three young per litter, but one to six offspring are possible (Robinette et al. 1961). Young mountain lions stay with the female for 10 to 24 months (MFWP 1996).

Mountain lion densities range from 1/100 mi^2 to 24/100 mi^2 and average 7.5/100 mi^2 in the western states (Johnson and Strickland 1992). In Montana, a typical male mountain lion's territory can overlap those of several females and may range from 50 to 150 mi^2 in size; that of a female is usually less than 50 mi^2. Once young mountain lions leave their mother, generally at 1 to 2 years of age, they may not be able to immediately find an unoccupied territory. In such cases, younger lions may become transient, covering wide areas in search of a suitable territory to occupy (MFWP 1996).

Mountain lions were extirpated from the eastern two-thirds of Nebraska during the 1890s, but are still occasionally reported from western Nebraska (Jones et al. 1983). Recent sightings and depredation complaints suggest that mountain lion populations may be increasing in Nebraska.

Mountain Lion Population Impact Analysis

Mountain lion populations can sustain moderate to heavy losses of adults and still maintain viable populations. Robinette et al. (1977) reported an annual mortality of 32% in Utah, while Ashman et al. (1983) noted a sustained annual mortality of at least 30% in Nevada. In addition, Ashman et al. (1983) believed that under "*moderate to heavy exploitation (30%-50%),"* mountain lion populations on their study area had the capability to rapidly replace annual losses through recruitment (reproduction and immigration).

The allowable annual harvest for mountain lions is 30% of the population (USDA 1994). WS has never taken any mountain lions in Nebraska, but would closely coordinate any efforts to do so with the NGPC.

4.4.1.2 Alternative 2 - No Federal Nebraska WS Program and Alternative 6 - Technical Assistance Only:

Both Alternative 2 and Alternative 6 would result in no Nebraska WS operational program and the potential effects would be similar, therefore they will be analyzed together. Some type of predator damage management would most likely be conducted by producers, various state or local governmental agencies, or other entities. The impacts on wildlife populations could vary considerably from those described in Alternative 1, because of the potential for the improper or inappropriate selection and use of damage management methods, emphasis on lethal methods, duplication of effort, and/or possible misuse of pesticides.

A thorough review of the potential impacts of these two alternatives can be found in USDA (1994). The USDA EIS (1994) summarized the biological impacts of the No WS Program Alternative as follows:

"Biological impacts that would be expected under the No Action Alternative (No WS Program Alternative in this EA) *include all impacts that occur under the Current Program Alternative* (No Action Alternative in this EA) *plus impacts that relate to the reasons listed previously. Taking of target species would be more variable (i.e., lower for some species in some areas and higher in other areas). However, taking of nontarget species probably would be higher, and for some small populations, could become biologically significant. This would be especially important if the species was threatened or endangered. Species diversity could be significantly affected. The indirect impacts on nontarget species affected through the food chain or by uncontrolled releases of toxicants into the environment also could increase. In some areas, people could use unapproved chemical methods. Misuse of chemicals could increase and thereby adversely affect certain wildlife populations and public health and safety."*

Predator damage management would certainly be handled differently without WS' assistance. State agencies and private individuals would not be subject to the same restrictions and operating policies adhered to by Nebraska WS (such as the requirements of NEPA and the need to coordinate and plan with the BLM and Forest Service). We assume that a state agency such as the NGPC or NDA would administer a program, but there would be an interim period, while funds were secured and an organization was established, where livestock producers would have limited or no assistance and would conduct needed control by whatever means available to them. Any assumption of predator damage management by the state would probably dilute resources needed for other wildlife management and/or state functions.

Alternatives 2 and 6 would likely have greater adverse impacts on wildlife populations than the current program.

4.4.1.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

Alternative 3 would authorize Nebraska WS predator damage management on BLM, Forest Service, USFWS, state, tribal, private, city, and county lands, as requested to protect livestock, wildlife, property, and public health and safety. The actual area where wildlife damage management activities would be carried out is unknown and could vary from year to year, based on need. However, the area that would be worked in any one year would be similar to the area worked under Alternative 1. Alternative 3 differs from Alternative 1 in the timing of control and the species considered as targets, based on the combined needs to protect wildlife and livestock, property, public health and safety, and public lands.

Nebraska WS estimates that predator damage management conducted under this alternative could increase the kill of coyotes, but any increase probably would not exceed 2% of WS' current take. A 2% increase, based on 1997 data, would mean that 54 additional coyotes would be taken each year. Furthermore, if WS' take of red foxes were increased by 50% due to the need to protect wildlife, Nebraska WS would kill about 327 red foxes statewide. (Note: this estimate is based on WS' FY94 "take" of 218 red foxes, the highest number taken in the last six years.) The NGPC coyote and red fox population data indicates that the viability of predator populations in Nebraska would not be significantly affected by WS activities conducted as a result of Alternative 3, The Proposed Action (Andelt 1997).

Alternative 3 would have a minimal impact on targeted wildlife populations.

4.4.1.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

As noted in Table 4-1, all Nebraska sheep producers and many cattle producers surveyed by WS already practice some form of nonlethal predator damage management. Nebraska WS predator damage management techniques implemented under Alternative 4 would be similar to those practiced under the current program. The impacts to target populations would then be identical to those described in 4.4.1.1 for Alternative 1.

4.4.1.5 Alternative 5 - Corrective Damage Management Only:

Under Alternative 5, Nebraska WS would only initiate lethal damage management of predators after verifying the loss of livestock due to predation. Nebraska WS' coyote kill could be reduced under Alternative 5, but the impacts to target populations would be similar to those described under Alternative 1.

The impacts to target populations would be similar to those described in 4.4.1.1 for Alternative 1.

4.4.2 Effectiveness and selectivity of damage management methods.

Chapter 3 includes a discussion about the relative effectiveness and selectivity of the various methods used by Nebraska WS personnel and that discussion will not be repeated here. Under the current program, all methods are used as effectively and selectively as practically possible, in conformance with the ADC Decision Model (Slate et al. 1992) and program directives. The selectivity of each method is based, in part, on the application of the method, the skill of WS' personnel, and the direction provided by WS' directives and policies. The humaneness of each method is based on the perception of the pain or anxiety caused by the method. How each method is perceived often differs, depending on the person's familiarity with and perception of the issue as discussed in Chapter 2.

The effectiveness and selectivity of each alternative is based on the methods employed under that alternative. WS personnel are trained in the use of each method and are certified by the NDA, Plant Industry as *Commercial Pesticide Applicators*. Effectiveness of the various methods may vary depending on circumstances at the time of application. Method effectiveness and/or applicability depends on factors such as weather conditions, the time of year, biological and economic considerations, legal and administrative restrictions, or other issues. Because various factors may preclude the use of certain tools, it is important to maintain the widest possible selection of damage management methods for use in selectively and effectively resolving predator damage management problems.

4.4.2.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

Several methods employed under the current program are typically 100% selective for target species. These methods include aerial hunting, shooting from the ground, and denning. Cage trapping may capture a few nontarget animals, but these animals are typically released unharmed. While the methods discussed above are nearly 100% selective in capturing/killing only the target species, other methods such as leghold traps and snares can be somewhat less selective.

WS uses leghold traps with offset jaws to reduce injuries, pan-tension devices to make traps more selective, and checks traps according to NGPC regulations. Pan-tension devices increase the amount of weight required to set off the trap and effectively reduce the capture of smaller nontarget animals (Turkowski et al. 1984, Phillips and Gruver 1996). Pan-tension devices are always used by WS unless their use would preclude capture of the intended target species. During 1996-98, 1,605 target and only 45 nontarget animals were trapped or snared and killed in Nebraska (Table 4-8). WS personnel often try to reduce the need for setting traps or snares by first trying to remove target animals by shooting. If shooting is not successful or feasible, traps and/or snares may be used to resolve the problem. Nontarget animals captured in traps or snares are typically released unless WS personnel believe that they would not survive.

As used by WS in Nebraska, snares are more selective than traps (Table 4-8). The selectivity of snares is largely a function of how and where they are set. Break-away snare locks are also sometimes used to provide for the release of larger animals that could be accidentally caught.

The use of livestock guarding dogs by sheep producers has been proven effective in preventing some predation losses (Green 1987) and is generally perceived as a selective form of nonlethal control. However, guard dogs may also kill target and nontarget animals. Timm and Schmidt (1989) documented that guard dogs regularly killed deer fawns, and anecdotal evidence from WS personnel and livestock producers suggests that they may also kill coyote and red fox pups and elk calves. Llamas have also been advocated as effective livestock guarding animals (Franklin and Powell 1994), but have also been implicated as carriers of paratuberculosis (Johne's disease) which may be transmissible to native ungulates or domestic livestock (Wildlife Management Institute 1995). This disease involves a chronic wasting of the intestinal tract and associated lymphoid tissues, and no known cure is available.

Table 4-8. Selectivity of Traps, Snares and M-44s as used by Nebraska WS Personnel during FY93-95.

	Traps[1]	**Snares[1, 2]**	**M-44s**
Target			
Coyote	354	476	5,577
Red Fox	89	25	48
Striped Skunk	147	23	0
Badger	154	22	0
Bobcat	3	0	0
Raccoon	153	88	0
Opossum	67	5	0
3-Year Total	967	639	5,625
Nontarget			
Red Fox	1	0	0
Striped Skunk	3	1	6
Badger	3	0	0
Porcupine	3	1	0
Bobcat	2	0	0
Raccoon	5	3	10
Opossum	2	0	3
Coyote	1	0	0
Weasel	1	0	0
Rabbit	2	0	0
3-Year Total	23	5	19
% Selectivity	97.6	99.4	99.7

[1] These figures only refer to target animals caught in leghold traps and snares. Nontarget animals caught and released are not included in these totals.
[2] These figures refer primarily to animals caught in neck snares.

Hunting dogs are moderately expensive to use due to feeding and care. However, they are useful for denning where they are highly selective, not only for the offending species, but for offending individuals. Denning is the practice of finding the burrow of the targeted predator(s) and asphyxiating the young with a gas cartridge that produces carbon monoxide when ignited. Denning is highly selective because positive identification of the species is possible and is very effective in reducing livestock losses to predators (Till and Knowlton 1983, Till 1992). Dogs are also valuable for trailing and decoying target predators that are to be removed by shooting.

In Nebraska, non-capture methods (aerial hunting, calling and shooting, shooting, denning, M-44s and dogs) accounted for 2,361or 90.3%, of the coyotes taken in 1998. Capture methods (leghold traps and neck snares) accounted for 257 or 9.6%, of the coyotes taken in 1998.

4.4.2.2 Alternative 2 - No Federal Nebraska WS Program and Alternative 6 -Technical Assistance Only:

Under Alternatives 2 and 6, no federal operational predator damage management program would exist, therefore no methods would be employed by WS personnel and the selectivity and effectiveness of methods used by WS would not be an issue. Livestock producers or state and local agencies would likely conduct predator damage management and would probably be less selective due to their lack of training, experience, adequate time to devote to predator problems, and a reduced emphasis on the need to adhere to regulations. Illegal use of pesticides could occur, along with indiscriminant trapping. State law currently provides that red foxes and coyotes may be taken by livestock producers without a license and outside of normal hunting and trapping seasons. Without WS' program, producer-employed nonlethal methods would likely decrease as producers would undoubtedly focus their attention on lethal methods.

4.4.2.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

Alternative 3 would be as selective as Alternative 1, but would be more effective due to WS' increased ability to conduct predator damage management on other public lands as requested and when necessary. WS policies and methods and producer-implemented nonlethal damage management methods would not change and the cost of implementing Alternative 3 would be comparable to the costs associated with Alternative 1.

4.4.2.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

Alternative 4 is similar to the current program in that livestock producers are, on average, currently using about 7.2 nonlethal predator management methods (Nebraska WS unpubl. data). The selectivity and effectiveness of Alternative 4 would not differ substantially from the selectivity and effectiveness for Alternative 1, except that livestock producers might lose additional livestock while they implement the nonlethal methods required under Alternative 4.

4.4.2.5 Alternative 5 - Corrective Damage Management Only:

Under Alternative 5, WS would still be able to respond with all the methods included under Alternative 1, but would not be authorized to employ any of these methods under a lethal preventive damage management strategy. Selectivity of methods would be similar to Alternative 1, but WS would be less effective at minimizing livestock losses. By restricting corrective control to the immediate vicinity of predation losses, WS would be unable to effectively resolve some depredation problems. Till (1992), for instance, found that depredating coyotes traveled an average of 2 miles and as far as 6 miles from their den site to the sheep flocks where they killed lambs. Similarly, Shivik et al. (1996) used radiotelemetry to document that coyotes traveled up to 4.2 miles and through other coyote territories to kill lambs.

In addition, WS would probably be less effective at reducing coyote predation on spring and summer livestock grazing areas due to the logistics of getting to remote areas and the necessity of using less effective coyote damage management methods. Till and Knowlton (1983) noted that coyotes with pups are more likely to kill sheep than those without, and Gantz (1990) suggested that late winter aerial hunting of coyotes on summer sheep grazing allotments removes coyotes that might otherwise produce pups. Gantz (1990) went on to conclude that late winter aerial hunting of coyotes on summer sheep range was effective in reducing coyote predation. By conducting preventive damage management in late winter or early spring, the likelihood of transient coyotes reoccupying and establishing their own territories in time to produce pups is greatly reduced. Furthermore, Wagner (1997) determined that aerial hunting 3 to 6 months before sheep are grazed on an area was cost effective and reduced the number of traps, snares and M-44s needed in the field, thereby reducing potential risks to nontarget species.

Alternative 5 is slightly more selective than Alternative 1, due to the increased use of aerial hunting and calling and shooting. The cost of predator damage management would increase under Alternative 5, however, because more intensive corrective predator damage management would be required. Livestock losses to predators would be expected to increase under Alternative 5 when compared to Alternatives 1 and 3, because damage management would only occur after livestock depredations were verified.

4.4.3 Risks posed by damage management methods to the public and domestic pets.

WS' predator damage management program in Nebraska is guided by program directives, cooperative agreements, MOUs and federal and state laws. Predator damage management may have both positive and negative effects on public health and safety; WS may create a safer environment by removing threatening predators or may expose the public to potentially harmful damage management methods. WS uses appropriate chemical and non-chemical methods to minimize a variety of wildlife damage problems and WS personnel are aware of the potential risks to nontarget animals and humans. WS' use of toxicants is regulated by the EPA through the FIFRA, by state law and the NDA, Plant Industry, and by WS Directives. Along with effectiveness, cost, and social acceptability, risk is an important criterion for selection of an appropriate damage management strategy. Determination of risks to nontarget animals, the public, and WS personnel is thus an important prerequisite for successful application of the IWDM approach. Based on a thorough Risk Assessment (USDA 1994, Appendix P), APHIS concluded that WS' methods have negligible impacts on the environment when used according to directives, policies, laws and label directions.

4.4.3.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

The current Nebraska WS predator damage management program is based on an IWDM approach to protect livestock, property, wildlife, and to safe-guard public health and safety on public and private lands as described in Chapter 3 of this EA. Based on the risk assessment from USDA (1994), the environmental and public health and safety risks associated with WS' damage management is low. The greatest risks to public health and safety from WS' use of mechanical and chemical methods are incurred by the WS personnel who apply the methods. During the 1994-98 analysis period, no injuries (to WS personnel or members of the public) related to WS' use of any chemical or mechanical predator damage management method in Nebraska were reported. Mitigation measures that address safety concerns about WS' use of wildlife damage management methods are listed at the end of Chapter 3.

Of the non-chemical wildlife damage management methods used by WS, leghold traps and neck snares pose the greatest risk to nontarget species. Domestic pets that are infrequently captured in these devices can usually be released unharmed. WS limits the use of leghold traps and snares on public lands during bird hunting seasons and warning signs are always posted where these devices are set on public or private property.

The two chemical methods used in predator damage management (sodium cyanide in the M-44 device and the gas cartridge) pose possible risks, but USDA (1994) noted that the risks associated with these methods are mitigated through specific direction provided by WS program policies. Risks identified in the evaluation process for these chemicals were primarily environmental risks addressed by the EPA rather than safety or health risks to the public. EPA use restrictions preclude use of the M-44 in areas where it may pose a danger to T&E species. Furthermore, M-44s and the gas cartridge do not present secondary poisoning risks to other animals that may scavenge on the carcass of an animal killed by these methods (USDA 1994, Appendix P). M-44s present some risk to free-roaming dogs and thus, are not placed on designated public lands during the regular bird hunting seasons or at any other time when exposure to the public or pets is probable. In addition, warning signs are placed in the general area and adjacent to each device whenever M-44s are used.

For these reasons, the risks posed to the public and domestic pets from WS' methods is low.

4.4.3.2 Alternative 2 - No Federal Nebraska WS Program and Alternative 6 -Technical Assistance Only:

Both alternatives would result in no federal operational predator damage management program in the analysis area. Therefore, the use of methods would be at the discretion of individuals or agencies that would conduct wildlife damage management activities. WS would make recommendations (Alternative 6), but implementation of the recommendation would be by another entity. Increased use of the same methods by less skilled or experienced individuals, coupled with reduced over-sight of how predator damage management is conducted, could result in an increased risk to the public. In addition, no program would be available to the NGPC, NDA, or NDH in case of a public health and safety threat caused by wildlife.

This alternative would likely result in increased risks to public health and safety when compared to Alternative 1. Lacking professional assistance, some livestock producers might use illegal toxicants, a cheap form of predator control that represents one of the greatest threats to the environment, T&E species, domestic animals, and public safety. Risks to T&E species would probably be greater under Alternatives 2 and 6 than from any other alternative.

4.4.3.3 Alternative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

The analysis for Alternative 3 is the same as for Alternative 1. Thus, the impacts to public health and safety and domestic pets would be minimal because of direction and over-sight provided by program policies and directives, MOUs, EPA restrictions, and mitigation methods.

4.4.3.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

As noted before, Alternative 4 is similar to the existing program in that producers are currently using about 7.2 nonlethal wildlife damage management methods per livestock operation (Nebraska WS unpubl. data). The impacts of Alternative 4 on public health and safety and domestic pets would be the same as those identified for Alternative 1.

4.4.3.5 Alternative 5- Corrective Damage Management Only:

The analysis for Alternative 5 would be similar to the analysis for Alternatives 1 and 3. The risks posed by corrective control only would be no different than the risks posed by the same methods used under a strategy that included preventive damage management.

4.4.4 Concerns about WS' Impact on T&E species.

WS has consulted with the USFWS regarding the nationwide program and the NGPC for state-listed species and would continue to implement all applicable *Reasonable and Prudent Measures* to ensure protection of T&E species. Endangered species consultations with the USFWS have been completed on those species for which a *"may affect determination"* has been made (as listed in the EIS), and where applicable, the *Reasonable and Prudent Measures* have been implemented (USDA

1994). Chapter 3 lists all mitigation measures and SOPs that have, or would be implemented to insure that T&E species wouldn't be adversely affected by the program.

4.4.4.1 Alternative 1 - Continue the Current Nebraska WS Program (No Action):

Nebraska WS conducted an informal Section 7 consultation with the USFWS and NGPC for state-listed species regarding the potential impacts of the current program and the proposed action. The USFWS and NGPC have concurred with Nebraska WS' assessment that neither the current program nor the proposed action is likely to adversely affect any T&E species that may occur in Nebraska. Mitigation measures to address concerns about impacts to T&E species are listed at the end of Chapter 3.

4.4.4.2 Alternative 2 - No Federal Nebraska WS Program and Alternative 6 -Technical Assistance Only:

No operational WS activities would be conducted pursuant to either of these alternatives and therefore, there would be no risks to T&E species from federal WS program actions. Some type of damage management would most likely be implemented by livestock producers or other private individuals, however, and any such management initiated by individuals with limited training and experience would be more likely to affect nontarget species, including T&E species. Lacking professional assistance, some livestock producers might use illegal toxicants, a cheap form of predator control that represents one of the greatest threats to the environment, T&E species, domestic animals, and public safety. Risks to T&E species would probably be greater under Alternatives 2 and 6 than from any other alternative.

4.4.4.3 Alterative 3 - Integrated Wildlife Damage Management for Multiple Resources and Land Classes (Proposed Alternative):

The analysis is the same as that for Alternative 1.

4.4.4.4 Alternative 4 - Nonlethal Damage Management Required Prior to Lethal Control:

The analysis is the same as that for Alternative 1.

4.4.4.5 Alternative 5 - Corrective Damage Management Only:

The analysis for Alternative 5 would be similar to the analysis for Alternatives 1 and 3. The risks posed by corrective control only would be similar to the risks posed by the same methods used under a strategy that included preventive damage management.

4.4.5 Summary of Nebraska WS' Impacts.

Table 4-12 compares the alternatives and issues (impacts) discussed in this EA. The impacts are rated as: Neutral, Neutral/Low, Low, Low/Moderate, Moderate, Moderate/High, and High. Some impacts are also rated in a positive (+) or negative (-) manner, reflecting society's perception of how the impact could affect the environment.

Table 4-12. A Comparison of the Issues/Impacts with the Alternatives

Issues/Impacts	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Coyote	Neutral/Low	Low	Low	Low	Low	Neutral/Mod
Red Fox	Low	Low	Low	Low	Low	Neutral/Mod
Raccoon	Low	Low	Low	Low	Low	Neutral/Mod
Striped Skunk	Low	Low	Low	Low	Low	Neutral/Mod
Mink	Low	Low	Low	Low	Low	Neutral/Mod
Badger	Low	Low	Low	Low	Low	Neutral/Mod
Bobcat	Neutral/Low	Low	Low	Low	Low	Neutral/Mod
Nontarget	Low	Mod/High	Low	Low	Low	Mod
Game Species	Low	Mod (-)	Mod	Low	Low	Mod
T&E Species	Low	Mod/High (-)	Mod	Low	Low	Mod/High
Methods[1]	Mod	Low	Mod	Mod	Low	Low
Selectivity	Low	Neu/Low	Low	Low	Low	Neutral/Low
Humaneness[1]	Low	Low	Low	Low	Low	Low
WSAs/WAs[1]	Low	Low	Low	Low	Low	Low
Public Lands[1]	Low	Low	Low	Low	Low	Low
Public Health & Safety	Mod (+)	Low	High (+)	Low	Low	Low

[1]Public perception was not considered in the comparison of these issues/impacts.

The analysis in this EA failed to identify any cumulative impacts nor are any significant impacts to the human environment expected because of predator damage management conducted by the Nebraska WS program. Any localized reduction of predator populations would soon be replaced and habitats reoccupied as Nebraska WS personnel would only conduct predator damage management on areas with agreements for control, cooperative agreements, or wildlife damage management work plans. Nebraska WS personnel work on about 5% of the total state acreage, annually. The effects (*"Other Take + Nebraska WS' Take"*) to predator populations that Nebraska WS targets during damage management are neutral to low/moderate and do not have a long-term adverse impact on any species.

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APPENDIX A

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APPENDIX B

GLOSSARY

Abundance: The number of individuals of a species in a given unit of area.

Allotment: A specific area of public lands within which grazing by one or more livestock operators may be authorized.

Animal Behavior Modification: The use of scare tactics/devices (such as electronic distress sounds, propane exploders, pyrotechnics, lights, scarecrows, etc.) to deter or repel animals that cause damage to resources or property or threaten human health and safety.

Animal/Livestock Husbandry: The use of livestock management practices, such as shed lambing, night penning, or the use of herders, to reduce mortality from weather, predation, or other causes.

Animal Rights: A philosophical and political position that animals have inherent rights comparable to those of humans.

Animal Welfare: Concern for the well-being of individual animals, unrelated to the perceived rights of the animal or the ecological dynamics of the species.

Behavior Modification: See *Animal Behavior Modification*.

Canid: A coyote, dog, fox, wolf or other member of the dog (Canidae) family.

Carnivore: A species that primarily eats meat (member of the Order Carnivora).

Carrying Capacity: The number of animals a given unit of habitat can support.

Compensation: Monetary reimbursement for loss of resources.

Confirmed Losses: Wildlife-caused losses or damages verified by APHIS-WS. These figures usually represent a fraction of the total losses.

Corrective Damage Management: Management actions applied when damage is occurring or after it has occurred.

Denning/Den Hunting: The process of locating predator (primarily coyote) burrows and destroying the pups. The adult predators may also be killed.

Depredating Species: An animal species causing damage to, or loss of crops, livestock, other agricultural or natural resources, property, or wildlife.

Depredation: The act of killing, damaging, or consuming animals, crops, other agricultural or natural resources, property, or wildlife.

Direct Control: Administration or supervision of wildlife damage management by WS, often involving direct intervention to capture depredating animals.

Diversity: The distribution and abundance of living organisms.

Endangered Species: Federal designation for any species that is in danger of extinction throughout all or a significant portion of its range.

Environment: The conditions, influences, or forces that affect or modify an organism or an ecological community and ultimately determine its form and survival.

Environmental Assessment: An analysis of the impact of a planned action to the human environment to determine the significance of that action and whether an EIS is needed.

Environmental Impact Statement: A document prepared by a federal agency to analyze the anticipated environmental effects of a planned action or development, compiled with formal examination of options and risks.

Eradication: Elimination of specific wildlife species, generally considered pests, from designated areas.

Forage: Food for animals, especially when consumed by browsing or grazing.

Furbearer: An administrative or legal grouping of mammal species harvested for their fur.

Habitat: An environment that provides the requirements (i.e., food, water, shelter, and space) essential for the development and sustained existence of a species.

Habitat Modification/Management: Protection, destruction, or modification of a habitat to maintain, increase, or decrease its ability to produce, support, or attract designated wildlife species.

Harvest Data: An estimate of the number of animals removed from a population by humans.

Harvest Rate/Level: For any given wildlife species, a harvest ceiling established by wildlife management specialists to regulate the harvest of a species. This value represents a proportion of the population that can be taken without adversely impacting the long-term maintenance of the population.

Humaneness: The perception of compassion, sympathy, or consideration for animals from the viewpoint of humans.

Integrated Pest Management: The procedure of integrating, applying, and assessing practical pest management methods while minimizing potentially harmful effects to humans, nontarget species, and the environment.

Integrated Wildlife Damage Management: See *Integrated Pest Management*. The IPM approach applied to the objective of managing damage rather than pest animal populations.

Lethal Management Methods/Techniques: Wildlife damage management methods that result in the death of targeted animals (e.g., M-44s, aerial shooting, calling and shooting, denning, etc.).

Local Population: The population within an immediate specified geographical area.

Long-term: An action, trend, or impact that affects the potential of an event over an extended period of time.

Magnitude: Criteria used in this EA to evaluate the significance of impacts on species abundance. Magnitude refers to the number of animals removed in relation to their abundance.

Nonlethal Control Methods/Techniques: Wildlife damage management methods or techniques that do not result in the death of targeted animals (e.g., live traps, repellents, fences, etc.).

Nontarget Species/Animal: An animal species or local population that is inadvertently captured, killed, or injured during wildlife damage management.

Offending Animal/Species: The individual animal(s) within a specified area causing damage to property, public health and safety, wildlife, or to forest, range or agricultural resources.

Omnivore/Omnivorous: An animal that eats both animal and plant matter; a generalist, opportunistic feeder that eats whatever is available.

Open Range: Unfenced grazing lands.

Pesticide: A toxic chemical substance used to control pest animals.

Pesticide Use Proposal: A procedure whereby a petition is submitted to and approved by a government agency(ies) before a pesticide, in a specific formulation and for a specific purpose, can be used.

Population: A group of organisms of the same species that occupies a particular area.

Predacide: A toxicant used to control or manage predators or damage caused by predators.

Predator: An animal that kills and consumes another animal.

Preventive Damage Management: Management applied before damage begins.

Prey: An animal that is killed and consumed by a predator.

Public Land: Land that is managed by a government agency (i.e., federal, state, regional, county or municipal jurisdiction).

Pyrotechnics: Specialized fireworks used to frighten wildlife.

Range Lambing: Lambs born on the open range or in large pastures.

Rangeland: Land covered with native grasses, forbs, and/or shrubs valuable for forage.

Raptors: Carnivorous birds (e.g., owls, hawks, falcons, etc.) that prey on other animals.

Registered Chemical: A chemical that has been approved by the appropriate government agency(ies), such as the EPA and/or NDA, for use in a specific formulation and for a specified purpose.

Repellent: A substance with taste, odor, or tactile properties that discourages specific animals or species from using a food or place.

Requester: Individual(s) or agency(ies) that request wildlife damage management assistance from WS.

Selectivity: Damage management methods that affect the specific animals or animal species responsible for causing damage without adversely affecting other species.

Shed Lambing: Housing ewes and newborn lambs in pens or sheds to provide food, shelter, and medical care during and immediately after birth.

Short-term: An action, trend, or impact that does not have long lasting affects to the reproductive or survival capabilities of a species.

Significant Impact: An impact that will cause important positive or negative consequences to man and his environment.

Take: The capture or killing of an animal.

Target Species/Animal/Population: An animal, species, or population at which wildlife damage management is directed.

Technical Assistance: Advice, recommendations, information, demonstrations, and materials provided to others for managing wildlife damage problems.

Threatened Species: Federal designation for a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Total Harvest: The total number of individual animals intentionally taken by humans from a population. Harvest does not include natural or accidental mortality.

Toxicant: A poison or poisonous substance.

Unconfirmed Losses: Losses or damage reported by resource owners or managers, but not verified by WS.

Wilderness Study Area: Undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, and managed to preserve its natural conditions.

Wildlife: Any wild mammal, bird, reptile, or amphibian.

Wildlife Damage Management: Actions directed toward resolving livestock or wildlife predation, protecting property, or safeguarding public health and safety in a coordinated, managed program.

Work Plan: A management plan developed jointly by WS and the BLM, Forest Service, NGPC, and/or NDA specifying when, where, how, and under what constraints wildlife damage management will be conducted. Work plans generally include a map showing areas designated for planned control, restricted control, no control, and special protection.

Exhibit 23

[Report]

Adjust

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The Rogue Agency

A USDA program that tortures dogs and kills endangered species

by Christopher Ketcham

From the March 2016 issue

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One morning in the fall of 1980, Rex Shaddox got a call from his supervisor at the Uvalde, Texas, office of Animal Damage Control. Shaddox had worked for Animal Damage Control, which was then a branch of the U.S. Fish and Wildlife Service, for seventeen months. His job was to trap and kill wild carnivores, coyotes in particular, that were said to prey on the flocks of local sheep ranchers.

The supervisor, Charles Brown, told Shaddox to meet with his fellow agents at the city dump outside town. "We're gonna do some M-44 tests," Brown said. "With dogs." The M-44, a spring-loaded device that is planted in the ground and ejects sodium cyanide when set off, was among the weapons used by Animal Damage Control to kill coyotes.

When Shaddox arrived at the dump, he found Brown and several colleagues standing over a pit of stinking garbage. A truck from the Uvalde city pound pulled up. It contained abandoned dogs of various breeds. The pound officer removed a small collie from the truck, and Brown took it by the neck. The animal, docile and quiet, stared at its captors.

Illustrations by Danijel Žeželj

Brown brandished an M-44 cartridge. He forced the dog's mouth open and, with his thumb, released the trigger on the device. It sprayed a white dust of cyanide into the collie's mouth.

The dog howled. It convulsed. It coughed blood. It screamed in pain. The animals in the truck heard its wailing. They beat against their cages and cried out.

"All right," said Brown to his trappers. "See, this stuff may be out of date, but it still works." He opened a capsule of amyl nitrite under the collie's nose. Amyl nitrite is an immediate antidote to cyanide poisoning.

The collie heaved and wheezed. Brown then seized it and unleashed another M-44 dose. The dog screamed again. Shaddox started yelling, telling Brown to stop. Brown kicked the collie into the garbage pit.

"He and the other trappers thought it was funny," Shaddox told me. "It's convulsing and dying, and he's laughing. And this is what he's teaching his men. That was just a hell of a way to die. No sympathy, no feeling, no nothing. I'm no animal-rights guy. But heartless bastards is all they were. Right there, that's the culture. And these are federal employees. This is what your government is doing to animals."

Shaddox quit his job after a series of disputes with Brown over the incident in Uvalde. He went on to a long career in wildlife law enforcement, and spent not

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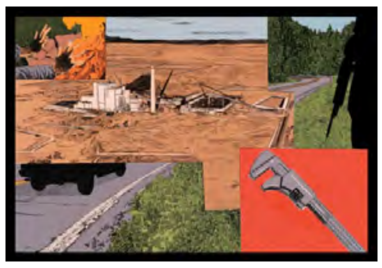

[Report]

The Machine Breaker

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Forbidden Fruit

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Over the years, Animal Damage Control has been known by many names. At its founding, in 1885, it was the Branch of Economic Ornithology. It became the Bureau of Biological Survey in 1905, and was known as the Division of Predatory Animal and Rodent Control in the 1920s. In 1985, the agency became a part of the U.S. Department of Agriculture, and in 1997, its name was changed from Animal Damage Control to Wildlife Services. The agency's purpose, however, has never changed. "The focus of a government trapper is protecting the livestock industry by killing predators," said Carter Niemeyer, a retired Wildlife Services agent. "Ranchers call us up, and the system kicks in, guns blazing."

Since 2000, Wildlife Services operatives have killed at least 2 million native mammals and 15 million native birds. Many of these animals are iconic in the American West and beloved by the public. Several are listed as endangered or threatened under the Endangered Species Act. In 2014, Wildlife Services killed 322 wolves, 61,702 coyotes, 2,930 foxes, 580 black bears, 796 bobcats, five golden eagles, and three bald eagles. The agency also killed tens of thousands of beavers, squirrels, and prairie dogs. The goal of this slaughter, according to the agency's literature, is to provide "federal leadership and expertise to resolve wildlife conflicts and create a balance that allows people and wildlife to coexist peacefully." The 1931 Animal Damage Control Act, the agency's enabling legislation, directs it to "conduct campaigns for the destruction or control" of any "animals injurious to agriculture."

By the time Niemeyer retired, in 2000, after twenty-five years at the agency, he had personally killed hundreds of coyotes and had overseen the deaths of thousands more. On some days, working in Montana, Niemeyer skinned ten coyotes an hour as helicopters hauled the heaped carcasses in from the backcountry. (The government sold the skins for revenue.) Wildlife Services gunned down coyotes from airplanes and helicopters. Its trappers used poison baits, cyanide coyote pups from dens with lengths of barbed wire, strangled them, or clubbed them. Sometimes they set the animals on fire in the dens, or suffocated them with explosive cartridges of carbon monoxide. "We joked about using napalm," Niemeyer told me.

Despite the agency's efforts to wipe out coyotes, they returned in larger numbers. "During my career, it was decades of the same thing repeated to no effect," said Niemeyer. "I think the word for this behavior is 'insanity.' But Wildlife Services has not changed, because their activities are under the public radar, and no one knows how to reform them. Their program fits the western states' obsession with killing predators."

Peter DeFazio, a Democratic congressman from Oregon, has repeatedly called for a congressional investigation of Wildlife Services, describing it as a "rogue agency" that is "secretive" and "unaccountable." He said that he considers the lethal control program a "wasteful subsidy" and has called the agency's practices "cruel and inhumane." DeFazio has proposed legislation to reduce government funding for lethal control, but Congress, under pressure from the livestock industry, rejected these attempts at reform.

"We have seen a host of credible leaked information from credible former employees about the inhumane practices," DeFazio told me recently. He said he has asked Wildlife Services for "detailed numbers about information. I've served on the Homeland Security Committee, and Wildlife Services is more difficult to get information from than our intelligence agencies."

When I went to Idaho in June 2014 to document what Wildlife Services calls "control actions," I asked the agency if I could accompany its trappers in the field. I was told by a spokeswoman that this was not possible. She explained that "only wildlife-management professionals or persons directly involved are allowed on operations, in order to conduct a safe operation."

I called up Lynne Stone, a wildlife advocate who lives in Ketchum, Idaho, to ask about probable locations for control actions in the state that summer. Stone had cultivated sources — which she refused to disclose — who fed her this highly guarded information.

We met in a café in Hailey, ten miles south of Ketchum. Stone told me that the killing of wolves by Wildlife Services was "merciless and indiscriminate." In July 2012, for example, trappers discovered four wolf pups holed up in a culvert near Idaho City. The pups were killed immediately. The reason, according to Wildlife Services, was that a single sheep had been killed by one or several "offending" wolves from a pack in the area. "Wolves generally give birth around mid-April, so these four pups were likely just over three months old," Stone told me. "They were totally dependent on their pack to feed them. How can three-month-old pups be 'offending'?"

Stone had gotten word that a wolf named B450, a gray male that was the four hundred and fiftieth wolf to be radio-collared by the state's Department of Fish and Game, was on the move in the Sawtooth Valley, forty miles to the north. In 2009, B450 had survived the destruction of his father, mother, brothers, and sisters, who were alleged to have attacked livestock near the town of Stanley, Idaho, and were shot by Wildlife Services trappers in airplanes and helicopters. For two years, B450 had wandered central Idaho alone, but in the spring of 2012 he found a mate, who bore him three pups. They formed a new pack. It was likely, Stone told me, that B450's pack would encounter cattle and sheep grazing on the valley's lush summer grass, and that Wildlife Services would be called in if the wolves opted to prey on the ready meat.

A day after talking with Stone, I drove to the Sawtooth Valley with Natalie Ertz, the founder of WildLands Defense, a nonprofit that monitors wolf packs and their habitats. As we traveled on a dirt road near the headwaters of the Salmon River, Ertz listened on her radio monitor, hoping for a transmission from B450's collar. A storm blew in from the west, the temperature plummeted, and the sky shook with snow. "Wait," she said. She got out of the truck to inspect a frozen pile of scat in the road. It was the leaving of a coyote.

We drove on, and passed a man on a horse who was herding several dozen bleating sheep. "Tasty little meals for a wolf," Ertz said. She admitted that she didn't like ranchers. "It's not personal," she said. "It's that ranchers, as a means of doing business, get Wildlife Services to kill wolves for them."

That night we found a campsite on a benchland under tall pines. We set our tents and built a fire and listened again for the chirrup of B450 on the receiver. Ertz stood up and howled in the night, but no answer came. Not even the coyotes sang.

We listened again for the signal in the morning, hiking through the wet forest after the storm had passed and the weather had warmed. Nothing. "That's good," said

Two weeks later, on June 29, after we were gone from the Sawtooth Valley, a calf was allegedly killed by one wolf or several. The calf's owner called Wildlife Services, whose agents set traps to kill "all offending wolves" in the area. By July 2, a yearling called B647, the son of B450, was found near death in a trap and was killed by an agent. On July 9, a subadult female from the pack, B648, was shot by Wildlife Services. It required two more days to bait and catch B450 in a leghold trap. A Wildlife Services agent killed him too.

John Peavey is a third-generation rancher in central Idaho who runs 7,000 sheep on Flat Top ranch, which lies fifty miles south of the Sawtooth Valley, and on tens of thousands of acres of adjacent public lands. He served for two decades in the Idaho state senate and worked from a young age at Flat Top. During his time in political office, Peavey was known never to appear in public without a cowboy hat on his head.

I told him I was doing an investigation of Wildlife Services. "I suspect this will be an ugly article," he said. "But Wildlife Services is pretty vital to our making do. Predators are a big problem for ranchers in the West. It's our number-one problem. We can't survive without taking care of the predation."

Peavey told me that he loses at least 200 sheep a year to predators and regularly calls Wildlife Services to his aid. In May 2013, he said, he lost more than thirty sheep to wolves. "We were range-lambing, and the wolves come and scatter them to hell and breakfast. One little lamb, about ten minutes old, was killed by a wolf. Really tragic, it just makes you cry — a ten-minute life span." At Peavey's request, Wildlife Services used one of the agency's Piper Cub airplanes to track and shoot six wolves from a pack that was roaming near Flat Top ranch.

Peavey has attempted to use nonlethal methods to dissuade wolves from attacking his sheep on the range, but he claims that they have had little effect. "My guys are out blaring their radios and flashing their lights where we build a fire — and we have big guard dogs, one-hundred-pound Pyrenees and Akbash, though wolves often kill our dogs. We've probably lost ten to twelve dogs over the last six years." His wife, Diane Josephy Peavey, who in recent years has read essays on Idaho public radio praising the virtues of ranching, told me, "It's a little hard to be where we are, with sheep, and watch them get slaughtered, and we're supposed to put the money in to coexist nonlethally. That's fine, but it's a huge expense. Coexistence means the wolves live and all the other animals die."

John Peavey told me that range-lambing — in which ewes give birth on open public lands rather than in protected sheds on private land — is the only way for ranchers to make a profit. Shed-lambing requires a lot of hay, at great cost. "Six hundred thousand dollars is probably not enough money to outfit a hay crew," he said. "Shed-lambing is too expensive. Our business model is to range-lamb when the weather is warm and the grass is growing. And when the wolves come in, it's incredibly disruptive. We're very vulnerable."

Carter Niemeyer, the retired Wildlife Services agent, said that Peavey's range-lambing operation is also expensive, but the cost gets shifted onto the federal government. "The history of John Peavey over the years has been that when he's out range-lambing, it's led to a lot of calls to Wildlife Services for the removal of wolves and coyotes," he said. "His range-lambing is a long way from home, out there in sagebrush. When the sheep are lambing, the herders aren't supposed to crowd them. You leave them alone. So you've got sheep strung out for miles, ripe for the picking. All you're doing is inviting attack. In some cases, when you put livestock way out there in the backcountry where it's beyond the capability of the owner to protect them, it's a form of animal cruelty. Do we continue to reward this bad behavior by bringing in gunships to kill predators that are simply reacting to lambs on the range as predators should and must react?"

Niemeyer said that it was galling to watch stockmen use public lands for forage while refusing to accept the real price of their business model. He told me about a former Wildlife Services agent who described sheep ranchers as "cry boys and cheap men" — because, as Niemeyer put it, "they're always whining and they're incredibly cheap, demanding the public pay their costs."

I asked him about Peavey's claim that predators are the number-one problem facing ranchers. The most recent reports from the National Agricultural Statistics Service, a branch of the USDA, suggest that stockmen annually lose almost 500,000 head to predators nationwide. The USDA data, however, is based on self-reporting by ranchers.

Niemeyer told me I should also look at the methods Wildlife Services used to confirm depredations. The agency was supposed to conduct its own due diligence of ranchers' reports, but the investigations were farcical. "A rancher calls up and says, 'Goddamn wolves killed twenty-eight of my stock,' but he can't prove a thing. And we say, 'All right, Charlie, we'll get 'em.' The trapper shows up to the site and toes the carcass of the animal with his boot. 'Yep. Wolf did it.' And that's the investigation. Of course a wolf did it — the rancher says so, which makes it the truth."

After Rex Shaddox left Wildlife Services, in 1980, he worked as an undercover narcotics cop in Texas and Colorado, an investigator for the Humane Society of the United States, and a wildlife-crimes detective with the Texas Parks and Wildlife Department, where he is still posted. He has continued to follow Wildlife Services' activities as a part of his current job. "If you're a wildlife cop," he told me, "you constantly hear about Wildlife Services doing bad things."

Between January 1990 and September 1991, Shaddox led an undercover investigation into the illegal distribution and use of a poison called Compound

1080 in Wyoming. The tasteless, odorless toxin has no known antidote. A single ounce can kill 200 adult humans, or 20,000 coyotes, or 70,000 house cats.

Stockpiles of the poison were supposed to have been destroyed or turned over to the Environmental Protection Agency after it was banned in 1972, but the State of Wyoming never complied with the destruction order. Instead, Wildlife Services, along with members of the Wyoming Wool Growers Association, the Wyoming Farm Bureau, and the state's Department of Agriculture, secretly sold Compound 1080 to ranchers for use in what Shaddox described as a conspiracy for "the illegal poisoning of wildlife, the illegal lacing of cadavers with poisons on public lands, and the illegal killing of endangered species." Not one government official implicated in the conspiracy went to jail. "Some of these guys got better jobs in Wildlife Services," Shaddox said.

Doug McKenna, who retired in 2012 after twenty-five years as a wildlife-crimes enforcement officer at the U.S. Fish and Wildlife Service, worked with Shaddox on the Wyoming investigation. I asked McKenna whether he thought Wildlife Services had reformed its ways. "I don't believe it for a minute," he said. "The agency still disregards federal and state environmental, wildlife-protection, and resource regulations."

He told me about an Arizona rancher named Jose Manterola, who, in 2002, had poisoned — accidentally, by his account — bald eagles that were roosting on the public-land allotments where he was running sheep. "We went to Wildlife Services and asked them for help with the investigation. The trappers told us, 'We can't talk to you because this guy is a client of ours.' I was shocked. We're a federal agency asking another federal agency for help in a criminal investigation, and we were stonewalled. We eventually prosecuted the rancher, and his federal grazing lease was revoked, but we got no help from Wildlife Services."

When domestic pets were accidentally killed by poisons that had been distributed by Wildlife Services shut up." Shaddox said that Charles Brown, the supervisor who poisoned the collie with M-44, ordered him to "cover up the killing of these nontarget dogs, to remove the collars and bury the dead animals, and make sure always to separate the collars and the bodies." (Brown, who is now the agency's eastern regional director, declined to comment for this article.)

I asked Shaddox whether he believed that Wildlife Services was acting extralegally today. "I know absolutely that it's still going on," he said. "I hear it from state and federal wildlife agents. I know absolutely that the cover-up of the illegal killing of domestic pets, the illegal poisoning of wildlife, and the illegal use of 1080 and M-44s is still going on."

Samuel Sanders, another former trapper I spoke with, worked for Wildlife Services in Nevada for seven years. He rose to the rank of supervisor before quitting in 2011. "Violating both federal and state law when it comes to the application of pesticides is encouraged by Wildlife Services," Sanders told me. Employees, he said, weren't properly certified for the use of poisons in the field. "The certification test was fixed so that employees always pass. The supervisor reads the answers off to employees."

Shortly before he quit, Sanders filed a complaint against Wildlife Services in the federal Merit Systems Protection Board court, charging that his higher-ups retaliated against him for whistleblowing about the agency's violations of federal and state law. The judge dismissed the case on a technicality.

"Although many employees have witnessed some of their co-workers and even supervisors violate laws," Sanders told me, "they say nothing, fearing the retaliation they've witnessed when others have reported the violations. They think it will just stop happening after time, but it doesn't. They know the supervisors are aware of the violations. When an employee does report violations by W.S. employees or management, upper management does a token investigation to cover up the incident. Even the national leaders in D.C. have been made aware of this, and they do the same thing."

In 2012, a Wildlife Services trapper named Jamie Olson posted a series of graphic photos to Facebook that appeared to depict his dogs attacking and killing a coyote caught in a leg trap in Wyoming. He included portraits of himself smiling beside a coyote's mutilated cadaver. (Olson declined to comment for this article.)

In response to the photos, Peter DeFazio wrote a letter to Thomas Vilsack, the secretary of the USDA, requesting an audit of "the culture within Wildlife Services." His letter stated that Olson "may have apparently committed acts of animal cruelty" that violated the agency's directives about trapped wildlife. Those directives include instructions that trapped animals "be dispatched immediately" and that employees "exhibit a high level of respect and professionalism when taking an animal's life."

An internal investigation by Wildlife Services concluded that the trapped coyote was being used by Olson to train his dogs "how to 'posture' when confronting a trapped coyote." Shaddox scoffed at this account. "I've read the report and findings and looked at the photos. The dogs are absolutely attacking and killing the coyote in the series of pictures," he told me.

Olson was not fired or reprimanded for his treatment of the coyote. His behavior, according to Wildlife Services documents, "violated no existing rules."

In September 2014, I drove into Idaho's Salmon-Challis National Forest with Natalie Ertz's brother, Brian, who had spent many hundreds of hours tracking Wildlife Services trappers to document their kills. We had gotten information about a pending lethal-control action against a pack of wolves in Moyer Basin, a remote valley of the Yellowjacket Mountains, where Wildlife Services agents, according to our source, would be out prowling the sky in one of the Piper Cubs, a noisy yellow single-prop known as the

We camped on a forested bluff overlooking the valley. We'd have a fine view of the airplane's kill zone. The landscape was splendid. The soft-contoured mountains faded in distant blue shrouds, the great forests of conifers sighed in the breeze, the autumn aspens glowed in the slant light of the afternoon sun, and the rich bottomlands were flooded behind beaver dams. "Prime wolf habitat," Ertz said.

A September storm erupted during the night and bent our tents, pelting us with rain and sleet, and soaking our sleeping bags. Ertz awoke before me, keeping his ear to the sky at dawn. But no Killer Bee.

Over breakfast he recounted the two days he'd spent in the spring of 2010 looking for members of the Buffalo Ridge wolf pack, which he heard had been targeted with a kill order. The pack had been seen near Squaw Creek, a tributary of the Salmon River that ran seventy-five miles south of Moyer Basin. Ertz arrived before the trappers, ascended through an aspen grove, and found where the pack was denning. The adults were on a hunt, and had left their pups behind. The afternoon was overcast, Ertz said, and threatening rain. Each time the thunder rumbled, the pups, young and innocent, howled in response, volleying their high-pitched cries in a kind of conversation with the sky. "It was one of the most profoundly wild experiences of my life," Ertz told me.

Ertz and I set out in his car, driving up and down rough dirt roads for several hours until at midday we found a flatbed Ford parked in a meadow next to a stream. The decals on the door said USDA, and a ramp attached to the bed suggested that it had carried an A.T.V. whose driver was off in the backcountry.

There was a warning on a fence post nearby:

> MECHANICAL DEVICES (TRAPS, SNARES, OR OTHER RESTRAINING DEVICES) HAVE BEEN PLACED IN THIS AREA TO CAPTURE ANIMALS CAUSING DAMAGE OR HARM. THESE DEVICES AND THE ANIMALS CAPTURED IN THEM ARE THE PROPERTY OF THE UNITED STATES GOVERNMENT.

We waited. After two hours, an A.T.V. came trundling toward us, driven by a trapper in his thirties who wore a hooded sweatshirt and a trucker's cap. Strapped across the dashboard was a four-foot pole with a loop at its end. The loop is meant to cinch around a wolf's neck so that an animal can be killed without close contact.

The trapper wouldn't give his name. I asked him about the trapping of wolves in Moyer Basin. "I'm not supposed to be talking to you," he said. "Talk to Todd Grimm" — referring to the Idaho state director of Wildlife Services.

Indicating the nearby sign, I asked what kinds of traps he was using, where they were located, and whether they posed a risk to the public. "Talk to Todd," he said. "That sign has warned you, and that's all I'm going to say."

When I asked for a phone interview with Wildlife Services, Lyndsay Cole, an assistant director of public affairs at the USDA, asked me to provide all my questions in writing. I submitted thirty-five questions related to specific points in this article and to Wildlife Services policy as a whole. Cole didn't answer the questions; instead, she emailed me a single-page statement with links to various public-relations documents the agency had put out. "Wildlife Services experts use a science-based Integrated Wildlife Damage Management (IWDM) decision-making model," the statement said. "Activities are conducted to minimize negative impacts to overall native wildlife populations." Cole eventually responded to questions sent by a fact-checker from this magazine. She stated, in part, "We aren't able to speculate on methods that may have been used against policy in the past," and called the examples of agency misbehavior "not representative." When I asked Wildlife Services if I could talk with Todd Grimm, the agency did not respond to the request.

Once, during Carter Niemeyer's time with Wildlife Services in Montana, a sheep rancher course not," Niemeyer told him. "Why do you ask?" Wildlife Services had recently mounted an aerial-gunning campaign in the hills around the rancher's property to strike at coyotes before they could take sheep. The result of the cull, the perplexed rancher explained, was increased depredation.

Rob Wielgus, a wildlife ecologist at Washington State University, has an explanation for this paradox. In 2013, he examined data that showed that the hunting of adult male cougars led to more attacks on livestock by the remaining cat population. "Killing older resident cats resulted in a huge influx of teenage male cats," Wielgus told me. "The teenage males are the livestock depredators. The older cats were cops that kept the younger troublemakers out."

In 2014, Wielgus published a similar study of wolves and their attacks on livestock in Idaho, Wyoming, and Montana. He reviewed the number of wolves that were killed annually over twenty-five years and the number of depredations of livestock for each year, and declared that the livestock industry was "not going to be happy" with his conclusion: Kill more wolves, he said, and depredations on livestock increase.

Wielgus believes that lethal assaults on predators produce social chaos in their populations. "We've now seen this in grizzlies, black bears, cougars, leopards, and wolves. Social disruption is a huge negative effect. Why is the livestock lobby unhappy with this? Because they want to kill predators. They cannot believe the scientific evidence. They're convinced that the only good predator is a dead predator."

Niemeyer had told me to read the work of Robert Crabtree, an ecologist and the founder of the Yellowstone Ecological Research Center. Crabtree found that more coyote pups within a given litter survive if their numbers are culled. Not only are there more attacks on livestock following lethal control of coyotes — there are also more coyotes. Wildlife Services has killed nearly a million coyotes during the past decade, but the number of coyotes in the seventeen

"We keep family units broken up, leading to a lot of dispersal, a lot of subadult coyotes moving into other country after their families are broken, and younger coyotes breeding sooner than they would if they weren't thrown into being alone," Niemeyer said. "It's all very self-serving for the Wildlife Services program. You create steady work by steady persecution."

In 1998, Peter DeFazio sponsored an amendment to reduce funding to Wildlife Services by $10 million, from a total budget of $50 million. The bill passed in the House by a vote of 229 to 193. Then the American Farm Bureau went into action, bombarding members with phone calls and faxes. House Republican Joe Skeen, a New Mexico stockman whose ranch had been visited ninety-nine times by Animal Damage Control agents between 1991 and 1996, led the assault on the amendment. Within twenty-four hours, the House took the unusual step of revoting the bill. Thirty-eight lawmakers switched their votes from yes to no. "I've seen such a revote happen perhaps a half-dozen times in twenty-one years in Congress," DeFazio told me.

In 2011, he tried again. He sponsored an amendment to the House agriculture appropriations bill to cut $11 million from Wildlife Services' budget. The amendment, which would have returned the money to the federal treasury for deficit reduction, was endorsed by Taxpayers for Common Sense, the Humane Society, and the Natural Resources Defense Council. It was defeated.

In 2012, DeFazio introduced a bill called the Compound 1080 and Sodium Cyanide Elimination Act, which would have banned the deployment of sodium cyanide for predator control and the use of Compound 1080 for any purpose. The bill died in committee.

Jonathan Lovvorn, the chief counsel at the Humane Society of the United States, says that he has tried and failed to rein in Wildlife Services through the court system. The agency's statutory mandate "just says, 'Kill wildlife,' without any restrictions," he told me. "There really is no law to apply that might restrain the agency, even with a sympathetic judge."

Recently, I spoke on the phone with Brooks Fahy, the executive director of Predator Defense, a nonprofit group based in Oregon. Fahy has spent more than thirty years monitoring Wildlife Services. He doesn't see much hope. "The political power of livestock is too strong," he said. I asked Fahy about the Wildlife Services Reform Act, which DeFazio drafted but failed to propose in the last session. It would have banned aerial gunning, along with the use of neck and foot snares and M-44 cyanide devices, and mandated the housing of livestock behind barriers during lambing and calving season. It would have also required that "all available and viable nonlethal management and control methods" be attempted before lethal control is implemented. The nonlethal methods include electric fencing to shock and dissuade predators; "harassment and scaring devices," namely "pyrotechnics and noisemakers, trained dogs, effigies, electronic devices such as recorded distress calls"; and "lights such as spotlights, strobe lights, and lasers."

The bill itself was a compromise, fashioned to be politically acceptable to ranching interests by promoting the idea that livestock and predators can coexist on public lands. Fahy was skeptical. "We can have more fencing, sirens, and strobe lights," he said, "but at what cost to the ecosystem and the wildlife?" And in the end it may be, as John Peavey's experience suggests, that these measures will not work. Wolves, after all, were designed to eat sheep.

In the meantime, the lethal-control methods continue to bear unintended consequences. In 1998, Bill Guerra Addington, a third-generation Texan, tripped an antiquated M-44 that was designed to fire a .38 Special cartridge. He nearly lost his hand to the bullet. "I equate these predator-killing devices to land mines designed to kill people," he wrote in a letter to DeFazio. In 2003, Dennis Slaugh, a rockhound from was sprayed in the face with white poison dust. He began vomiting and rushed to a hospital. The cyanide has lingered in his system and is slowly starving his body of oxygen.

Brooks Fahy said that he has received several hundred reports from pet owners about the disappearance of dogs and cats owing to what the owners claim were Wildlife Services activities. He told me the story of a pit bull named Bella, who was killed in Texas, in 2011, by an M-44 trap. The trap was placed less than a thousand feet from the doorstep of Angel and J. D. Walker, the dog's owners. According to Fahy, the trapper had received special permission from Wildlife Services to kill coyotes outside his normally assigned duty areas as a favor to his father, who leased ranchland adjacent to the Walkers' property. The Walkers found Bella dead ninety feet from the trap. Her mouth was bloody. She had vomited. "She had a horrible, weird smell, not just a death smell," said Angel.

The Walkers buried their dog, and the next day they complained to Michael J. Bodenchuk, the agency's Texas director. "He never responded to us at all," said Angel. The following week, the local trapper reset the M-44s that he had placed near the Walkers' house, including the one that had killed Bella. One afternoon, returning home from school with her sons, Angel found three freshly killed coyotes hung on the fence along the road, with wire tied around their necks. She considered it a message from Wildlife Services.

Christopher Ketchamis a fellow at MIT's Knight Science Journalism program. His most recent article for *Harper's Magazine,* "The Great Republican Land Heist," appeared in the February 2015 issue.

TAGS
21st century Agricultural pests Career as Oregon congressman Career as sheep farmer Career in wildlife law enforcement Career in Wildlife Services Carter Niemeyer Control Coyotes Dogs Endangered species Government policy John Peavey Mortality Natalie Ertz Officials and employees Pesticides and wildlife Peter DeFazio Pets Poisoning in animals Predatory animals Public lands Rex Shaddox Samuel Sanders Sheep farming Sodium cyanide Trapping United States Views on wolf control Wildlife depredation Wildlife management Wildlife

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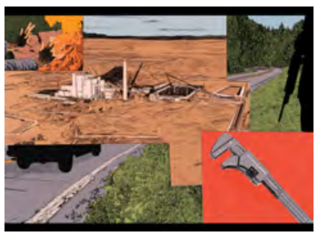

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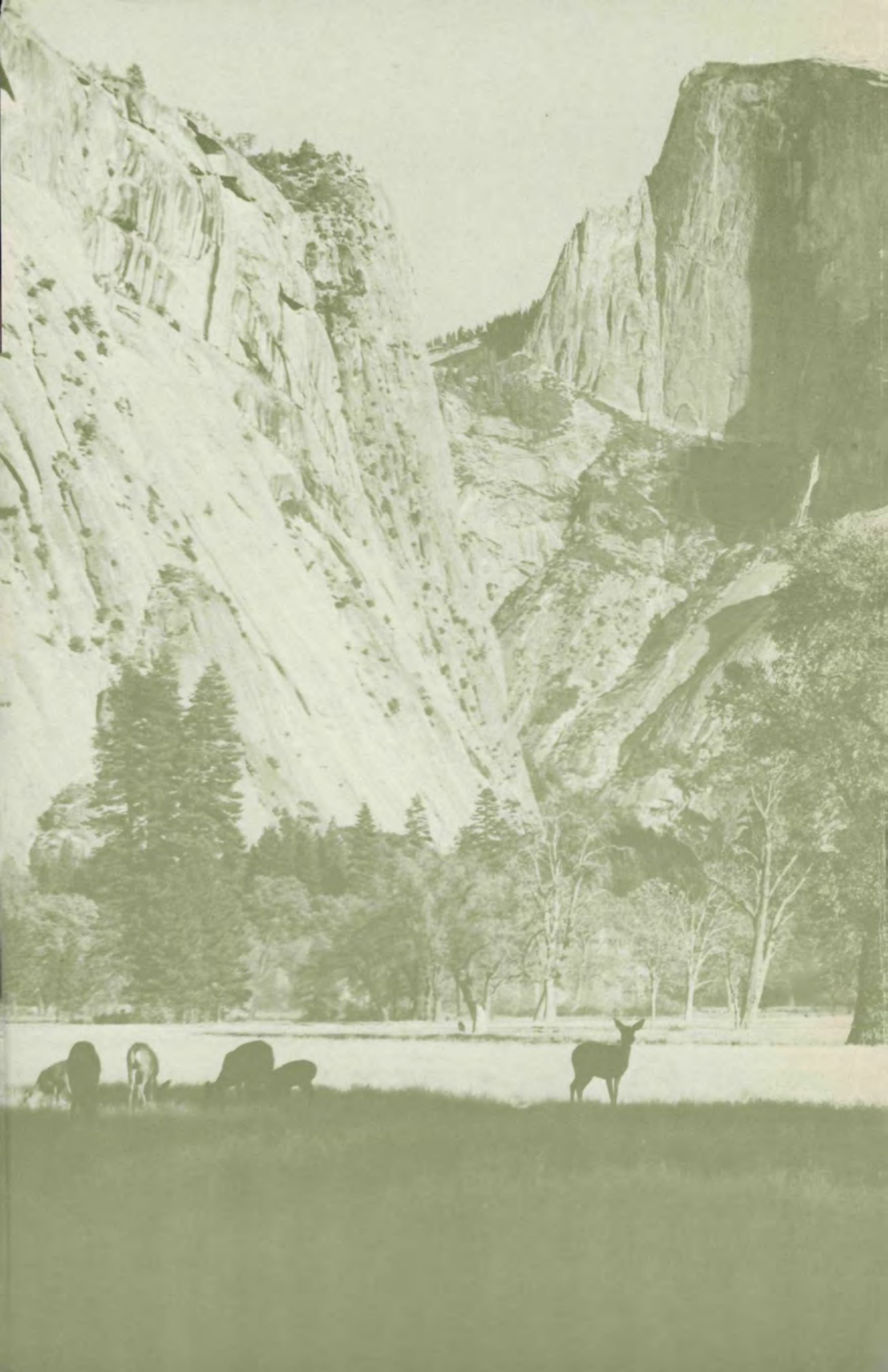

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IN THE NATIONAL PARKS

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WILDLIFE MANAGEMENT IN THE NATIONAL PARKS

ADVISORY BOARD ON WILDLIFE MANAGEMENT, APPOINTED BY SECRETARY OF THE INTERIOR UDALL

A. S. Leopold (Chairman), S. A. Cain, C. M. Cottam, I. N. Gabrielson, T. L. Kimball

March 4, 1963

Historical

In the Congressional Act of 1916 which created the National Park Service, preservation of native animal life was clearly specified as one of the purposes of the parks. A frequently quoted passage of the Act states " . . . which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

In implementing this Act, the newly formed Park Service developed a philosophy of wildlife *protection,* which in that era was indeed the most obvious and immediate need in wildlife conservation. Thus the parks were established as refuges, the animal populations were protected from wildfire. For a time predators were controlled to protect the "good" animals from the "bad" ones, but this endeavor mercifully ceased in the 1930's. On the whole, there was little major change in the Park Service practice of wildlife management during the first 40 years of its existence.

During the same era, the concept of wildlife management evolved rapidly among other agencies and groups concerned with the production of wildlife for recreational hunting. It is now an accepted truism that maintenance of suitable habitat is the key to sustaining animal populations, and that protection, though it is important, is not of itself a substitute for habitat. Moreover, habitat is not a fixed or stable entity that can be set aside and preserved behind a fence, like a cliff dwelling or a petrified tree. Biotic communities change through natural stages of succession. They can be changed deliberately through manipulation of plant and animal populations. In recent years the National Park Service has broadened its concept of wildlife conservation to provide for purposeful management of plant and animal communities as an essential step in preserving wildlife resources ". . . unimpaired for the enjoyment of future generations." In a few parks active manipulation of habitat is being tested, as for example in the Everglades where controlled burning is now used experimentally to maintain the open glades and piney woods with their interesting animal and plant life. Excess populations of grazing ungulates are being controlled in a number of parks to preserve the forage plants on which the animals depend. The question already has been posed—how far should the National Park Service go in utilizing the tools of management to maintain wildlife populations?

The Concept of Park Management

The present report proposes to discuss wildlife management in the national parks in terms of three questions which shift emphasis progressively from the general to the specific:

1) What should be the *goals* of wildlife management in the national parks?

2) What general *policies* of management are best adapted to achieve the pre-determined goals?

3) What are some of the *methods* suitable for on-the-ground implementation of policies?

It is acknowledged that this Advisory Board was requested by the Secretary of the Interior to consider particularly one of the methods of management, namely, the procedure of removing excess ungulates from some of the parks. We feel that this specific question can only be viewed objectively in the light of goals and operational policies, and our report is framed accordingly. In speaking of national parks we refer to the whole system of parks and monuments; national recreation areas are discussed briefly near the end of the report.

As a prelude to presenting our thoughts on the goals, policies, and methods of managing wildlife in the parks of the United States we wish to quote in full a brief report on "Management of National Parks and Equivalent Areas" which was formulated by a committee of the First World Conference on National Parks that convened in Seattle in July, 1962. The committee consisted of 15 members of the Conference, representing eight nations; the chairman was Francois Bourliere of France. In our judgment this report suggests a firm basis for park management. The statement of the committee follows:

"1. Management is defined as any activity directed toward achieving or maintaining a given condition in plant and or animal populations and/or habitats in accordance with the conservation plan for the area.

A prior definition of the purposes and objectives of each park is assumed. "Management may involve active manipulation of the plant and animal communities, or protection from modification or external influences.

"2. Few of the world's parks are large enough to be in fact self-regulatory ecological units; rather, most are ecological islands subject to direct or indirect modification by activities and conditions in the surrounding areas. These influences may involve such factors as immigration and/or emigration of animal and plant life, changes in the fire regime, and alterations in the surface or subsurface water.

"3. There is no need for active modification to maintain large examples of the relatively stable 'climax' communities which under protection perpetuate themselves indefinitely. Examples of such communities include large tracts of undisturbed rain-forests, tropical mountain paramos, and arctic tundra.

"4. However, most biotic communities are in a constant state of change due to natural or man-caused processes of ecolgical succession. In these 'successional' communities it is necessary to manage the habitat to achieve or stabilize it at a desired stage. For example, fire is an essential management tool to maintain East African open savanna or American prairie.

"5. Where animal populations get out of balance with their habitat and threaten the continued existence of a desired environment, population control becomes essential. This principal applies, for example, in situations where ungulate populations have exceeded the carrying capacity of their habitat through loss of predators, immigration from surrounding areas, or compression of normal migratory patterns. Specific examples include excess populations of elephants in some African parks and of ungulates in some mountain parks.

"6. The need for management, the feasibility of management methods, and evaluation of results must be based upon current and continuing scientific research. Both the research and management itself should be undertaken only by qualified personnel. Research, management, planning, and execution must take into account, and if necessary regulate, the human uses for which the park is intended.

"7. Management based on scientific research is, therefore, not only desirable but often essential to maintain some biotic communities in accordance with the conservation plan of a national park or equivalent area."

The Goal of Park Management in the United States

Item 1 in the report just quoted specifies that "a prior definition of the purposes and objectives of each park is assumed." In other words, the goal must first be defined.

As a primary goal, we would recommend that the biotic associations within each park be maintained, or where necessary recreated, as nearly as possible in the condition that prevailed when the area was first visited by the white man. A national park should represent a vignette of primitive America.

The implications of this seemingly simple aspiration are stupendous. Many of our national parks—in fact most of them—went through periods of indiscriminate logging, burning, livestock grazing, hunting and predator control. Then they entered the park system and shifted abruptly to a regime of equally unnatural protection from lightning fires, from insect outbreaks, absence of natural controls of ungulates, and in some areas elimination of normal fluctuations in water levels. Exotic vertibrates, insects, plants, and plant diseases have inadvertently been introduced. And of course lastly there is the factor of human use—of roads and trampling and camp grounds and pack stock. The resultant biotic associations in many of our parks are artifacts, pure and simple. They represent a complex ecologic history but they do not necessarily represent primitive America.

Restoring the primitive scene is not done easily nor can it be done completely. Some species are extinct. Given time, an eastern hardwood forest can be regrown to maturity but the chestnut will be missing and so will the roar of pigeon wings. The colorful drapanid finches are not to be heard again in the lowland forests of Hawaii, nor will the jack-hammer of the ivory-bill ring in southern swamps. The wolf and grizzly bear cannot readily be reintroduced into ranching communities, and the factor of human use of the parks is subject only to regulation, not elimination. Exotic plants, animals, and diseases are here to stay. All these limitations we fully realize. Yet, if the goal cannot be fully achieved it can be approached. A reasonable illusion of primitive America could be recreated, using the utmost in skill, judgment, and ecologic sensitivity. This in our opinion should be the objective of every national park and monument.

To illustrate the goal more specifically, let us cite some cases. A visitor entering Grand Teton National Park from the south drives across Antelope Flats. But there are no antelope. No one seems to be asking the question—why aren't there? If the mountain men who gathered here in rendezvous fed their squaws an antelope, a 20th century tourist at least should be able to see a band of these animals. Finding out what aspect of the range needs rectifying, and doing so, would appear to be a primary function of park management.

When the forty-niners poured over the Sierra Nevada into California, those that kept diaries spoke almost to a man of the wide-spaced columns of mature trees that grew on the lower western slope in gigantic magnificence. The ground was a grass parkland, in springtime carpeted with wildflowers. Deer and bears were abundant. Today much of the west slopes is a dog-hair thicket of young pines, white fir, incense cedar, and mature brush—a direct function of overprotection from natural ground fires. Within the four national parks—Lassen, Yosemite, Sequoia, and Kings Canyon—the thickets are even more impenetrable than elsewhere. Not only is this accumulation of fuel dangerous to the giant sequoias and other mature trees but the animal life is meager, wildflowers are sparse, and to some at least the vegetative tangle is depressing, not uplifting. Is it possible that the primitive open forest could be restored, at least on a local scale? And if so, how? We cannot offer an answer. But we are posing a question to which there should be an answer of immense concern to the National Park Service.

The scarcity of bighorn sheep in the Sierra Nevada represents another type of management problem. Though they have been effectively protected for nearly half a century, there are fewer than 400 bighorns in the Sierra. Two-thirds of them are found in summer along the crest which lies within the eastern border of Sequoia and Kings Canyon National Parks. Obviously, there is some shortcoming of habitat that precludes further increase in the population. The high country is still recovering slowly from the devastation of early domestic sheep grazing so graphically described by John Muir. But the present limitation may not be in the high summer range at all but rather along the eastern slope of the Sierra where the bighorns winter on lands in the jurisdiction of the Forest Service. These areas are grazed in summer by domestic livestock and large numbers of mule deer, and it is possible that such competitive use is adversely affecting the bighorns. It would seem to us that the National Park Service might well take the lead in studying this problem and in formulating cooperative management plans with other agencies even though the management problem lies outside the park boundary. The goal, after all, is to restore the Sierra bighorn. If restoration is achieved in the Sequoia-Kings Canyon region, there might follow a program of reintroduction and restoration of bighorns in Yosemite and Lassen National Parks, and Lava Beds National Monument, within which areas this magnificent native animal is presently extinct.

We hope that these examples clarify what we mean by the goal of park management.

Policies of Park Management

The major policy change which we would recommend to the National Park Service is that it recognize the enormous complexity of ecologic communities and the diversity of management procedures required to preserve them. The traditional, simple formula of protection may be exactly what is needed to maintain such climax associations as arctic-alpine heath, the rain forests of Olympic peninsula, or the Joshua trees and saguaros of southwestern deserts. On the other hand, grasslands, savannas, aspen, and other successional shrub and tree associations may call for very different treatment. Reluctance to undertake biotic management can never lead to a realistic presentation of primitive America, much of which supported successional communities that were maintained by fires, floods, hurricanes, and other natural forces.

A second statement of policy that we would reiterate—and this one conforms with present Park Service standards—is that management be limited to native plants and animals. Exotics have intruded into nearly all of the parks but they need not be encouraged, even those that have interest of ecologic values of their own. Restoration of antelope in Jackson Hole, for example, should be done by managing native forage plants, not by planting crested wheat grass or plots of irrigated alfalfa. Gambel quail in a desert wash should be observed in the shade of a mesquite, not a tamarisk. A visitor who climbs a volcano in Hawaii ought to see mamane trees and silver-swords, not goats.

Carrying this point further, observable artificiality in any form must be minimized and obscured in every possible way. Wildlife should not be displayed in fenced enclosures; this is the function of a zoo, not a national park. In the same category is artificial feeding of wildlife. Fed bears become bums, and dangerous. Fed elk deplete natural ranges. Forage relationships in wild animals should be natural. Management may at times call for the use of the tractor, chain-saw, rifle, or flame-thrower but the signs and sounds of such activity should be hidden from visitors insofar as possible. In this regard, perhaps the most dangerous tool of all is the roadgrader. Although the American public demands automotive access to the parks, road systems must be rigidly prescribed as to extent and design. Roadless wilderness areas should be permanently zoned. The goal, we repeat, is to maintain or create the mood of wild America. We are speaking here of restoring wildlife to enhance this mood, but the whole effect can be lost if the parks are overdeveloped for motorized travel. If too many tourists crowd the roadways, then we should ration the tourists rather than expand the roadways.

Additionally in this connection, it seems incongruous that there should exist in the national parks mass recreation facilities such as golf courses, ski lifts, motorboat marinas, and other extraneous developments which completely contradict the management goal. We urge the National Park Service to reverse its policy of permitting these non-conforming uses, and to liquidate them as expeditiously as possible (painful as this will be to concessionaires). Above all other policies, the maintenance of naturalness should prevail.

Another major policy matter concerns the research which must form the basis of all management programs. The agency best fitted to study park management problems is the National Park Service itself. Much help and guidance can be obtained from ecologic research conducted by other agencies, but the objectives of park management are so different from those of state fish and game departments, the Forest Service, etc., as to demand highly skilled studies of a very specialized nature. Management without knowledge would be a dangerous policy indeed. Most of the research now conducted by the National Park Service is oriented largely to interpretive functions rather than to management. We urge the expansion of the research activity in the Service to prepare for future management and restoration programs. As models of the type of investigation that should be greatly accelerated we cite some of the recent studies of elk in Yellowstone and of bighorn sheep in Death Valley. Additionally, however, there are needed equally critical appraisals of ecologic relationships in various plant associations and of many lesser organisms such as azaleas, lupines, chipmunks, towhees, and other non-economic species.

In consonance with the above policy statements, it follows logically that every phase of management itself be under the full jurisdiction of biologically trained personnel of the Park Service. This applies not only to habitat manipulation but to all facets of regulating animal populations. Reducing the numbers of elk in Yellowstone or of goats on Haleakala Crater is part of an overall scheme to preserve or restore a natural biotic scene. The purpose is single-minded. We cannot endorse the view that responsibility for removing excess game animals be shared with state fish and game departments whose primary interest would be to capitalize on the recreational value of the public hunting that could thus be supplied. Such a proposal imputes a multiple use concept of park management which was never intended, which is not legally permitted, nor for which can we find any impelling justification today.

Purely from the standpoint of how best to achieve the goal of park management, as here defined, unilateral administration directed to a single objective is obviously superior to divided responsibility in which secondary goals, such as recreational hunting, are introduced. Additionally, uncontrolled public hunting might well operate in opposition to the goal, by removing roadside animals and frightening the survivors, to the end that public viewing of wildlife would be materially impaired. In one national park, namely Grand Teton, public hunting was specified by Congress as the method to be used in controlling elk. Extended trial suggests this to be an awkward administrative tool at best.

Since this whole matter is of particular current interest it will be elaborated in a subsequent section on methods.

Methods of Habitat Management

It is obviously impossible to mention in this brief report all the possible techniques that might be used by the National Park Service in manipulating plant and animal populations. We can, however, single out a few examples. In so doing, it should be kept in mind that the total area of any one park, or of the parks collectively, that may be managed intensively is a very modest part indeed. This is so for two reasons. First, critical areas which may determine animal abundance are often a small fraction of total range. One deer study on the west slope of the Sierra Nevada, for example, showed that important winter range, which could be manipulated to support the deer, constituted less than two per cent of the year-long herd range. Roadside areas that might be managed to display a more varied and natural flora and fauna can be rather narrow strips. Intensive management, in short, need not be extensive to be effective. Secondly, manipulation of vegetation is often exorbitantly expensive. Especially will this be true when the objective is to manage "invisibly"—that is, to conceal the signs of management. Controlled burning is the only method that may have extensive application.

The first step in park management is historical research, to ascertain as accurately as possible what plants and animals and biotic associations existed originally in each locality. Much of this has been done already.

A second step should be ecologic research on plant-animal relationships leading to formulation of a management hypothesis.

Next should come small scale experimentation to test the hypothesis in practice. Experimental plots can be situated out of sight of roads and visitor centers.

Lastly, application of tested management methods can be undertaken on critical areas.

By this process of study and pre-testing, mistakes can be minimized. Likewise, public groups vitally interested in park management can be shown the results of research and testing before general application, thereby eliminating possible misunderstanding and friction.

Some management methods now in use by the National Park Service seem to us potentially dangerous. For example, we wish to raise a serious question about the mass application of insecticides in the control of forest insects. Such application may (or may not) be justified in commercial timber stands, but in a national park the ecologic impact can have unanticipated effects on the biotic community that might defeat the overall management objective. It would seem wise to curtail this activity, at least until research and small scale testing have been conducted.

Of the various methods of manipulating vegetation, the controlled use of fire is the most "natural" and much the cheapest and easiest to apply. Unfortunately, however, forest and chaparral areas that have been completely protected from fire for long periods may require careful advance treatment before even the first experimental blaze is set. Trees and mature brush may have to be cut, piled, and burned before a creeping ground fire can be risked. Once fuel is reduced, periodic burning can be conducted safely and at low expense. On the other hand, some situations may call for a hot burn. On Isle Royale, moose range is created by periodic holocausts that open the forest canopy. Maintenance of the moose population is surely one goal of management on Isle Royale.

Other situations may call for the use of the bulldozer, the disc harrow, or the spring-tooth harrow to initiate desirable changes in plant succession. Buffalo wallows on the American prairie were the propagation sites of a host of native flowers and forbs that fed the antelope and the prairie chicken. In the absence of the great herds, wallows can be simulated.

Artificial reintroduction of rare native plants is often feasible. Overgrazing in years past led to local extermination of many delicate perennials such as some of the orchids. Where these are not reappearing naturally they can be transplanted or cultured in a nursery. A native plant, however small and inconspicuous, is as much a part of the biota as a redwood tree or a forage species for elk.

In essence, we are calling for a set of ecologic skills unknown in this country today. Americans have shown a great capacity for degrading and fragmenting native biotas. So far we have not exercised much imagination or ingenuity in rebuilding damaged biotas. It will not be done by passive protection alone.

Control of Animal Populations

Good park management requires that ungulate populations be reduced to the level that the range will carry in good health and without impairment to the soil, the vegetation, or to habitats of other animals. This problem is world-wide in scope, and includes non-park as well as park lands. Balance may be achieved in several ways.

(a) *Natural predation*—Insofar as possible, control through natural predation should be encouraged. Predators are now protected in the parks of the United States, although unfortunately they were not in the early years and the wolf, grizzly bear, and mountain lion became extinct in many of the national parks. Even today populations of large predators, where they still occur in the parks, are kept below optimal level by programs of predator control applied outside the park boundaries. Although the National Park Service has attempted to negotiate with control agencies of Federal and local governments for the maintenance of buffer zones around the parks where predators are not subject to systematic control, these negotiations have been only partially successful. The effort to protect large predators in and around the parks should be greatly intensified. At the same time, it must be recognized that predation alone can seldom be relied upon to control ungulate numbers, particularly the larger species such as bison, moose, elk, and deer; additional artificial controls frequently are called for.

(b) *Trapping and transplanting*—Traditionally in the past the National Park Service has attempted to dispose of excess ungulates by trapping and transplanting. Since 1892, for example, Yellowstone National Park alone has supplied 10,478 elk for restocking purposes. Many of the elk ranges in the western United States have been restocked from this source. Thousands of deer and lesser numbers of antelope, bighorns, mountain goats, and bison also have been moved from the parks. This program is fully justified so long as breeding stocks are needed. However, most big game ranges of the United States are essentially filled to carrying capacity, and the cost of a continuing program of trapping and transplanting cannot be sustained solely on the basis of controlling populations within the parks. Trapping and handling of a big game animal usually costs from $50 to $150 and in some situations much more. Since annual surpluses will be produced indefinitely into the future, it is patently impossible to look upon trapping as a practical plan of disposal.

(c) *Shooting excess animals that migrate outside the parks*—Many park herds are migratory and can be controlled by public hunting outside the park boundaries. Especially is this true in mountain parks which usually consist largely of summer game range with relatively little winter range.

Effective application of this form of control frequently calls for special regulations, since migration usually occurs after normal hunting dates. Most of the western states have cooperated with the National Park Service in scheduling late hunts for the specific purpose of reducing park game herds. and in fact most excess game produced in the parks is so utilized. This is by far the best and the most widely applied method of controlling park populations of ungulates. The only danger is that migratory habits may be eliminated from a herd by differential removal, which would favor survival of non-migratory individuals. With care to preserve, not eliminate, migratory traditions, this plan of control will continue to be the major form of herd regulation in national parks.

(d) *Control by shooting within the parks*—Where other methods of control are inapplicable or impractical, excess park ungulates must be removed by killing. As stated above in the discussion of park policy, it is the unanimous recommendation of this Board that such shooting be conducted by competent personnel, under the sole jurisdiction of the National Park Service, and for the sole purpose of animal removal, not recreational hunting. If the magnitude of a given removal program requires the services of additional shooters beyond regular Park Service personnel, the selection, employment, training, deputization, and supervision of such additional personnel should be entirely the responsibility of the National Park Service. Only in this manner can the primary goal of wildlife management in the parks be realized. A limited number of expert riflemen, properly equipped and working under centralized direction, can selectively cull a herd with a minimum of disturbance to the surviving animals or to the environment. General public hunting by comparison is often non-selective and grossly disturbing.

Moreover, the numbers of game animals that must be removed annually from the parks by shooting is so small in relation to normally hunted populations outside the parks as to constitute a minor contribution to the public bag, even if it were so utilized. All of these points can be illustrated in the example of the north Yellowstone elk population which has been a focal point of argument about possible public hunting in national parks.

(e) *The case of Yellowstone*—Elk summer in all parts of Yellowstone Park and migrate out in nearly all directions, where they are subject to hunting on adjoining public and private lands. One herd, the so-called Northern Elk Herd, moves only to the vicinity of the park border where it may winter largely inside or outside the park, depending on the severity of the winter. This herd was estimated to number 35,000 animals in 1914 which was far in excess of the carrying capacity of the range. Following a massive die-off in 1919-20 the herd has steadily decreased. Over a period of 27 years, the National Park Service removed 8,825 animals by shooting and 5,765 by live-trapping; concurrently, hunters took 40,745 elk from this herd outside the park. Yet the range continues to deteriorate.

In the winter of 1961-62 there were approximately 10,000 elk in the herd and carrying capacity of the winter range was estimated at 5,000. So the National Park Service at last undertook a definitive reduction program, killing 4,283 elk by shooting, which along with 850 animals removed in other ways (hunting outside the park, trapping, winter kill) brought the herd down to 5,725 as censused from helicopter. The carcasses of the elk were carefully processed and distributed to Indian communities throughout Montana and Wyoming; so they were well used. The point at issue is whether this same reduction could or should have been accomplished by public hunting.

In autumn during normal hunting season the elk are widely scattered through rough inaccessible mountains in the park. Comparable areas, well stocked with elk, are heavily hunted in adjoining national forests. Applying the kill statistics from the forests to the park, a kill of 200-400 elk might be achieved if most of the available pack stock in the area were used to transport hunters within the park. Autumn hunting could not have accomplished the necessary reduction.

In mid-winter when deep snow and bitter cold forced the elk into lower country along the north border of the park, the National Park Service undertook its reduction program. With snow vehicles, trucks, and helicoters they accomplished the unpleasant job in temperatures that went as low as −40° F. Public hunting was out of the question. Thus, in the case most bitterly argued in the press and in legislative halls, reduction of the herd by recreational hunting would have been a practical impossibility, even if it had been in full conformance with park management objectives.

From now on, the annual removal from this herd may be in the neighborhood of 1,000 to 1,800 head. By January 31, 1963, removals had totalled 1,300 (300 shot outside the park by hunters, 600 trapped and shipped, and 406 killed by park rangers). Continued special hunts in Montana and other forms of removal will yield the desired reduction by spring. The required yearly maintenance kill is not a large operation when one considers that approximately 100,000 head of big game are taken annually by hunters in Wyoming and Montana.

(f) *Game control in other parks*—In 1961-62, excluding Yellowstone elk, there were approximately 870 native animals transplanted and 827 killed on 18 national parks and monuments. Additionally, about 2,500 feral goats, pigs and burros were removed from three areas. Animal control in the park system as a whole is still a small operation. It should be emphasized, however, that removal programs have not in the past been adequate to control ungulates in many of the parks. Future removals will have to be larger and in many cases repeated annually. Better management of wildlife habitat will naturally produce larger annual surpluses. But the scope of this phase of park operation will never be such as to constitute a large facet of management. On the whole, reductions will be small in relation to game harvests outside the parks. For example, from

50 to 200 deer a year are removed from a problem area in Sequoia National Park; the deer kill in California is 75,000 and should be much larger. In Rocky Mountain National Park 59 elk were removed in 1961-62 and the trim should perhaps be 100 per year in the future; Colorado kills over 10,000 elk per year on open hunting ranges. In part, this relates to the small area of the national park system which constitutes only 3.9 per cent of the public domain; hunting ranges under the jurisdiction of the Forest Service and Bureau of Land Management make up approximately 70 per cent.

In summary, control of animal populations in the national parks would appear to us to be an integral part of park management, best handled by the National Park Service itself. In this manner excess ungulates have been controlled in the national parks of Canada since 1943, and the same principle is being applied in the parks of many African countries. Selection of personnel to do the shooting likewise is a function of the Park Service. In most small operations this would logically mean skilled rangers. In larger removal programs, there might be included additional personnel, selected from the general public, hired and deputized by the Service or otherwise engaged, but with a view to accomplishing a task, under strict supervision and solely for the protection of park values. Examples of some potentially large removal programs where expanded crews may be needed are mule deer populations on plateaus fringing Dinosaur National Monument and Zion National Park (west side), and white-tailed deer in Acadia National Park.

Wildlife Management on National Recreation Areas

By precedent and logic, the management of wildlife resources on the national recreation areas can be viewed in a very different light than in the park system proper. National recreation areas are by definition multiple use in character as regards allowable types of recreation. Wildlife management can be incorporated into the operational plans of these areas with public hunting as one objective. Obviously, hunting must be regulated in time and place to minimize conflict with other uses, but it would be a mistake for the National Park Service to be unduly restrictive of legitimate hunting in these areas. Most of the existing national recreation areas are Federal holdings surrounding large water impoundments; there is little potentiality for hunting. Three national seashore recreational areas on the East Coast (Hatteras, Cape Cod, and Padre Island) offer limited waterfowl shooting. But some of the new areas being acquired or proposed for acquisition will offer substantial hunting opportunity for a variety of game species. This opportunity should be developed with skill, imagination, and (we would hopefully suggest) with enthusiasm.

On these areas as elsewhere, the key to wildlife abundance is a favorable habitat. The skills and techniques of habitat manipulation applicable to parks are equally applicable on the recreation areas. The regulation of hunting, on such areas as are deemed appropriate to open for such use, should be in accord with prevailing state regulations.

New National Parks

A number of new national parks are under consideration. One of the critical issues in the establishment of new parks will be the manner in which the wildlife resources are to be handled. It is our recommendation that the basic objectives and operating procedures of new parks be identical with those of established parks. It would seem awkward indeed to operate a national park system under two sets of ground rules. On the other hand, portions of several proposed parks are so firmly established as traditional hunting grounds that impending closure of hunting may preclude public acceptance of park status. In such cases it may be necessary to designate core areas as national parks in every sense of the word, establishing protective buffer zones in the form of national recreation areas where hunting is permitted. Perhaps only through compromises of this sort will the park system be rounded out.

Summary

The goal of managing the national parks and monuments should be to preserve, or where necessary to recreate, the ecologic scene as viewed by the first European visitors. As part of this scene, native species of wild animals should be present in maximum variety and reasonable abundance. Protection alone, which has been the core of Park Service wildlife policy, is not adequate to achieve this goal. Habitat manipulation is helpful and often essential to restore or maintain animal numbers. Likewise, populations of the animals themselves must sometimes be regulated to prevent habitat damage; this is especially true of ungulates.

Active management aimed at restoration of natural communities of plants and animals demands skills and knowledge not now in existence. A greatly expanded research program, oriented to management needs, must be developed within the National Park Service itself. Both research and the application of management methods should be in the hands of skilled park personnel.

Insofar as possible, animal populations should be regulated by predation and other natural means. However, predation cannot be relied upon to control the populations of larger ungulates, which sometimes must be reduced artificially.

Most ungulate populations within the parks migrate seasonally outside the park boundaries where excess numbers can be removed by public hunting. In such circumstances the National Park Service should work closely with state fish and game departments and other interested agencies in conducting the research required for management and in devising cooperative management programs.

Excess game that does not leave a park must be removed. Trapping and transplanting has not proven to be a practical method of control, though it is an appropriate source of breeding stock as needed elsewhere.

Direct removal by killing is the most economical and effective way of regulating ungulates within a park. Game removal by shooting should be conducted under the complete jurisdiction of qualified park personnel and solely for the purpose of reducing animals to preserve park values. Recreational hunting is an inappropriate and non-conforming use of the national parks and monuments.

Most game reduction programs can best be accomplished by regular park employees. But as removal programs increase in size and scope, as well may happen under better wildlife management, the National Park Service may find it advantageous to employ or otherwise engage additional shooters from the general public. No objection to this procedure is foreseen so long as the selection, training, and supervision of shooting crews is under rigid control of the Service and the culling operation is made to conform to primary park goals.

Recreational hunting is a valid and potentially important use of national recreation areas, which are also under jurisdiction of the National Park Service. Full development of hunting opportunities on these areas should be provided by the Service.

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Exhibit 25

USDA

United States
Department of
Agriculture

Animal and Plant
Health Inspection
Service

Washington, DC
20250

JUN 19 2009

Dear AMT and PLG,

It's telling that one of President Obama's first actions on the job was to issue a message to the heads of all Federal Departments committing his Administration will be the most open and transparent in the history of our country. This goes hand-in-hand with the President's commitment to increase the American public's trust in the Government that serves and represents them.

These are tall orders but we think we here in APHIS have already seen the President's commitment in action, from the listening sessions Secretary Vilsack has convened to collect feedback and solutions for the National Animal Identification System, to the Secretary's and Deputy Secretary's remarks at the recent public meeting on our biotechnology regulations indicating they want to hear from and engage with stakeholders who hold different perspectives and interests as part of their approach to the development of new regulations.

We take very seriously this charge to APHIS to operate in an exceedingly open, transparent, and accessible way for all the customers and stakeholders we serve. We know you do too, and we are very pleased that over the last several years we have seen real results stemming from this collective commitment to openness and transparency. Chief among these we think is the progress we have made in reducing the number of Freedom of Information Act (FOIA) cases in backlog with our Agency. This has been an Agency operating plan goal for several years now, and we believe our efforts have started to pay off. While we still have much work ahead of us, we want to share with you the results we have achieved. With the help of program employees on detail, the FOIA office is on pace to close 400 more cases than last year. And by October 1, the FOIA office will have cut the total number of cases that were in backlog at the start of the fiscal year in half.

To continue this good progress, we must make use of every tool available to help us achieve our goal of eliminating the FOIA backlog. The President's memo also addressed Federal Agencies' approach to FOIA. In no uncertain terms, the President said Agencies need not only comply with FOIA, but should work to share information proactively on policies and decisions so that members of the public don't have to use the FOIA to obtain information held by their Government.

Again, this is another tall order, and APHIS has already risen to the challenge. Last month, for instance, Animal Care began making facility inspection reports available to the public on the APHIS Web site. These were the most frequently requested APHIS records under the FOIA and making them available on our Web site will go a long way toward informing the public of our commitment to animal welfare, while also supporting our FOIA backlog reduction efforts.

We know other programs are currently evaluating with the FOIA office placing inspection reports online in the future. We strongly encourage ***all*** APHIS programs to look internally at records, inspection reports, closed investigative files, decision memos, and policy statements that, in the spirit of the President's call for public engagement and openness and transparency, should be made available online even before we receive a single FOIA request for them.

We have asked Legislative and Public Affairs, led by the FOIA office, to take the lead in working with each of you to ensure that the APHIS FOIA reading room on our Agency's Web site is populated with the kinds of records and documents that our stakeholders are interested in and help to explain to the public all the work that goes into APHIS' mission of protecting American agriculture and natural resources. We have also asked LPA to develop a standard process for each of your programs to determine what records need to be placed in the FOIA reading room and, prior to doing so, informing the Office of the Administrator of the significant policy documents that will be placed there.

And, finally, for these efforts to have their intended results, we must regularly communicate with our stakeholders to share with them the context of the documents and information being made available online. This is another job we have tasked LPA to lead.

Enclosed please find more background information prepared by the FOIA office on the President's call for openness and transparency, as well as the requirements set forth under the Electronic Freedom of Information Act. We appreciate your support of these important initiatives to meet the President's and Secretary's objectives and further APHIS' mission.

Enclosure

Kevin Shea
Acting Administrator

Bill Clay
Acting Associate Administrator

President Barack Obama's Message on Openness and Transparency

On his first day in office, President Barack Obama issued a memorandum on the Freedom of Information Act (FOIA) and his commitment to openness in Government. The Attorney General also issued a guidance memorandum reiterating our nation's fundamental commitment to open Government. This guidance emphasizes 1) the use of modern technology to inform the public about U.S. Government operations and 2) affirmative steps to readily and systematically post information online in "advance" of a FOIA request.

To meet the initiatives set forth by the President, APHIS will continue to increase its compliance with the Electronic Freedom of Information Act (E-FOIA) and post current documents to the APHIS E-FOIA Reading Room.

Agency Requirements under the E-FOIA

Under the E-FOIA, agencies are required to make documents available to the public for inspection and copying. As an enhancement to this requirement, the E-FOIA further requires that "electronic versions" of Agency records be made available through the World Wide Web in an electronic reading room. There are four types of documents that APHIS should maintain in the E-FOIA Reading Room. These include:

1. Final Agency opinions and decision documents;
2. Agency policies and policy interpretations;
3. Administrative staff manuals; and
4. Agency "hot topic" and frequently requested documents that are of high interest to the public.

Access to documents in the APHIS E-FOIA Reading Room will not only aid increased understanding of APHIS, but will decrease the number of FOIA requests, give the public convenient, instant access to pertinent records, and create informed citizens. The goal of E-FOIA is to make information publicly available online so that FOIA requests become an avenue of last resort.

Implementation of the E-FOIA

In a year-long effort, APHIS has developed an improved E-FOIA Reading Room and increased the number of documents posted to the APHIS website. These documents are important to our various stakeholders and provide greater accessibility to and understanding of current Agency actions. Continuing this trend, APHIS must continue to make disclosures of records to the E-FOIA Reading Room. Outlined below are steps that APHIS program offices and the FOIA office can take to further comply with the E-FOIA:

1. In coordination with the FOIA office, each program office will review its individual portion of the E-FOIA reading room to identify broken links, remove outdated records, and replace superseded records.

2. Program offices will identify and post APHIS manuals, decision documents and policy documents. These types of documents are considered releasable and should be made available to the public.

3. The FOIA office will work with APHIS program offices to identify records that are frequently requested and/or that APHIS anticipates will generate increased interest from the public and work to make these records available online.

4. Press releases issued by LPA will link to pertinent records placed in the FOIA reading room.

5. Finally, starting in FY10, the FOIA office will post records in the FOIA reading room prepared in response to FOIA requests.

Complying with the E-FOIA and posting current documents to the APHIS FOIA reading room are Agency responsibilities. LPA will be reaching out to leadership with each of APHIS' programs to discuss the steps above and other efforts to comply with the President's direction and requirements under the E-FOIA. The APHIS FOIA Reading Room can be accessed at the following website:
http://www.aphis.usda.gov/footer_items/foia_reading_room.shtml