WILDEARTH GUARDIANS
A FORCE FOR NATURE

February 17, 2009

William Clay, Deputy Administrator
U.S. Department of Agriculture-APHIS-Wildlife Services
14th and Independence Avenue, SW, Room 162 South
Washington, D.C. 20250-3402
P: 202.720.2054
F: 202.690.0053
bill.clay@aphis.usda.gov

Re: Demand for Immediate Supplementation of the 1994/1997 Animal Damage Control PEIS

Dear Deputy Administrator Clay:

Please find attached a demand letter from WildEarth Guardians to USDA-APHIS-Wildlife Services (WS) requesting that, pursuant to the National Environmental Policy Act, 42 U.S.C. 4321 et seq., and its implementing regulations, Wildlife Services immediately supplement the 1994/1997 Animal Damage Control Programmatic Environmental Impact Statement ("PEIS"). We would appreciate your written response to this demand letter within 14 business days. If you have any questions or comments, please do not hesitate to contact me at 303.819.5229.

Sincerely,

Wendy Keefover-Ring
Carnivore Protection Director
WildEarth Guardians

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

In 1994, Wildlife Services (WS) developed a programmatic environmental impact statement ("PEIS") pursuant to the National Environmental Policy Act ("NEPA"). This PEIS, which was amended and reissued in 1997, represents WS's most recent and comprehensive analysis of how its taxpayer-funded, nation-wide "Animal Damage Control Program" impacts human health and the environment. Although the 1994/1997 PEIS was likely legally inadequate at the time it was developed, today the PEIS is woefully outdated, scientifically unsound, and too narrow in scope. In short, the 1994/1997 PEIS is in dire need of supplementation and/or total revamping.

The Council on Environmental Quality ("CEQ") requires WS to supplement any of its NEPA analyses whenever the scope of its work substantially changes from that proposed in the corresponding EIS or whenever significant new circumstances or relevant information arise. See 40 C.F.R. § 1502.9. Both are true in this instance.

Those actions currently undertaken by WS in furtherance of its Animal Damage Control Program exceed the scope of the action proposed by the 1994/1997 PEIS. Each year, WS kills approximately 230 species of birds, approximately 25 species of mammalian carnivores, dozens more mammals, and species from other taxa including reptiles. However, the 1994/1997 PEIS analyzed impacts to only a handful of target species and lacked any analysis of how its control program might harm non-target species, including domestic pets and endangered wildlife.

Significant new circumstances and relevant information regarding WS's Animal Damage Control Program have arisen since 1997. Over the past 12 years, the American landscape has been substantially altered by rapid human population growth and subsequent habitat modification. At the same time, our understanding of continental-scale issues such as predator-prey relations and global warming has dramatically increased. Since 1997, myriad scientific studies bearing on the biological, ecological, and economic facets of WS's animal damage control program have been published. These studies, coupled with mounting public safety concerns surrounding WS's operations, have led to heightened public scrutiny of federally-funded wildlife control and caused a shift in public attitude towards ecosystem conservation but away from indiscriminate lethal controls.

For all these reasons, which are more fully stated below in this demand letter, WildEarth Guardians hereby submits that NEPA and its implementing regulations require that WS immediately supplement the 1994/1997 Animal Damage Control PEIS. WildEarth Guardians requests that WS fully involve the public in this upcoming supplementation, and that WS suspend its Animal Damage Control Program unless and until it brings the 1994/1997 PEIS into compliance with federal law.

II. NEPA AND THE DUTY TO SUPPLEMENT

NEPA mandates environmental review of all "major federal actions" that may "significantly affect" the quality of the environment. 42 U.S.C. § 4332(c). NEPA's "action-forcing procedures" require WS to take a "hard look" at the environmental consequences of its proposed actions before proceeding to act, and to encourage public involvement in the agency decision-making process, before decisions are made. See, e.g., Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 350 (1989). NEPA's hard look requirement insures a thorough analysis of environmental impacts stemming not only from the proposed action, but from the alternatives to that action and from other past, present, and reasonably foreseeable future actions for which there may cumulative impacts. See 40 C.F.R. §§ 1502.14 and 1508.7. See also Monroe County Conservation Council, Inc. v. Volpe, 472 F.2d 693 (2nd Cir.1972); Tomac v. Norton, 433 F.3d 852 (D.C. Cir. 2006)

The purpose of NEPA, which is primarily procedural in nature, is not to dictate results, but rather to ensure an informed and transparent agency decision-making process in which the public can actively participate. See e.g., Utah Environmental Congress v. Russell, 518 F.3d 817, 822 (10th Cir.2008). Importantly, WS's NEPA duties are ongoing, i.e., WS's duty of accurate and informed decision-making does not end with the preparation of an EIS. Rather, there are circumstances in which the agency is required to supplement its previous analyses.

Although NEPA does not expressly address the subject of post-decision supplemental environmental impact statements, the Supreme Court has held that such a duty is supported by NEPA's approach to environmental protection and its manifest concern with preventing uninformed action, as well as by the express mandate of CEQ regulations. See Marsh v. Oregon Natural Resources Council, 490 U.S. 360, 370-374 (1989). Specifically, the CEQ requires that all federal agencies "shall prepare supplements to either draft or final environmental impacts 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)(1). Furthermore, agencies "shall prepare, circulate, and file a supplement to a statement in the same fashion…as a draft and final statement…" Id. § 1502.9(c)(4).

III. WS MUST SUPPLEMENT THE 1994/1997 ANIMAL DAMAGE CONTROL PEIS

A. Substantial Changes Have Occurred to the Scope of the Animal Damage Control Program as Proposed in the 1994/1997 PEIS

The 1994/1997 Animal Damage Control Program PEIS used data only from fiscal year 1988 to evaluate how this program would affect species, people, and the environment (Ch. 4, p. 11). The 1994/1997 PEIS analyzed just 17 *target* species, including badgers, beavers, black bears, bobcats, coyotes, gray foxes, mountain lions, nutria, opossums, porcupines, black-tailed and Gunnison's prairie dogs, raccoons, red foxes, striped skunks, the "blackbird group," cattle egrets, and starlings.[1]

Since 1997, WS's Animal Damage Control Program has harmed far more species – both target and non-target – than the 17 analyzed in the 1994/1997 PEIS. In 2007, for example, WS spent more than $117 million to intentionally exterminate 2.4 million wild animals, representing a total of 319 species, i.e., 302 more than were analyzed in the PEIS. Also in 2007, WS *accidentally* killed reindeer, peregrine falcons, porcupines, mule deer, pronghorn, alligators, fish, turtles, ringtails, foxes, and dogs, none of which were analyzed in the PEIS. WS works ubiquitously throughout the U.S. and its Territories to carry out an Animal Damage Control Program that far exceeds the scope of that presented in the 1994/1997 PEIS. WS must supplement its PEIS to include a "hard look" analysis to all of these species in order to comply with NEPA.

[1] The PEIS did not distinguish between prairie dog species or black birds.

B. There is Significant New Information Relevant to the Environmental, Economic, and Public Safety Consequences of the Animal Damage Control Program

While the disparity in scope between those actions analyzed in the 1994/1997 PEIS and WS's actual activities under the Animal Damage Program is, in and of itself, grounds for NEPA supplementation, the sheer volume of new information relevant to the environmental, economic, and public safety consequences of WS's Animal Damage Program demand it. Such new information includes, but is not limited to: the critical ecological role of carnivores; current statistics on livestock predation, costs and benefits of predator control operations, and the proven ineffectiveness of large scale predator control; the proven ineffectiveness and growing unacceptability of trapping; the dangers of lead poisoning and other toxicants; the detrimental effects of aerial gunning; anthropogenic harms to threatened, endangered, rare, or sensitive species; the national security hazards presented by the Animal Damage Program itself; incidence of animal-vehicle collisions and disease; human overpopulation and the extinction crisis; global warming; and changing social attitudes towards wildlife and ecological degradation.

1. *The Ecological Role of Carnivores*

Carnivores can modulate prey populations and make them more vigorous (Murie and U.S. Department of the Interior 1940, Leopold 1949 (Reprint 1977), Logan and Sweanor 2001). Large carnivores increase biological diversity and functionality of ecosystems (e.g. Smith et al. 2003, Mezquida et al. 2006, Ripple and Beschta 2006). The effects from predation cascade through all the trophic layers—through the herbivores to the producers—and can even influence riparian systems, as these examples show:

Scientific understanding regarding the ecological role of wolves has increased since 1997. After the wolf reintroduction into Yellowstone National Park in 1995, elk, which had previously decimated willow and aspen stands, were forced to be more mobile to avoid predation. With decreased herbivory from sedentary elk herds, willow communities returned, beavers followed and used the new trees and shrubs to build their dams and lodges. Those structures not only brought water from underground to the surface, but made water flow more dependable. As a result, populations of neotropical and water-wading birds and moose increased (Smith et al. 2003).

Scientific understanding regarding the ecological role of mountain lions has also increased since 1997. The presence of mountain lions in desert ecosystems can have several top-down effects. Mountain lions increase biological diversity in both plant and animal communities and increase the functionality of precious western riparian systems. By modulating deer populations, lions prevent overgrazing near riparian systems, which sustain 75 to 80 percent of western wildlife. The result: more cottonwoods, rushes, cattails, wildflowers, amphibians, lizards, and butterflies, and deeper, but narrower, colder stream channels necessary for native fishes (Ripple and Beschta 2006).

Scientific understanding regarding the ecological role of coyotes has similarly increased since 1997. Despite their persecution, coyotes play important keystone roles in their ecosystems. Coyotes increase biological diversity by preying upon medium-sized carnivores such as skunks, house cats, foxes, and raccoons. This predation indirectly benefits ground-nesting birds (Crooks and Soule 1999), even greater sage-grouse (Mezquida et al. 2006), a species under consideration for listing under the Endangered Species Act (ESA). Coyotes indirectly protect kit fox populations by reducing red fox densities (because red foxes are small, they can easily enter kit fox dens, whereas coyotes are too big) (Cypher and Spencer 1998). By competing with medium-size predators, coyotes increase diversity of various rodent species (Henke and Bryant 1999).

In short, carnivores increase both the richness and complexity of animal life and indirectly contribute to better ecosystem function, free work known as "ecosystem services".[2] Despite these benefits, WS and others spend hundreds of millions of dollars annually in attempts to eradicate or scale back predator populations. Not only can this imperil native species and destabilize ecosystems, it has resulted in unintended consequences with generalists such as coyotes, which have increased their range several-fold as discussed below. WS justifies their work based on spurious economic arguments and to bolster populations of ungulates—species sought by hunters. A breadth of research involving the importance of native carnivores in ecosystems has issued since the 1994/1997 PEIS was published—including the above-cited sources in this section. Therefore, WS must rigorously research the peer-reviewed scientific literature to inform a new NEPA process.

2. *Current Data on Livestock Predation*

The relatively small amount of predation on livestock cannot justify WS's extensive predator killing. The WS PEIS states, "of all agricultural communities, the program probably affects the ranching industry the most, particularly the sheep industry" (Chapter 4, p. 130). WS then acknowledges that "predator control is one of the most controversial aspects" of its work (Chapter 3, p. 82). WS provides enormous resources to protect sheep from predators. Yet, this effort is misplaced and ineffective. Wild carnivores take only between one and five percent of annual production of animals held for human food production, and survey questionnaires completed by stock producers likely exaggerate the numbers of livestock killed by carnivores (Baker et al. 2008).

Every year the USDA's National Agricultural Statistics Service (NASS) reports on the U.S. cattle and sheep production inventory. Every five years, NASS counts unintended cattle and sheep deaths from predation, weather, disease, and other causes. The most recent report released for cattle deaths is 2006 and, for sheep, 2005. The reports reflect data from the previous calendar year.

In 2005, U.S. producers raised 104.5 million head of cattle (USDA NASS 2005a). Of these, 190,000 (or 0.18 percent) died as the result of predation from coyotes, domestic dogs, and other carnivores (USDA NASS 2006). In comparison, livestock producers lost 3.9 million head of cattle (3.69 percent) to maladies, weather, or theft (USDA NASS 2006).

Coyotes were the primary cattle predators—they killed 97,000 cattle in 2005--followed by domestic dogs, which killed 21,900 cattle. Wolves killed remarkably few cattle, 4,400 head, as did all of the wild cats (USDA NASS 2006).

In 2004, sheep producers raised 7,650,000 animals nationwide (USDA NASS 2005b). Of that

[2] Ecosystem services are the resources and processes that are supplied by the natural world. The benefits are myriad but include clean air and water, functioning soil systems, decomposition of waste, moderation of weather and other stochastic events, pollination and seed dispersal to name a few. Priceless, yet these services are in danger from anthropogenic threats.

figure, native carnivores and domestic dogs killed 3 percent, or 224,200 sheep (USDA NASS 2005c). In comparison, 5 percent of sheep died from illness, dehydration, falling on their backs or other causes (USDA NASS 2005c). Coyotes and domestic dogs were the main carnivores involved in sheep predation in 2004 (USDA NASS 2005c).

Several research biologists have described WS's work as haphazard and harmful. They dubbed the agency's methods the "sledgehammer" approach to wildlife management to indicate that the scale of predator eradications by WS is biologically harmful and unselective for the species killed (Treves and Karanth 2003, Mitchell et al. 2004, Stolzenburg 2006). In 2004 and 2005, WS killed approximately 100,000 mammalian carnivores annually; the carnivore-kill numbers increased to approximately 120,000 for the years 2006 and 2007, a 20 percent increase over the previous two years (2004 and 2005).

Economist Kim Murray Berger (2006) found that despite WS's efforts to kill five million predators at a cost of $1.6 billion for the period 1939 to 1998, it had little effect: 85 percent of U.S. sheep producers went bankrupt in that time period. Two different geographic areas, one where coyotes existed, and one where they were absent, showed identical declines in the sheep industry because of unfavorable market conditions, but not from predator-caused losses (Berger 2006). The most important factors to sheep production are the price of hay, farmhand wages, and lamb prices – these three factors represented 77 percent of production variations from year to year (Berger 2006). Researchers find no correlation between the number of coyotes killed and the number of lambs lost (Knowlton et al. 1999, Mitchell et al. 2004). Simply put: WS is both expensive and biologically harmful, but benefits producers little. WS must look at these new studies that concern agricultural economics and global trade, include them as part of a new NEPA analysis, and determine if the costs of the program derive any real economic benefit.

WS's claim that predator control benefits the livestock industry is unproven, according to independent biologists, an economist, and the GAO. Furthermore, losses are unevenly distributed and localized. The GAO writes, "*A small proportion of producers absorb high losses, whereas the vast majority of producers sustain less serious economic damage*" (GAO 2001, p. 36). In other words: Few livestock producers are actually affected by predation. Meanwhile, WS is killing thousands of native animals for the benefit of a few in agribusiness, and yet, the USDA's own reports show that predators kill few livestock.

In sum, each year, WS kills tens of thousands of wild animals and pets, endangers public safety and the safety of its own employees, and spends millions of tax dollars (local, state, and federal) to do so. The 1994/1997 PEIS upon which WS relies is anachronistic. Despite the $100 million annual investment in killing over one million animals each year, the GAO, and independent researchers and an economist have shown that the program is ineffective, and the costs outweigh any perceived benefits. It kills wild predators by the thousands using controversial and dangerous methods in futile attempts to bolster the nation's declining sheep industry.

3. *Public Lands Ranching Economics*

According to the Bureau of Land Management (BLM) (2004), "ranching tends to be a low- or negative-profit enterprise, and public land ranchers are no exception." The BLM (2004) adds, "data show that operations in all regions had, on average, negative returns." The federal agency charged with managing most of the ranches in the West acknowledges that ranching is a poor way to make a living—even when grazing fees are enormously subsidized by the government, and even though WS provides heavily subsidized predator-control activities.

The impulse to ranch, suggests the BLM, is not for profit but for social considerations such as "family, tradition, and a desirable way of life" (USDI BLM 2004). There are roughly 23,000 public lands ranching permittees. In one study of Forest Service and BLM ranchers, two general groups of ranchers emerged: hobby ranchers, which represented 50.5% of the total, had diversified income sources, and generally had small operations; and, secondly, dependent ranchers, who represented 49.5% of the total, were more dependent on ranching income, and ran larger operations which used public lands (USDI BLM 2004). To emphasize: most ranchers in the West are in the business for pleasure and social reasons, or as a hobby, but not to make a living. Compare 23,000 public lands ranching permittees, half of which are hobby ranchers, with 71.1 million wildlife watchers, 30 million anglers, and 12.5 million hunters, who spend $11 billion annually to engage in their recreational pursuits (USDI FWS 2007). WS's programs benefit a handful in agribusiness as compared to larger segments of the public, which values wildlife.

4. *Ineffectiveness of Large-Scale Predator Control*

The past decade has shown large-scale predator control to be ineffective, biologically expensive, and inherently non-selective (Mitchell et al. 2004). Surveys indicate that 11 to 71 percent of animals killed to prevent conflicts with humans or livestock were not involved in such incidents. If those data are extrapolated to WS, the agency over-killed 1.5 to 9.7 million animals indiscriminately. In other words, WS killed several million animals that had no negative interactions with humans between 1996 and 2001 (Treves and Karanth 2003). In 2007, WS killed 121,524 native carnivores such as coyotes, bobcats, bears, mountain lions, and wolves.

WS's approach to predator control is blanket, indiscriminate, and wasteful. With lethal methods, the agency cannot pretend to capture the "single offending animal" or use "surgical precision" as it has claimed in the past. Moreover, a GAO Report (1995) found that WS rarely used non-lethal methods of predator control. No data suggest that WS has otherwise improved or emphasized its usage of non-lethal alternatives since the 1995 GAO report.

WS partly justifies its predator-killing operations based on the argument that reducing predator numbers will elevate prey species' numbers. Many peer-reviewed studies, however, have shown that killing predators not only destabilizes ecosystem functions, but can fail to increase prey populations—unless prey species are below their carrying capacity (National Research Council 1997, Ballard et al. 2001, Logan and Sweanor 2001, Cougar Management Guidelines Working Group 2005).

The Colorado Division of Wildlife, for example, concluded that mule deer herd recruitment problems were associated with poor quality winter range conditions and disease, not predation (Watkins et al. 2002, Pojar and Bowden 2004). Mosnier et al. (2008) found that intensively killing bear and coyote populations to protect a threatened and isolated population of caribou in Canada only benefited the caribous for a short duration and concluded that lethal control measures failed to help the caribou in the long-term. A study on Sonoran pronghorn found that drought, not predation, is the primary cause for the decline of this endangered species (Bright and Hervert 2005). In their "Pronghorn Management Guide," Lee et al. (1998) found that if habitat is unsuitable, predator control will fail to create robust prey species populations. Sawyer and Lindzey (2002) surveyed over 60 peer-reviewed articles concerning predator-prey relationships involving bighorn sheep and mountain lions, and they concluded that while predator control is often politically expedient, it does not address underlying environmental issues including habitat loss, loss of migration corridors, and inadequate nutrition.

Perhaps the best example of the ineffectiveness of large-scale predator control is how it has affected coyote populations. "Between killing contests, WS's actions, and state, local and private agencies, it is estimated that 400,000 coyotes are killed each year. That is more than 1,000 coyotes a day or almost a coyote a minute" (Finkel 1999).

Despite being the target of elimination campaigns since 1885, coyotes have expanded their range three-fold across North America (Crabtree and Sheldon 1999). After wolves were reintroduced into Yellowstone National Park in 1995, coyote densities declined by 50 percent in some areas and even up to 90 percent in wolf packs' core areas (Crabtree and Sheldon 1999, Smith et al. 2003). Perhaps because coyotes evolved under pressure from wolves, they became adaptable to persecution pressures. They are seemingly resilient in the face of extraordinary killing measures by WS, state agencies (especially South Dakota and Wyoming), and private individuals. For the years 2004 to 2007, WS killed 326,694 coyotes. Those actions could have major effects in the environment, which WS has failed to review, especially because the data it relies upon is outdated and often not peer-reviewed published studies.

WS frequently traps, snares, and poisons young coyotes, not the older or dominant individuals that are more likely to be involved with livestock depredations (Mitchell et al. 2004, Stolzenburg 2006). Coyotes are killed to benefit livestock growers, ostensibly to protect endangered species, or to bolster ungulate populations. Costly coyote eradication programs provide little real benefits to livestock growers (Berger 2006, Baker et al. 2008). Coyote-killing programs may make endangered species and other sensitive species more vulnerable to disease or to other predators (Sovada et al. 1995, Cypher and Spencer 1998, Kitchen et al. 1999, Baker et al. 2008). As Dr. Clait Braun, retired Colorado Division of Wildlife grouse expert, wrote, "No one has yet demonstrated that spring recruitment and breeding population size of sage-grouse have been or can be affected by predator control programs."[3]

While humans expend extraordinary resources to exploit coyote populations, these canids have proved incredibly adaptable. Killing coyotes does not work, and these expensive control programs are not supported by empirical science. Studies indicate that coyotes compensate for population losses using several strategies, such as emigration (Knowlton 1972, Crabtree and Sheldon 1999), producing more breeders (Knowlton 1972, Crabtree and Sheldon 1999), and compensating with larger litter sizes (Goodrich and Buskirk 1995).

Despite over a century of persecution, coyotes have expanded their range three-fold, and the sheep industry has not benefited from millions of dollars of coyote killing operations, because the biggest cost to sheep producers is labor, hay, and lamb prices, not predation. Killing coyotes to benefit other species is often a disguise used to justify predator control. Empirical studies show that coyote-killing operations result in a change in coyote breeding and migration strategies, which can overcome killing operations. Because coyotes have proved to be so resilient in the face of relentless persecution by WS and others, it makes little economical or biological sense to rely solely on lethal measures to protect livestock.

[3] Declaration of Dr. Clait Braun in Committee for Idaho's High Desert et al. vs. Mark Collinge et al. (April 2002).

Despite the growing body of empirical knowledge on the ineffectiveness of large-scale predator control, WS kills scores of native carnivores in the misplaced belief that predators dominate the relationships between themselves and their prey. If predators simply killed all of their prey, there would be neither. Myriad influences can determine the size of prey populations including habitat quality and quantity, disease, anthropogenic threats, and stochastic events. The effect of high levels of carnivore killing has enormous implications as we discuss in this letter. Since the PEIS issued in 1994/1997, many peer-reviewed studies concerning mammalian carnivores in ecosystems have been published, including the ones cited in this section, which WS must now incorporate as part of a new NEPA analysis of its program.

5. *Availability of Non-Lethal Solutions*

In the past handful of years, several biologists have expressed their skepticism about the current course and efficacy of lethal predator controls that involve millions of dollars and tens of thousands of dead carnivores (Treves and Karanth 2003, Mitchell et al. 2004, Berger 2006b, Stolzenburg 2006). Are lethal controls necessary to the extent they are now being used? Is it necessary to kill predators in order to control them? (Questions paraphrased from Littin and Mellor 2005). The humaneness of predator control by WS is certainly controversial (Marks et al. 2004, Littin and Mellor 2005, Hooke et al. 2006), and as we demonstrate here, their usage is neither economically nor biologically feasible when weighed against the danger that toxicants, aerial gunning, traps, poisons, hounding and shooting pose to the public and to non-target species of all stripes.[4]

Rather than emphasizing killing methods, WS should re-invest its budget and consider more sustainable, long-term solutions. Marin County provides an example. County commissioners in Marin County, California stopped their appropriations to WS and instead invested $40,000 per year in non-lethal alternatives such as fences, bells, and guard animals for ranchers. After five years of this experimental program, Commissioner Stacy Carlsen told a newspaper that ranchers experienced about a 2.2 percent loss of sheep compared to a 5 percent loss when WS offered leg-hold traps and lethal controls (Brenner 2005). As the Marin County example shows, long-term non-lethal controls are more effective, and obviously less controversial. The Marin County experiment holds promise for a larger broad-scale switch to non-lethal controls.

Large-scale carnivore killing threatens populations at the species level (Treves and Karanth 2003). Non-lethal methods of control effectively reduce livestock losses, and with less controversy. Unfortunately, livestock producers are not required to use these methods, and few economic incentives favor these methods because producers enjoy highly subsidized lethal predator controls. Treves and Karanth (2003) state, "A consensus is emerging that multiple non-lethal defenses must be deployed simultaneously, must be designed and installed with a particular species in mind, and must be modified periodically to avoid habituation by target species" (p. 1495).

To avoid predation, livestock husbandry practices prove useful. Treves and Karanth (2003) suggest, "Risk increases where more livestock are present, when sick or pregnant animals roam far from humans or buildings, when carcasses are left exposed, when humans are distant or absent, and when herds roam near cover" (p. 1495). Changing human and livestock behavior can

---

[4] Non-target species included two family pets killed by WS on federal lands in Utah in 2006. WS admits in its FY2006 tables that it killed 512 domestic dogs that year—obviously all were not "feral".

reduce the risk of predation.

Sheep and other small stock, because of their docile nature and inability to defend themselves against predators, require special protections (Knowlton et al. 1999, Baker et al. 2008). Human herders and several types of guard animals (llamas, some breeds of dogs, and burros) can be used—especially to guard against coyotes and black bears (Andelt 1996, Treves and Karanth 2003). Also, sheep and goats can be bonded with cattle, which more aggressively defend themselves (Andelt 1996). Guard animals are one of the most effective and efficient means to protect stock when animals are in proximity to each other and not diffuse on the landscape (Baker et al. 2008).

During lambing and calving season, livestock housed behind barriers such as fences, barns, pens, or sheds are more protected (Andelt 1996, Treves and Karanth 2003, Baker et al. 2008), but barriers can be breached and should be coupled with other non-lethal methods (Treves and Karanth 2003). Research on synchronizing the birthing season with that of wild prey species has also proven effective as it swamps predators and diverts them from livestock (Baker et al. 2008). Because coyotes (even breeding coyotes) generally do not specialize on sheep, ranchers can minimize their livestock losses by concentrating sheep into small, well-guarded areas (Sacks and Neale, 2002).

Scaring devices such as strobe lights, flashing highway lights, firecrackers, sirens, shock collars (for wolves), and noisemakers or fladry (flags tied to ropes or fences), offer yet other alternatives (Shivik et al. 2003). Aversive conditioning methods also provide means to prevent predation (Shivik et al. 2003), but have limited success with some carnivores because they can learn to avoid chemicals (Baker et al. 2008). That said, studies on conditioned taste aversion show promise in protecting eggs, crops, and fruit from mammals (Baker et al. 2005a, Baker et al. 2005b, Baker et al. 2008). Finally, the removal of livestock carcasses prevents scavengers from habituating to the taste of domestic animals (Andelt 1996). The use of two or more methods together has been proven to be the most effective(Andelt 1996).

Investment in non-lethal alternatives is not only more thrifty, but more effective.[5] Several common sense animal husbandry practices can prevent predation on livestock. However, WS has been reluctant to use non-lethal methods. WS must objectively evaluate its non-lethal options for animal damage control in its new NEPA analysis.

6. *Lack of Efficacy and Acceptability of Trapping*

While WS's 1994/1997 PEIS discussed traps and trapping, the information is woefully outdated. The literature on trapping has greatly expanded in recent years, and our understanding about the efficacy of trapping, including welfare implications, is better realized.

---

[5] The current wildlife fertility control research includes chemical, viral, or mechanical birth control mechanisms such as hormonal therapies, immunocontraceptives, steroidal contraceptives, and surgical sterilization. Most of the literature suggests that these measures are more humane than traditional lethal wildlife controls such as shooting, poisons, or traps (e.g., Seglund et al. 2000, Tuyttens and Macdonald 1998, and Pluhar 1995). Enormous issues concerning the efficacy of fertility prevention of wild animal populations remain and have not yet been adequately explored. Paul Curtis et al. (1997) warned that the government and others may expend huge amounts of money on reproductive control research and patenting only to learn that wildlife contraception is a public relations disaster. Rather than providing a "humane" solution for controlling wildlife populations, some fertility controls can cause suffering or even death (Oogjes 1997).

Muth et al. (2006) surveyed 3,127 conservation professionals, who were members of the American Fisheries Society, Society for Conservation Biology, North American Wildlife Enforcement Officers' Association, and The Wildlife Society. Asked whether leg-hold traps should be banned, respondents indicated *yes* by 46 percent, *no* by 39 percent, and *no opinion* by 15 percent (Muth et al. 2006). Further, the leg-hold trap ban was favored by 59 percent of people employed in the private sector, in higher educational institutions, and nongovernmental organizations (Muth et al. 2006).

The professionals cited pain and stress and harm to non-target species as the two primary reasons for favoring a trapping ban (Muth et al. 2006). Secondary reasons included: trapping's non-necessity, unsportingness, conflicts with public values, and concerns about it being unethical. Trapping proponents favored its efficiency, believing it had no effect on furbearer populations. Ironically, of the respondents that hunted or trapped, 80 percent indicated that they thought leg-hold traps could harm or kill non-target species—including expensive hounding dogs (Muth et al. 2006).

Animal traps fall under two categories: restraining or killing. Restraining traps hold the animal until the trapper arrives to kill it (Iossa et al. 2007). Kill traps are meant to result in immediate death and are used either terrestrially or underwater (Iossa et al. 2007). The terrestrial versions snap the neck or spine. Underwater traps render the animal unconscious until death. Traps do not discriminate between species and often non-target animals are caught. They can capture or kill threatened and endangered species, birds, domestic animals, and even humans.

In 1999, the International Organization for Standardization (ISO) defined humane standards for killing and restraining traps. The ISO assessed trap performance, including capture effectiveness, and efficacy of killing traps (Iossa et al. 2007). We discuss their findings below.

a. Restraining Traps

According to Iossa et al. (2007), restraining traps come in five varieties: 1) *stopped neck snares*: wire loops which are arranged vertically with the intent of having the animal's head enter the wire loop, which then tightens around the neck, but is stopped at a certain diameter. 2) *Leg-hold snares*: wire loops placed horizontally and designed to restrain an animal's leg(s). 3) *Leg-hold traps*: either padded or unpadded and consisting of two jaws that open to 180 degrees and when triggered, fasten onto an animal's leg or foot. 4) *Box or cage traps*: using an opening and bait to attract an animal, a box trap's trigger causes the door to slam shut and capture the animal. 5) *Pitfall traps*: used to capture small terrestrial mammals into a smooth-sided container, which may contain bait.

Animals frequently sustain injuries from restraining traps such as physiological trauma, dehydration, exposure to weather, or predation by other animals or death because of restraining traps (Harris et al. 2005). Animals released from restraining traps may later die from injuries and/or reduced ability to hunt or forage for food (Harris et al. 2005). In their review, Iossa et al. (2007) assessed injuries associated with animals restrained by kill traps using international standards.

The ISO assessed trauma levels and assigned points, on a scale to 34, for the most common trap injuries. The ISO's scale ranges from mild trauma to death. Examples from the scale are: Mild injuries include a claw loss; moderate injuries include permanent tooth fracture; moderately severe injuries include compression fractures; severe injuries include the amputation of three or more digits; and death (Iossa et al. 2007). The ISO rated far more injury categories and standardized the welfare performance of traps (Iossa et al. 2007). The major drawback to the ISO standards, however, is their failure to assess pain (Iossa et al. 2007).

While a broken tooth may be low on the trauma score, for humans teeth-related pain is often considered excruciating and unbearable (Harris et al. 2005, Iossa et al. 2007). Broken teeth or missing claws can inhibit carnivores' ability to catch prey and may actually increase the risk of livestock predation (Harris et al. 2005) because domestic stock are easier to capture than more desirable native prey. Moreover, pain and distress, if prolonged, can affect animals' health and ability to survive (Harris et al. 2005). In studies reviewed by Harris et al. (2005), physiological changes from trapping injuries often go unassessed. Trapped animals respond in two ways from traps: psychological stress and or pain, and secondarily from exertion (Harris et al. 2005). The former can significantly alter hormones, enzymes, and electrolytes and lead to long-term muscle damage (Harris et al. 2005).

In reviewing 39 studies, Iossa et al. (2007) found that most leg-hold traps cause significant injuries. Even padded leg-hold traps caused minor and major injuries (Iossa et al. 2007). Animals restrained in leg-hold traps suffer stress, and because of poor selectivity in captures, traps can reduce the survivability of released animals (Iossa et al. 2007).

In a study by the USDA-National Wildlife Research Center, Shivik et al. (2000) found that traps that had the greatest success for capturing animals were the least selective, caught the most non-target species, and caused the most injuries. In a subsequent study, Shivik et al. (2005) found improvements in traps' efficacy, species selectivity, and injury ratings. The authors hint that WS has been developing tools to improve trapping (Shivik et al. 2005). Others have worked on electronic-signal technology that immediately alerts a trapper that an animal is caught (Larkin et al. 2003) or tranquilizers on traps and snares to prevent injuries (Marks et al. 2004).

Iossa et al. (2007) found that leg-hold snares are generally humane with little mortality for target species, but that can be untrue for non-target species, which may experience high amounts of mortality. In addition, foot swelling from foot-snare injuries, while receiving a low scoring on the ISO scale, may be under-rated because even temporary injuries may affect an individual negatively (Iossa et al. 2007).

Box traps can result in broken teeth or abrasions. Iossa et al. (2007) suggest several ways to improve traps so that injuries are minimized such as reducing mesh size to protect teeth and to use non-abrasive materials on the interior to prevent abrasions. Box traps are less stressful than are leg-hold traps (Harris et al. 2005). Yet, animals held in box traps tested higher for cortisol levels when compared with untrapped individuals (Harris et al. 2005). With all restraining traps, trap check times must be frequent to reduce exposure and damage associated with restraint (Iossa et al. 2007).

Leg-hold traps are considered inhumane by a number of countries and are banned in 80 countries, including the European Union (Iossa et al. 2007). In the United States, traps are banned or limited in some states. An October 2007 consent decree between Animal Protection Institute and the Maine Department of Inland Fisheries and Wildlife limits leg-hold traps to protect Canada lynx. Arizona passed a 1994 initiative; California, a 1998 initiative; Colorado, a

1996 initiative; Florida, a 1972 regulation; Massachusetts, a 1996 initiative; New Jersey, 1984 legislation; Rhode Island, 1977 legislation; and Washington, a 2000 initiative, all of which ban or limit trap use (Jones and Rodriguez 2003). Given the social resistance to traps, as illustrated by state-level attempts to limit their use, Shivik et al. (2000) call upon trappers to abide by 1997 international agreements concerning acceptable animal injury standards.

b. Kill Traps

According to Iossa et al. (2007), five kinds of kill traps are utilized: 1) *Deadfall traps* which use gravity to kill an animal by crushing its skull, vertebrae, or vital organs. 2) *Spring traps* of two varieties—one has a bar that (usually) crushes the animal's neck; and two, a trap that uses rotating jaws. 3) *Killing snares* of two kinds. The first, a self-locking snare that tightens as the animal pulls to escape, and the second, a power snare that uses springs to quickly tighten a noose. Both asphyxiate. 4) *Drowning traps* that hold the animal underwater until the animal dies from hypoxia, a shortage of oxygen in the blood. 5) *Pitfall traps* have water at the bottom. Rodents or small animals are induced to enter them and drown.

Kill traps' effectiveness depends upon many variables, including the species caught, trap size, and trapper ability (Iossa et al. 2007). Field conditions are often not as optimal as laboratories where experiments on traps are frequently conducted (Iossa et al. 2007). Some propose that if the purpose of capturing an animal is to kill it, then killing traps may be more suitable as the animal is not left in pain, shock, dehydrated, and at risk for predation (Harris et al. 2005). Kill traps are enormously faulty, however, and should not be used for the reasons that follow.

One standard for kill traps is that at least 70 percent of the animals trapped must be rendered unconscious in 60 seconds for short-tailed weasels (*Mustela erminea*); 120 seconds for American pine martens (*Martes americana*), Canadian lynx (*Lynx canadensis*) and fisher (*Martes pennanti*); and 180 seconds for all other species (Iossa et al. 2007). European researchers believe that the kill time should be 30 seconds after a kill trap has been triggered (Harris et al. 2005). The AVMA suggests that kill-trap technology must improve and come to the standards as proposed by the ISO (ISO 10990-4 1999), Gilbert (1981), Proulx and Barrett (1991, 1993), or Hiltz and Roy (2000).

Of the 23 kill traps reviewed by Iossa et al. (2007), 18 failed to render the animals unconscious in the recommended time. Other welfare restrictions involve injured animals escaping and mis-strikes. The latter refers to metal clamping down on an unintended body part (Iossa et al. 2007). Iossa et al. (2007) found that mis-strikes occurred up to 10 percent of the time. In neck snares used on coyotes (*Canis latrans*), mis-strikes ranged from 8-14 percent, and the percentage of animals that remained alive in kill traps ranged from 17-86 percent. Furthermore, the authors found that coyotes escaped from kill traps from 3-13 percent of the time. These data show that kill traps are enormously inefficient at quickly killing as is intended. The AVMA echoes these sentiments. It said that kill traps are controversial because they can produce a prolonged and stressful death that is not within the AVMA's criteria for euthanasia (2007).

Beavers (*Castor canadensis*) and river otters (*Lontra canadensis*), adapted to aquatic life, are adept are swimming and diving for long periods. Thus, death by hypoxia is slow even if the animal struggles; these animals often become distressed while attempting to escape from an underwater trap (Iossa et al. 2007).

Technologies such as water diversion devices behind beaver dams, which prevent flood events, make trapping beavers unnecessary (Muth et al. 2006). In 2007, WS killed 50,000 rodents, half of which were beavers. River otters should not be trapped as their populations are in trouble in many areas in the West. WS killed nearly 2,000 river otters for the years 2004-2007.

If an animal gets trapped it may be injured, which raises welfare concerns, especially if it escapes (Iossa et al. 2007). Trappers have developed most traps, their primary concern is undamaged pelts, not quick and humane deaths (Iossa et al. 2007). The literature offers several examples, including improving the striking precision so that death comes more quickly (Harris et al. 2005, AVMA 2007, Iossa et al. 2007). The AVMA (2007) recommends daily trap checks and suggests that kill traps only be employed when all other acceptable means have not worked.

Not only does the public generally abhor trapping, so do most wildlife professionals (Muth et al. 2006). Kill traps may not actually be "quick" while killing, and they may cause suffering or injury to animals that is unacceptable under standards suggested by researchers cited here, the ISO, and the AVMA. Dozens of studies concerned with the effectiveness of traps, the welfare of animals, and the attitudes of people have come out since the 1994/1997 PEIS was released. Therefore, WS must engage in a new NEPA process and address the trapping issue.

7. *Dangers of Lead Poisoning and Other Poisons/Toxicants*

a. Lead Toxicity

WS uses firearms to kill hundreds of animals each year, from armadillos to birds to predators. Invariably, this activity puts lead into the environment and poisons wildlife if carcasses and body parts are not removed. Bullets often shatter when they hit bone—leaving fragments in tissue. Raptors, ravens, and mammalian scavengers consume lead when they feed on carcasses or gut piles that contain bullet fragments (Pain et al. 1997, Meretsky et al. 2000, Redig 2002, White 2005, 2006, Craighead and Bedrosian 2008, Mosnier 2008). Unpublished data indicate that Yellowstone grizzly bears consume lead-bullet fragments and are poisoned.[6] California condors are especially at risk from WS's predator-control programs. Failure by WS and others to mitigate lead in the environment could result in the extinction of this great bird in North America.

Species react differently to the intake of lead. California condors (*Gymnogyps californianus*), unlike turkey vultures (*Cathartes aura*), easily succumb to lead toxicity (Carpenter et al. 2003). In fact, lead poisoning from spent bullets has nearly caused the extinction of condors. In 1980, condors dropped to 30 individuals, which led to a captive breeding program (Meretsky et al. 2000). In the early 1980s, 15 of those condors died. Of the 4 bodies recovered, three died from lead poisoning and the fourth from sodium cyanide (Meretsky et al. 2000). Between 1997 and 2001, four more condors died from lead toxicity (Schoch 2001, Sanborn 2002). Meretsky et al. (2002) have recommended that wildlife managers and others create large-scale, hunting-free reserves for condors or disallow the usage of lead shot in their ranges. California has complied but other states such as Utah, where WS's activities are high, have not. In October 2007, it banned lead ammunition for deer hunting in condor habitat (Kemsley 2007).

---

[6] Cory Hatch, "Lead in grizzly blood during hunt season: Researcher wonders if preliminary results show a danger to bruins from hunters' bullets" http://www.jacksonholenews.com/article.php?art_id=3892 <last visited 2/2/09>.

Other raptors, and especially their chicks, are also vulnerable to lead toxicity from bullet fragments that result from prairie dog shooting and other activities (Pauli and Buskirk 2007, Craighead and Bedrosian 2008). Lead poisoning in raptors can cause either lethal or sublethal effects (Pauli and Buskirk 2007, Craighead and Bedrosian 2008). Lead bullet fragments dissolve with stomach acid, allowing absorption into the bloodstream (Redig 2002). A single lead shotgun pellet or lead sinker that is absorbed in the digestive tract of a raptor is toxic enough to cause mortality (Sanborn 2002). Raptors' stomach pH level of 1—1.4 is extremely low (Pain et al. 1997). A low pH readily dissolves lead and increases toxicity (Pain et al. 1997).

In raptors, non-lethal side effects from lead ingestion can include lethargy, dehydration, blindness, and heart damage (Knopper et al. 2006). Lead poisoning causes anemia, stunts neurological development, lowers bone density, and causes paralysis (Craighead and Bedrosian 2008). Sublethal toxic effects could harm populations because individuals may not survive and reproduce (Pauli and Buskirk 2007). Even minor decreases in an individual raptor's fitness can result in mortality. Sublethal lead exposure can increase risk of collisions with powerlines, decrease weight, and muscle mass (Craighead and Bedrosian 2008). In long-lived bird species such as eagles, lead exposure can skew the entire population towards younger, nonbreeding animals that harm the long-term viability of a species (Craighead and Bedrosian 2008).

Waterfowl also ingest lead shot either as food or grit. WS shoots blackbirds and other wildlife near lakes, ponds, or riparian areas. Lead in the bird's gizzard is ground down, it enters the stomach and is exposed to acid, resulting in the production of lead salts which are then absorbed into the bloodstream (Pain et al. 1997).

Mammalian scavengers can also become susceptible to lead toxicity (Knopper et al. 2006). Missouri and other states are currently contemplating lead bullet bans because of toxicity issues (Kemsley 2007).

WS's PEIS states that in 1988, the most species shot by WS's agents were coyotes, beavers, and blackbirds.[7] Yet, the PEIS claims that the most damage from shooting activities is realized by the shooter himself because of poor handling (i.e., recoil, hearing damage, gunshot wounds) (Appendix P, 32). Not only has WS failed to adequately account for the environmental harms that lead shot causes, it has not considered the effects of lead poisoning on its own agents. Shooting contaminates the shooter. A subject who irregularly shot with lead bullets at a shooting range exhibited higher levels of lead levels during periods when he recreated (Gulson et al. 2002). Lead negatively effects human neurological systems (Hardison et al. 2004). WS's agents who practice at target ranges or who engage in frequent shooting activities may be at risk for elevated lead levels.

Currently, several non-toxic bullets are being developed (Meretsky et al. 2000, Oltrogge 2002), with a tungsten-tin bullet soon to be released and distributed by MDM Muzzleloaders of Maidstone, Vermont (Kemsley 2007). Because of new options to toxic lead bullets, wildlife and public lands managers must immediately retire lead ammunition and anchor weights. This toxic heavy metal should no longer pollute public lands and waterways. Companies have developed

---

[7] In addition to the lead issues raised here, removing these particular animals by shooting can cause other unintended environmental consequences. Coyotes' breeding dynamics change to make up for exploitation (discussion supra). When beavers are removed from their wetland ecosystem, the whole system can change (discussion supra), and shooting blackbirds near water puts this heavy metal directly into a solution where it dissolves and is readily taken up by plants (Sanborn 2002).

the technology to end this environmentally destructive practice that causes the demise or harm of unknown numbers of native wild birds, mammalian carnivores, aquatic species, and even humans. In the short-term, failure to reduce lead levels in the environment will lead to the extinction of free-roaming California condors.

In short, as our synthesis indicates, lead poisoning from bullet fragments can have profound effects on birds and mammals. Especially at risk are California condors. WS uses large amounts of firearms across a variety of taxa. Invariably, they are adding to the lead load in the environment. Lead toxicity remains an enormous problem that has received little attention outside of academia. Several peer-reviewed studies concerning lead toxicity in the environment have issued since WS released its 1994/1997 PEIS. As a result, WS must undertake a new analysis that takes these studies into account.

b. Other Toxicants

Numerically, WS kills most species using toxicants. WS uses a wide range of poisons on a variety of taxa—from mammals, to birds, to rodents and lagomorphs, and even plants.

The PEIS claims that it used three criteria to assess risks for its chemical methods, including an exposure assessment, a toxicological evaluation, and a risk assessment. The evaluation in WS's PEIS is based upon chemicals used by the agency for the period 1988 to 1991 (Chapter 4, p. 20). WS's risk assessment considered exposure to threatened and endangered species, non-target species, recreationists, residents, and pest control operators. The PEIS claims that, "risk assessment makes the assumption that current use patterns would continue as they have during FY 1988 and 1991" (Chapter 4, p 20).

Given "that even a small quantity of a highly toxic active ingredient released into the environment could have a significant effect upon a nontarget receptor" (Chapter 4, p. 29), WS should not be trusted to safely handle these agents. Because WS's risk assessment is now 17 years old, and it has had numerous difficulties and has been repeatedly audited for its unsafe handling, use, and storage of toxicants, and since our understanding of these toxicants has improved or changed, WS must re-analyze all of the toxicants that it uses. Given that so many species are killed with toxicants, WS must also analyze whether these toxicants are beneficial for the purpose that they are being used for (for example, research shows that poisoning blackbirds and cattails do little to benefit sunflower growers), where alternatives to poisoning exist, and whether there is a cost-benefit in engaging in widespread poisoning schemes.

i. <u>Rodenticides and Anticoagulants</u>

In their review article concerning rodenticides, Mason and Littin (2003) assessed the humaneness of toxicants used to kill rodents. The first type of toxicants involve ingested baits (such as anticoagulants, zinc phosphide, calciferol, and alpha-chloralose); fumigants (such as sulphur dioxide, carbon dioxide, phosphine and cyanide gas) (Mason and Littin 2003). Ingested toxicants pose several welfare conundrums such as orphaning and death of dependent pups when the mother is killed, the killing of non-target animals, secondary poisoning of non-target animals, and dosage issues (which influences the intensity and duration of the suffering) (Mason and Littin 2003).

Because of genetic resistance, the first generation anticoagulants have been replaced by second generation toxicants that include brodifacoum, fifenacoum, and bromadiolone (Mason and Littin 2003). Anticoagulants are effective because they interfere with Vitamin K-1 metabolism, which affects the clotting of blood and the repair of blood vessels, and exposed animals typically die from blood loss, or cardiac, respiratory, or kidney failure (Mason and Littin 2003). These toxicants are slow acting, and may take several days to kill. Anticoagulants cause several clinical effects including internal hemorrhaging which can produce severe pain because the blood pools in enclosed spaces such as the lungs, kidneys, spinal cord, and eye orbits—which can cause other problems such as inability to breathe (Mason and Littin 2003). The dosage can influence the time it takes an animal to die, but it can be from several hours to days.

Anticoagulant rodenticides are not only inhumane (Paparella 2006), but cause direct secondary affects on mountain lion and bobcat populations (Riley et al. 2007). Secondary poisoning from anticoagulants harms a whole range of species, from birds to mammals, and often goes undetected because liver tissue must be tested using high-performance liquid chromatography (HPLC), and rarely do researchers find un-decomposed bodies in the field (Riley et al. 2007). When testing has been done, the occurrence rate on predators and scavengers has been high. Not all animals that tested positive for anticoagulants died from a lethal dose (Riley et al. 2007).

Further, what constitutes a lethal dose for many wildlife species is unknown (Riley et al. 2007). Anticoagulants can stress bobcats and mountain lions so that they become susceptible to mange (Riley et al. 2007). Mange may result in dehydration, starvation, and then death (Riley et al. 2007). Riley et al. (2007) found anticoagulant toxicants in 35 of the 39 (90 percent) cats they had radio-collared in their study of urban felids in southern California, and nearly 80 percent of the bobcats showed positive for two or more compounds (brodifacoum, bomadialone, difethialone, and prothrombin—all available as household and landscape rodenticides). All four of the mountain lions in the study tested positive for anticoagulant poisoning. The dead bobcats and mountain lions were severely afflicted with mange on their heads and shoulders, and the bobcats typically had mange over their entire body (Riley et al. 2007). Every animal that had died of mange had been exposed to anticoagulants (Riley et al. 2007). The leading cause of coyote deaths in the study area was also anticoagulants—because they and bobcats fed on rodents. Therefore, when lions killed and ate coyotes, they were exposed to large quantities of these toxicants too (Riley et al. 2007).

Anticoagulants persist in tissue, up to 256 days for bromadiolone and more than 250 days for brodifacoum (Riley et al. 2007). Rodents that are targeted with these poisons may ingest doses that surpass lethal dose amounts, which increases the amount of toxicity passed to carnivores (Riley et al. 2007). The PEIS's only reference to brodifacoum is to Weather Blok (0.005 percent formula), used to kill Polynesian rats in Hawaii to protect sea turtle eggs (Appendix P, p. 245).

ii. <u>Alpha-Chloralose</u>

WS uses alpha-chloralose to capture birds, but not to kill them (Woronecki and William 1993). In 1992, WS gained approval from the U.S. Food and Drug Administration to use alpha-chloralose to capture "nuisance waterfowl" such as coots, and on pigeons (Belant and Seamans 1999, Belant et al. 1999). It is applied in corn baits that are "removed from the site following each treatment" (Appendix P, p. 181). Only WS's agents or their designees can apply this pesticide (Woronecki and William 1993). According to WS, while it is toxic to rats, mice, dogs and cats, immobilized birds "are immediately removed" so that non-target scavengers and predators are not harmed (Appendix P, p. 182).

Alpha-chloralose rapidly depresses the cortical centers of the brain, which in turn depresses the central nervous system, which then causes abnormally low blood pressure and a decrease in respiratory ability (Belant and Seamans 1999, Seamans and Belant 1999). A sublethal dose causes a lower level of depression, while a lethal dose can result in central nervous system and heart failure (Seamans and Belant 1999). Mute swans that were given 30 mg/kg of alpha-chloralose died (Belant et al. 1999).

WS's PEIS claims that, "no T&E [threatened and endangered] species are expected to be adversely affected by use of this formulated product" (Appendix P, 182). Based on the annual tables that WS posts to its site, it is unclear how extensively the agency uses this toxicant, and whether non-target species are poisoned from alpha-chloralose. The November 5, 2007 stakeholders' newsletter indicated that WS had experienced a "wake of accidents" including issues with immobilizing and euthanasia drugs. The agency's report only looked at accidents and how it affected employees, but not the environment or public safety. WS must adequately consider whether or not its use of alpha-chloralose is efficacious, and those considerations must be included in a new PEIS process.

iii. Aluminum Phosphide

According to WS's PEIS, the agency uses aluminum phosphide to kill pocket gophers, prairie dogs, moles, ground squirrels, muskrats, marmots, voles, and Norway rats.[8] Like zinc phosphide (discussed below), aluminum phosphide changes to phosphine gas when it contacts water; phosphine kills by asphyxiation (Mason and Littin 2003). While zinc phosphide is used as bait, aluminum phosphide comes in tablet form and acts as a burrow fumigant (Mason and Littin 2003).

The PEIS states "aluminum phosphide is known for its extreme inhalation toxicity and reacts in the presence of moisture to release phosphine gas" (Appendix P, p. 243). Witmer and Fagerstone (2003) found that aluminum phosphide is highly lethal to mammals and that a human could die from inhaling only a few breathes. It is absorbed into the respiratory system and gains admission to the blood stream where it blocks cells' processes and changes hemoglobin (Witmer and Fagerstone 2003).

Phosphine gas causes a painful death to its subjects. According to Mason and Littin (2003), in humans, phosphine gas exposure causes "coughing, choking, breathlessness and pressure in the chest, nausea and vomiting, lung and abdominal pain, headaches and buzzing in the ears, jaundice, intense thirst, and also ataxia [loss of muscular coordination], paraesthesias [skin sensations such as burning, itching, or bricking], intention tremors and convulsions, before leading to coma" along with pulmonary edema [build up of fluids in the lungs preventing breathing] and myocardial damage. Studies on laboratory rodents showed "similar signs of respiratory irritation and pain and other forms of discomfort" (Mason and Littin 2003, p. 14).

---

[8] Some of these species are considered keystone species in their ecosystems, and all species of prairie dogs have either been petitioned for listing under the ESA, are candidate species, or are listed under the ESA. See discussion for species supra.

While considered by the EPA to be in the highest category of toxicity, WS's PEIS claims that secondary toxicity is highly unlikely (Appendix P, p. 243). Though secondary toxicity may not be a large problem, exposure to non-target species, including humans, certainly is. Aluminum phosphide routinely kills burrowing non-target species. Witmer and Fagerstone (2003) noted susceptible species include rodents, burrowing owls, reptiles and amphibians, lagomorphs, and small carnivores such as raccoons, foxes, weasels, and skunks. Applicators often do not know when non-target species are in the burrows at the times poisons are applied (*Rocky Mountain Animal Defense vs. Colorado Division of Wildlife et al. 2001*).

Unintentional poisonings of humans and companion dogs occur (Goel and Aggarwal 2007). On a global scale, some 300,000 human fatalities from pesticides such as aluminum phosphide occur—mostly in rural areas or in developing countries (Goel and Aggarwal 2007). EPA staff has confirmed that children and dogs could likely be exposed to aluminum phosphide if children or dogs dig up recently poisoned holes and are exposed to the gas (pers. comm. Suzanne Wuerthele, the EPA's Region 8 toxicologist). The EPA suggests that aluminum phosphide use should come no closer than 100 feet of a residence (EPA 1998). At a close distance, phosphine gas could penetrate into basements from tunnels into basements (EPA 1998). The EPA strongly suggests that applicators be extremely cautious when applying this toxicants: wearing protective breathing apparatuses, ensuring that non-certified applicators are no more than fifty feet away from a certified overseer, and that local residents be notified. These common sense suggestions are often ignored in practice but must be addressed in a new PEIS process.

In sum, aluminum phosphide is a hazardous toxicant that harms mammals. While a large amount of literature on aluminum phosphide poisoning to humans is available, we have concentrated on effects to wildlife. Aluminum phosphide causes an agonizing, inhumane, and barbaric death. A whole host of non-target species ranging from burrowing owls, coyotes, badgers, reptiles, amphibians, skunks, weasels, foxes, and rabbits can die from this toxicant. It is preferable for wildlife managers to attempt non-lethal solutions as much as possible (Fagerstone 2002). This is not what is practiced, however, because these deaths are relatively inexpensive and they occur unnoticed below ground. The 1994/1997 PEIS fails to adequately consider both cumulative and site-specific impacts upon the environment from aluminum phosphide. Because of substantial new information and studies have been prepared since the PEIS was published that include information about extreme toxicity to a breadth of non-target species—both those below and above ground—including the likelihood of poisoning children and dogs, that death from aluminum phosphide is slow and painful, WS must develop a new PEIS that considers all these factors.

iv. <u>Avitrol, (4-Aminopyridine)</u>

Avitrol (also known as 4-Aminopyridine or 4-AP), used in corn or grain baits, is meant to target blackbirds, pigeons, house sparrows, crows, grackles, cowbirds, gulls, and starlings (EPA 2007). It is used to both kill birds and to "alarm" members of a flock. The agency sets out both treated and untreated grain, and the birds that consume the baited grain experience a loss of motor coordination, may tremble, act erratically, vocalize, and often die, thus frightening away the other flock members (EPA 2007). While the Migratory Bird Treaty Act (MBTA) prevents the killing of migratory birds, broad exceptions are made to protect agricultural interests (16 USC §§ 703-712). The new registration excludes all powdered formulas and a gull formula, but allows formulas that used corn or grain baits (EPA 2007). The new label requirements for all formulas of 4-AP require that applicators remove all uneaten product "at the end of the dosing period" and adhere to a 25-foot buffer around all "permanent bodies of water" (EPA 2007).

The EPA considers Avitrol to be highly toxic to most vertebrate species; it attacks the nervous system. Avitrol is acutely toxic to mammals through three routes: orally, dermally, and by inhalation (EPA 2007). The EPA found that Avitrol is "mobile and persistent in the open environment" and can be mobile both in soils and water (EPA 2007). The EPA reports, "the reported LD50 [lethal dose for 50 percent of test animals] for blackbirds, rats and dogs are 2.4, 28.7 and 3.7 mg/kg body weight, respectively. The assumed mean body weights for blackbirds, rats and dogs are 0.07, 0.40 and 10 kg, respectively" (EPA 2007). Avitrol can have secondary poisoning effects, especially on avian predators, including a documented case of the death of a peregrine falcon (a species listed under the ESA at the time of the poisoning incident in 1998) (EPA 2007).

The 1994/1997 PEIS understates toxicity problems. For instance, it claims that secondary poisonings, based on laboratory tests, are minimal (Appendix P, p. 186), but can be toxic to dogs and cats if they consume "undigested Avitrol from the intestinal track" (p. 188). Non-target species such as meadowlarks, mourning doves, and sparrows can die from 4-AP (p. 191). The PEIS does suggest that non-target species such as meadowlarks, mourning doves, and sparrows can die from Avitrol (Appendix P, p. 191). However, any avian or mammal could die from exposure to a lethal dose. Threatened and endangered species include Aleutian Canada goose, Attwater's prairie chicken, and whooping cranes (Appendix P, p. 191). The EPA could not find clinical data for aquatic animals (EPA 2007).

In sum, Avitrol, a pesticide presented in a baited grain, kills or frightens members of a flock. It is highly toxic to all vertebrate species, both directly and secondarily, and is mobile and persistent in soils and in water. Avitrol easily poisons non-target and secondary species prompting the EPA to reregister and limit its usage in 2007. WS must look at the new information concerning Avitrol as part of its new PEIS process. The PEIS is outdated especially in light of the 2007 reregistration, which highlights the acute toxicity of this product and limits its usage. Given that the EPA believes that any avian or mammal that is exposed to Avitrol could die, NEPA requires that that agency prepare a new PEIS and take a hard look at environmental problems associated with Avitrol, especially species that are considered threatened or endangered. Given the high toxicity of this poison and the imminent harm that could come from its misuse, and WS's poor track record with maintaining a safe toxics inventory, WS must undergo a thorough NEPA process and determine if this product is necessary for usage at all.

v. Sodium Cyanide (M-44s) and Sodium Flouroacetate (Compound 1080)

WS uses sodium cyanide-M-44 devices and Compound 1080-livestock protection collars to kill mammalian carnivores, especially coyotes but many other species, including those that enjoy federal protections such as wolves, California condors, and bald eagles. Both agents are Category I toxicants, the most acute, according to the EPA (EPA 1994, 1995). These deadly biological agents pose imminent harm in the environment and to people and are considered biological warfare agents.

WS hopes that these toxicants will benefit livestock growers, but risks associated with their use are great (including mishaps involving humans, pets, and protected species). WS has experienced a string of failed Office of Inspector General (OIG) audits relative to its toxics program (discussion below), and because any benefits from these toxicants are vastly over-rated given their inherent dangers—including potential usage as bioterrorism agents, WildEarth Guardians petitioned the EPA in January 2007 to ban these toxicants (Docket number, EPA-HQ-OPP-2007-0944). The EPA reviewed our petition and its four addenda and then organized a public comment period from November 2007 to March 2008. It received several thousand comments. On January 16, 2009, the EPA made a determination not to cancel or suspend these toxicants; on January 30th, WildEarth Guardians asked the Administrator Lisa Jackson to reconsider the decision in light of the change in Administration. In March 2008, the EPA sent WS a notice of warning letter for its illegal placement of M-44s on public lands (discussion below under the Sam Pollock incident).

The OIG audits are significant new information, which raises monumental issues concerning bioterrorism and the safety of the human environment which the 1994/1997 PEIS did not contemplate, and which must be thoroughly vetted as part of a new NEPA process.

M-44s are spring-loaded devices, topped with smelly baits that lure carnivores. When a carnivore tugs on the M-44, a spring shoots a pellet of sodium cyanide into the animal's mouth. When the cyanide pellet mixes with moisture, it turns into a deadly vapor. Sodium cyanide morphs into hydrogen cyanide gas, which is easily absorbed by the lungs (PEIS 1994). Death is rapid (Goncharov et al. 2006, Hooke et al. 2006).

Sodium cyanide is acutely toxic to both birds and mammals (PEIS), and M-44s kill hundreds of non-target species (e.g., bears, badgers, kit and swift foxes, bobcats, ringtail cats, javelinas, beavers, hawks, and pets) and thousands of target species (particularly coyotes and striped skunks) each year. In 2007, WS killed 14,274 animals, and a total of 68,000 animals from 2003 to 2007 with M-44s.

After only two minutes, a subject that triggers an M-44 device can die (Hooke et al. 2006). M-44s are highly dangerous for field personnel to place,[9] and potentially even more dangerous for the unsuspecting humans that might come in contact with them (Petel et al. 2004). Bird deaths from M-44 poisoning are underreported because of birds' ability to leave the vicinity in a few seconds (FWS 1993).

The EPA's M-44 use restrictions under the FIFRA (EPA Registration No. 56228-15) make it illegal to use in areas where federally listed threatened or endangered species occur. Despite this fact, WS and the FWS executed a biological opinion allowing for their use in lynx core areas in Colorado. In its Biological Opinion of 1993, the FWS noted that WS killed several non-target species of concern with M-44s: grizzly bears, kit and swift foxes, and ringtails. The agency found that M-44s could potentially jeopardize the continued existence of jaguarundi, ocelot, and California condors, among other species (FWS 1993). In August 1998, Montana, Fish, Wildlife and Parks documented that a grizzly bear died from an M-44. Bobcats, closely related to Canada lynx, a threatened species, occasionally are killed by WS's M-44s, which may mean that lynx could also be harmed by these devices.

[9] In Australia, sodium cyanide applicators must have a respirator on hand, special clothing, and an antidote kit (Petel et al. 2004), whereas Wildlife Services personnel are simply warned not to travel with cyanide capsules in the glove box or in tool boxes and to carry an antidote kit (USDA-APHIS 2001).

APHIS's Colorado (2005) environmental assessment states, "although the M-44 is selective for canids, APHIS-WS takes some nontargets other than canids on rare occasions" (USDA 2005). But M-44s may be selecting for the wrong canids, as a study at the Hopland Research and Extension Center showed that younger coyotes were more likely to be attracted to M-44s than were older animals—the ones more likely to be implicated in livestock losses (Sacks et al. 1999, Mitchell et al. 2004). WS likely indiscriminately kills animals that were never involved in livestock conflicts (Treves and Karanth 2003). Because M-44s are more unselective than previously thought, WS must consider non-target kills and the efficacy of using M-44s as part of its new PEIS process.

Despite federal regulations, WS has a track record of killing threatened or endangered species such as wolves (see list supra) and condors, as well as failing to adequately post notices, resulting in dead pets and causing primary and secondary exposure to humans.

In 1994, the EPA promulgated twenty-six use restrictions governing the placement of M-44s under FIFRA. Nevertheless, APHIS has, on a number of occasions, violated FIFRA and the ESA. By their very nature, M-44s are indiscriminate. As a result, pets and humans have been put into danger. In each of the instances that follow, the use restrictions for M-44s were violated by APHIS:

- In 1994, in New Mexico, WS illegally placed several M-44's in the Gila National Forest. The New Mexico Department of Agriculture fined WS $1,000 and suspended the license of the trapper and his supervisor.
- 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. WS illegally placed the device there without her knowledge or permission.
- On March 3, 1999, while irrigating his farm in Crawford, Colorado with his three-year old daughter and his dog, Paul Wright witnessed his dog's death after it had 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. The USDA paid the Wrights $9,500.
- In May 1999, a Virginia couple lost their dog, Rufus, to an M-44.
- In December 1999, two bird-dogs were killed by sodium cyanide during a bird-hunting trip in New Mexico on state lands.
- In January 2000, a dog died from M-44 poisoning in Estacada, Oregon.
- In May 2001, Maggie and Johnny Watson's dog in Gardner, Colorado was poisoned by an M-44. Other neighbors' dogs may have also been similarly poisoned.
- On February 4, 2002, Danielle Clair's dog died by an M-44 in Philomath, Oregon.
- On May 3, 2003, Dennis Slaugh, while recreating on federal public land in Uintah County, Utah, triggered an M-44. He thought he was brushing off an old survey stake. The device 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. Reportedly, he has been severely disabled ever since his encounter with cyanide (Ketchum 2008).

- On February 21, 2006, FWS biologist Sam Pollock was secondarily poisoned from handling his dog, Jenna, who was lethally asphyxiated by an M-44 illegally set by WS to kill coyotes on U.S. Bureau of Land Management land near Vernal, Utah. Pollock became ill with a headache and faintness, and noticed a metallic taste in his mouth. Mr. Pollock filed a tort claim that was denied. In March 2008, the EPA issued a notice of warning to WS that found that WS violated FIFRA on at least two counts, including placing the M-44 in a public recreation area and within 50 feet of a public road or pathway, and warned that future violations would result in enforcement actions.

- In April 2006, Sharyn and Tony Aguiar's two-year-old German shepherd was killed at a rock quarry in Utah. The couple filed a tort claim lawsuit against WS, but it was also denied. In a June 21, 2006, internal memorandum to colleagues, Barbara Knotz and Jeff Green, then Utah State Director of WS, 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. <u>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.</u> I recommend against settling this claim." (Emphasis added.)

Director Bodenchuk's egregious comments concerning members of the public purposely poisoning their pets to gain compensation reveals an astonishing mindset from a top WS official. This statement *was redacted* from documents sent by WS sent to WildEarth Guardians, but not in documents we received from the EPA.

This list of incidents may represent only a sampling of cases—where individuals have come publicly forward. Often people living in rural communities are afraid to speak out when incidents occur. In each of these cases, WS denied any culpability.

In 2008, the EPA issued a warning letter to WS about its mishandling of M-44s. Because it seems that WS is unable to fully comply with label restrictions as set out by the EPA, the agency must fully analyze this enormous problem as part of its PEIS process.

In 1972, President Richard Nixon banned Compound 1080 (sodium flouroacetate, FCH_2COOH), which was used to poison predators and prairie dogs and others, but in 1985, President Ronald Reagan and Secretary of the Interior James Watt brought this toxicant back in the limited form of Livestock Protection Collars (also known as "LPCs") to kill coyotes. The formula consists of one percent sodium fluoroacetate (Appendix P, p. 272).

At present, Compound 1080 is registered for use only in the following 11 states: Idaho, Montana, New Mexico, Ohio (on a case-by-case basis), Pennsylvania, South Dakota, Texas, Utah, Virginia, West Virginia, and Wyoming, according to officials at the EPA and APHIS. Of those states, Idaho, Utah, Virginia, West Virginia, Ohio, and Pennsylvania are operating under a state label (confidential personal communication, government official, 12/5/06). In 1998, California and Oregon banned Compound 1080.

Compound 1080 is colorless, odorless, tasteless, and quite water soluble; some countries consider this toxin as a threat to water supplies in the event of chemical warfare (Osweiler 1984). Compound 1080 is poisonous in small amounts. In humans, 2 to 10 mg/kg constitutes a lethal dose (Goncharov et al. 2006). In other words, 182-910 milligrams could kill a 200-pound person. The latency period for Compound 1080 to take affect is hours; in one study on animals between 5.3 to 14.6 (Hooke et al. 2006). Connolly (1998) described a shorter period, one half to two hours. Death to humans takes three to five hours (Goncharov et al. 2006).

Death by Compound 1080 is slow and unpleasant. Symptoms include convulsions, heart blockage, respiratory failure, hallucination, pain, and deep depression (Eason 2002, Goncharov et al. 2006). In January 2004, the FWS found a wolf that had been illegally poisoned by Compound 1080 in Idaho. According to a federal agent, the wolf, which was found near a rock slide, exhibited abrasions on its paws from convulsions, its teeth were clenched, and its body rigid.

Although it has been studied for decades, there is only one fool-proof remedy: ethanol (Goncharov et al. 2006). Alcohol must be administered immediately to be effective because it is a competitive inhibitor (Goncharov et al. 2006). No antidote exists.

Livestock protection collars strap Compound 1080 onto the necks of sheep or goats (PEIS 1994, Connolly 1998). The collars do not protect the individual that wears the collar, but aim to "target" the predator that bites the collar. While the intention to target the individual animal involved in livestock losses makes more sense than broad-scale indiscriminate killing methods, livestock protection collars have inherent problems. The collars are easily lost; they readily rip and spill their toxic contents; and safe disposal is problematic. Moreover, both poisoned livestock and predator carcasses often go undiscovered.

Spills associated with livestock protection collars occur. All of the contents of the spill may not be found, particularly if the carcass of the sheep or lamb is dragged. While some soil micro-organisms can break down 1080, conditions such as extreme cold or drought might cause 1080 residue to persist in the soil for several weeks or months (Eason 2002).

Furthermore, livestock protection collars can be easily lost or punctured by vegetation or barbed wire. In one study, 107 collars were either inadvertently lost or punctured, while only 57 were pierced by coyotes (Watson 1990). Connolly (1998) suggests that coyotes can bury collars or drag them away from sheep carcasses and that about half of missing collars were not recovered in research studies.

Livestock protection collars routinely go missing, according to WS's records. WildEarth Guardians reviewed 1990s records from Texas and found that, of the 1,787 sheep or goats that were collared, 1,655 livestock protection collars were returned to storage, while 156 were reported as missing. The numbers do not add up, as 1,787-1,655 =132. The numbers of missing collars or disposed collars equals 156. This means that at least twenty-four collars containing an acutely toxic substance went uncounted.

In at least two instances, more collars were returned to storage than were reported as used. WS Cooperator Agreement 20269 indicates that 21 animals on that Texas ranch were collared; yet 36 collars were returned to storage. Agreement 72193 indicates that 6 animals on that ranch were collared; yet 10 were returned to storage. We cannot know from these records where other discrepancies have occurred, such as if fewer collars were returned to storage than were actually used.

Moreover, of the 1,787 livestock protection collars applied in this Texas sample, only 56 coyotes were "suspected killed by LPC". Of that number, only 3 coyote carcasses were recovered. In other words, 53 Compound 1080-tainted coyote carcasses were not recovered, which poses risks for scavenging animals. Two agreements indicate that the livestock killed while wearing those collars were also not recovered (agreements 29295 and 64202.)

The Texas FOIA also indicated that several collars were punctured by cactus, mesquite trees, and fences. Agreement 64202, for example, states, "most of torn collars had prickly pear [cacti] punctures." When they accidentally burst it is virtually impossible for applicators to recover the disseminated poison, with consequent environmental contamination.

In some cases, LPCs were disposed of even when no predation on domestic livestock occurred. Because of WS's codes, we cannot determine what happened, although it is likely that many of the LPCs were punctured, made unusable, and then had to be destroyed. Agreement 11403 shows that 40 livestock were collared, one was punctured by a coyote, yet 21 LPCs were burned. Agreement 23211 shows that 46 livestock were collared, 2 LPCs were punctured, one collar went missing, yet 13 LPCs were buried. Agreement 64202 states, "most of torn collars had prickly pear [cactus] punctures." Other older records in the Texas FOIA indicate that several collars were punctured by cactus, mesquite trees, and fences. As we have already indicated, LPCs are inherently unsafe.

Finally, most of the LPCs destroyed in the Texas sample were burned. We are concerned that the method of burning is also laxly regulated. One record indicated that the propellant used to burn LPCs was diesel. What types of fuels are applicants using to burn LPCs? Of the 68 records we reviewed, only 3 were buried, but it is unclear if they were buried properly and away from water sources, and whether they were or are buried on public lands.

The EPA and APHIS rely on private individuals to properly dispose of Compound 1080 once a spill has occurred. Livestock producers, who have been trained by licensed applicators, are expected to incinerate or bury everything that has come into contact with Compound 1080. Those that bury the toxicant must do so under three feet of soil (Connolly 1998). The burial site is supposed to be one-half mile from human habitation and away from water sources; no more than 10 collars can be buried at one site; and the sites must be ten feet apart from each other (Connolly 1998). Relying on livestock producers to properly dispose of Compound 1080, without any oversight by certified personnel, presents potential problems, including theft or improper disposal, which could cause unintentional human poisonings to occur.

Because carcasses and spills associated with Compound 1080 must be handled as hazardous waste (Mitchell et al. 2004), and because the EPA and WS rely upon individuals who may or may not be properly trained to handle this toxicant or who purposely do not handle this the waste from this toxicant properly, environmental risks could and probably do occur. LPCs are routinely lost or maybe stolen. Animals contaminated with Compound 1080 are not found. The toxicant is spilled onto the ground when collars are inadvertently ripped. WS must consider all these factors as it engages in a new PEIS process.

In 1989, a newly-hired predator-control agent to the Wyoming office of the Wyoming

Department of Agriculture found that those officials had hoarded Compound 1080 despite the ban. They sold 1080 to private individuals who used it to poison wildlife, including bald and golden eagles (Robinson 2005). In 1991, the FWS and the EPA raided the offices of the Wyoming Department of Agriculture; the FWS subsequently engaged in a law enforcement action that led to several convictions (Robinson 2005). But that did not end illegal poisonings.

In 2001, approximately 60 pets were poisoned by 1080 in Grand Junction, Colorado and the investigating police officer, David Palacios, who handled the poisoned animals experienced, "'flu like symptoms, only 10 times worse'" (Lofholm 4/12/01). The Grand Junction police and federal investigators were never able to apprehend the culprit who ultimately dumped the poison into the local sewer system (Lofholm 3/15/01, 4/12/01).

The EPA's ELLS Pesticide Report (EPA's database) shows that in 1984, 3 magpies died from Compound 1080 and in 1989, 58 ravens were poisoned by the substance. We do not know if these poisonings were legal under the auspices of the EPA's use restrictions, but they may have constituted violations of both FIFRA and the MBTA.

Most of the current literature on Compound 1080 research comes from New Zealand and Australia where Compound 1080 is used in baits or in M-44 ejectors. As a result of this practice, researchers have found that numerous non-target species (including herbivores) can die from Compound 1080 (Lloyd and McQueen 2000, Eason 2002, Martin and Twigg 2002, Martin et al. 2002, Marks and Wilson 2005). The FWS found that Compound 1080 used in livestock protection collars is a "direct exposure risk to grizzly bears and gray wolves" and thus made jeopardy determinations related to Compound 1080 for those species (FWS 1993). APHIS found that Compound 1080 may affect golden eagles, bald eagles, ocelot, San Joaquin kit fox, ocelot, and jaguarundi (PEIS 1994).

While birds, such as vultures, ravens, magpies, hawks, and even mammals can flee an area in seconds, because Compound 1080 takes hours to act, their poisoned corpses may not be found readily. Sodium flouroacetate is, in fact, "highly toxic to birds and mammals" (FWS 1993).

Furthermore, Compound 1080 can cause secondary poisoning to predators and even to herbivores (FWS 1993, Eason 2002). But while Compound 1080 can be eliminated through metabolization by animals that receive non-toxic doses, carrion poisoned with 1080 can be toxic for many months (Eason 2002). The EPA's reregistration eligibility determination for 1080 states that scavengers, including those that are threatened and endangered, could be affected by Compound 1080 if those animals consume the meat around the head or neck of dead livestock that wore livestock protection collars (EPA 1995a).

Despite the foregoing, APHIS claims that while non-target species have been known to scavenge from a sheep or goat carcass wearing the collar, "none were known to be poisoned by Compound 1080" (USDA 1994). WS has now been contradicted and discredited by newer information. Thus, the agency must update its NEPA analysis because the old analysis is based on faulty facts. In sum, because of the toxicity of Compound 1080 and potential for primary and secondary poisonings; the likelihood that livestock protection collars will be inadvertently punctured or lost; and the potential for 1080 to be used as a weapon of terror, WS must stop the manufacture, distribution, and use of this dangerous toxin until it undertakes and completes a new NEPA process.

Since the 1994/1997 PEIS, there has been significant new information showing that M-44s and Compound 1080 present a significant risk to the environment and human health, and their use should therefore end. The risks posed by the use of Compound 1080 and M-44s far outweigh any perceived benefits, especially when compared with effective non-lethal alternatives.

vi. DRC-1339

The toxicant DRC-1339, a deadly avian toxin, may be the biological agent that WS uses the most, because according to their kill tables, it is associated with the largest numbers of deaths.[10] In 2007, WS killed 2,145,074 birds—mostly starlings—with this biological agent. DRC-1339 is permitted for use in poultry and livestock feedlots, buildings, fenced areas where crops are not present, wildlife refuges, gull colonies in coastal areas, and bird staging areas and roosting sites (EPA 1995b). WS has used and may use it liberally in North and South Dakota ostensibly to protect sunflower growers by poisoning large numbers of blackbirds, grackles, and others.[11] Ironically, sunflower seed is often sold as wild birdfeed to bird-watching enthusiasts.

The EPA writes that DRC-1339 is "slow-acting and highly toxic to target species": death takes one to three days after ingestion. WS explains in its 1994/1997 PEIS that, "DRC-1339 is a slow-acting avicide, so many more birds may be affected by consumption of bait and are not necessarily found after treatment is completed" (Appendix P, p. 198). This view is echoed by a recent article authored by WS's researchers, who found that *the slowness of the toxicant to act (one to several days) combined with birds' mobility, leaves researchers with few target and non-target species to retrieve* (Johnston et al. 2005). Johnston et al. (2005) write, "with respect to the use of CPTH [DRC-1339] to control pest bird populations, it is highly problematic, if not impossible, to conduct a field baiting study and subsequently determine the number or percentage" of exposed birds.

This fact explains how WS's annual kill tables can fluctuate by more than a million individuals in a year. In 2004, WS killed 2.3 million starlings, but in other years claimed half of that amount, such as 1.2 million starlings in 2007. Since the 1994/1997 PEIS issued, WS's researchers have indicated that kill numbers may be grossly inaccurate, and that the actual kill numbers are unknown. WS may actually kill far more species with DRC-1339 than it claims.

In February 2008, a man described picking up 5 dozen dead or dying starlings in his back yard with a pitch fork in Winchester, Indiana after WS had poisoned a nearby dairy feedlot (Slabaugh 2008). In March 2008, a woman in Yakima, Washington reported picking up three trash bags full of dead birds after witnessing the death of thousands (Antone 2008). In New Jersey, several thousand dead birds ended up on lawns, cars, and porches; WS promised, in future, not to allow bird mortality to occur over a weekend so that federal agents could be on hand (Murray 2009). If people are picking up dead birds by the pitchfork full in back yards, how can WS count them? It cannot.

---

[10] DRC-1339 ($C_7H_9NCL_2$) is known by several names: starlicide, "starlicide complete", 3-chloro-4-methylbenzeneamine hydrochloride, 3-chloro-4-methylaniline-hydrochloride, 3-Chloro-p-toluidine hydrochloride, CPTH, or CTH (USDA 1994, EPA 1995b, Jacobs Undated).

[11] The EPA allows Wildlife Services and others to target the following species with DRC-1339: black-billed magpies, boat-tailed grackles, blackbirds (Brewer's, red-wing, rusty, tri-colored, and yellow-headed), brown-headed cowbirds, common crows, grackles (common and great-tailed), ravens (common and white-necked), gulls (great black-backed, herring , and ring-billed), pigeons, and starlings (EPA 1995b).

How many blackbirds and other native species are actually killed by WS each year? In FY 1988, WS claimed *it killed 3.7 million blackbirds in nine states* (PEIS, Chapter 4, p. 64). For perspective, 3.7 million blackbirds is more than double the total kill figure for the entire U.S. in FY 2006, which was 1.6 million. WS's PEIS argues that "the red-winged blackbird is the most numerous and widely distributed blackbird species in the United States (Webb and Royall 1970)" (PEIS Chapter 4, p. 64). Yet, the National Audubon Society has recently reported that even "common" species of birds are disappearing. Of 20 common birds (including several sparrows and grackles) surveyed, the average decline was 68 percent (Butcher and Niven 2007). Certainly, broad-scale poisoning operations contribute to native bird declines—especially if WS killed nearly 4 million birds in a handful of states in a single year.

Since WS does not know how many blackbirds and other species it kills in a year, neither can the public. In fact, the PEIS gives no methodology for how it counts the hundreds of thousands of dead each year – it appears as if the kill totals are pure speculation. As part of its new PEIS, WS must provide a reproducible, accountable methodology for figuring the annual death tolls. Pure speculation will no longer suffice, and is a particularly dangerous methodology for managing wildlife.

The recklessness of putting out so much DRC-1339 into the environment alarms the FWS. It indicates in several biological opinions that only strychnine (a highly regulated substance) has more potency than DRC-1339. More chilling, WS is unaccountable for DRC-1339's damage in the environment. An August 12, 1999 biological opinion from the FWS to Dr. George Linz, a USDA researcher, indicates that despite poisoning 450 sites on North and South Dakota, "virtually no data was [*sic*] acquired from this effort." Further, the FWS has repeatedly warned WS in a series of biological opinions about WS's failure to account for non-target poisonings. FWS suspects that WS could harm and may have harmed federally protected species such as whooping cranes, bald eagles, peregrine falcons[12] and American burying beetles, according to biological opinions.

Since the 1994/1997 PEIS issued, it has become apparent based on the FWS's biological opinion that WS does not know how many non-target species it kills and that this information is vital to the decision maker and to the public. NEPA requires agencies to collect data, and under the new PEIS process, WS must collect the data on how many species it kills with DRC-1339 and other toxicants.

DRC-1339 kills target species such as blackbirds, but also poisons other species unintentionally through two processes: 1) directly: grain-eating birds consume the toxicant and die; and 2) indirectly: avian predators or scavengers eat dead or dying birds that have been poisoned by DRC-1339. While DRC-1339 is acutely toxic acute to granivorous birds, laboratory studies indicate that hawks and kestrels experience no adverse effects when fed starlings that had been poisoned by one-percent, active-ingredient baits. However, other carnivorous birds such as crows, ravens, owls, and magpies were more acutely sensitive to DRC-1339 than were hawks and kestrels (EPA 1995b).

[12] FWS specifically indicated in its January 7, 2000 BO that even though peregrine falcons are no longer listed under the ESA, that they are protected by the MBTA.

Linz et al. (2002) contend that the species susceptible to DRC-1339 include waterfowl (LD_{50} 10-100 mg/kg), doves, galliformes, and owls (LD_{50} < 20 mg/kg). Johnston et al. (2005) describe a much larger non-target species list: savannah sparrows, killdeers (insectivores that consume little grain), mourning doves, meadowlarks, American pipits, northern cardinals, horned larks, herring gulls, ring-necked pheasants, American robins, American tree sparrows, Canada geese, mallards, northern flickers, , downy woodpeckers, dark-eyed juncos, green-winged teals, song sparrows, vesper sparrows, grasshopper sparrows, field sparrows, and rock doves. The FWS documented that a peregrine falcon, then a listed species, died from secondary toxicity after eating starlings near a DRC-1339-baited site (FWS, BO, Oct. 4, 1995). The fact that raptors die from secondary poisoning and numbers of non-target species based on the studies above are new issues that WS must address in a renewed PEIS process.

Poisoning black birds with DRC-1339 fails to protect crops, and these efforts, including using non-lethal controls, do not benefit sunflower growers economically (Linz and Bergman 1996, Blackwell et al. 2003). Given that these methods fail, as WS researchers note, there is no purpose or need to use this toxicant, especially in light of the fact that it causes unknown numbers of non-target species' deaths. Coupled with WS's admission that glyphosate only slightly reduces nesting activity, WS must conduct an in-depth analysis of its blackbird removal program—perhaps a compensation program would be more efficacious, for example.

WS asserts that only it can apply DRC-1339 and alpha-chloralose, but that starlicide can be applied by certified applicators (USDA 2006). Jacobs (undated), a writer for the EPA, claims that all products with 98% active ingredient of 3-chloro-p-toluidine hydrochloride, 3-chloro-4-methylbenzenamide hydrochloride, or 3-chloro-4-methylaniline hydrochloride are restricted to either certified applicators or for use only by the USDA; however, any certified applicator can apply 0.1% active ingredient ready-made-bait mixture. New information since the release of the 1994/1997 PEIS indicates no clarity around the question of who can apply certain toxicants such as DRC-1339, and at what concentrations. A new process to analyze this information must be undertaken to mitigate these questions.

Because Johnston et al. (2005) found it impossible to count the number of birds killed by DRC-1339 in field experiments, they turned to modeling to estimate mortality. They exposed blackbirds (a target species) and mourning doves (a non-target species) to the toxicant and then used a model to demonstrate the efficacy of DRC-1339. They found that mourning doves consumed more grain relative to their body weights than did blackbirds; doves were more susceptible to the poison—if the regime occurred during a short period of time. The more days that the bait was left out, however, increased the number of blackbirds relative to mourning doves, because over multiple days, blackbirds repeatedly dosed themselves. Without citing any sources, Johnston et al. (2005) claim that other non-target species such as several varieties of sparrows and snow geese had no mortality in previous field studies. Relying on a personal communication, but not a study, Johnston et al. (2005) determined that meadowlarks and northern cardinals "generally consume at least an order of magnitude less rice seed bait than do mourning doves." They therefore conclude that for these species, exposure to DRC-1339 "would be at least ten times less than for mourning doves" making mourning doves the non-target species most affected by this toxicant.

Because mourning doves are a hunted species, WS must consider cumulative impacts on dove population such as state and federal bag-setting limits. WS must consider bag limits on a site-specific level, and the FWS must consider how many doves WS poisons each year before setting limits.

Sunflower growers have "rejected" non-lethal techniques to protect their sunflower crops "because of poor efficacy, negative cost-benefit ratios, and difficult logistics" (Linz et al. 2002). The most common methods include scaring devices such as propane canisters that emit booms and reducing cattail populations in wetlands. WS writes, "despite extensive research, the efficacy of most non-lethal techniques remains unproven or inconsistent" (USDA 2006). Because the PEIS suggests these non-lethal techniques as mitigation, in addition to, or before using lethal techniques, growers rejection of them is significant new information that should be factored into a new NEPA analysis. Since poisoning birds directly does not seem to work, but neither does poisoning cattails, and the fact that growers reject non-lethal solutions, it seems apparent that there is little benefit from the bird-poisoning program.

The toxicant DRC-1339 is probably the most widely used toxicant by WS. It kills the largest number of species overall. Yet, as recent media reports (Antone 2008, Slabaugh 2008, Murray 2009) make clear, WS cannot document how many birds it actually kills using DRC-1339. People are picking up birds and by the trash bag full, while numerous others go uncounted. The agency's own researchers indicate that models – not actual data – project how many birds they kill per year, thus this explains the huge fluctuations – by one million animals per year – that WS numerates. WildEarth Guardians remains concerned about the potential for non-target species to be killed by this toxicant, the decline in native bird populations across the U.S., as well as secondary poison threats to wildlife and to people's pets despite WS's assurances to the contrary. Therefore, WS must use the significant new information and studies that have issued since 1994/1997 to inform its NEPA process concerning DRC-1339.

vii. Glyphosate

Since 1991, WS has sprayed over 61,408 acres of cattail marshes with herbicide in North Dakota to reduce blackbirds' roosting habitats (USDA 2008). The enormous amounts of glyphosate, a plant defoliant commercially sold as Rodeo™, poured onto wetlands to benefit the sunflower industry in North and South Dakota likely contravenes the MBTA, the Bald and Golden Eagle Protection Act, the Clean Water Act, the NEPA, FIFRA, and the ESA.

WS poisons cattails with glyphosate, but has failed to determine the effects of this pesticide on wildlife (especially those that are federally protected), people, and the environment. A recent study of glyphosate indicates that those effects are largely unknown, yet WS's 2008 environmental assessment only discloses the benefits of this toxicant. Glyphosate could potentially present primary and cumulative poisoning threats to a host of species, especially to whooping cranes (that feed on poisoned invertebrates), bald eagles (that frequently feed on poisoned fish), amphibians (vulnerable to pesticides because of porous skin), invertebrates, and fish—including species that may be protected under the ESA such as the Topeka shiner (which historically ranged in South Dakota)[13] and the pallid sturgeon (a resident of the Mississippi and Missouri Rivers).[14]

Under a recent environmental assessment (EA) for black bird eradication in North and South Dakota, WS sprays 70 percent of cattails in particular wetlands with glyphosate so that roosting

[13] See Federal Register, Vol. 69, No. 143, July 27, 2004.

[14] See Federal Register, Vol. 55, No. 36641, September 6, 1990.

habitat for blackbirds and common grackles is destroyed to benefit sunflower growers (USDA 2008). The EA claims that this work is beneficial to waterfowl and other wildlife. Further, the EA admits that cattail management fragments cattail populations and "could *slightly limit* the availability of cattail breeding habitat for Red-wing Blackbirds and Yellow-headed Blackbirds in localized areas" (USDA 2008 at 3). If the treatments only work "slightly," the precautionary principal warns that it is not worth the enormous environmental hazards posed on the environment, wildlife, invertebrates, and people. More alarming is that WS proposes to increase this activity by 8,000 acres per year (total of 32,000 acres) in the coming four years (USDA 2008).

Native cattails (*Typha glauca*) have hybridized with an invasive species (*Typha latifolia*), and farming practices (soil disturbance from frequent tillage and an increase in soil salinity) have resulted in the spread of this hybrid species into monotypic stands (Ralston et al. 2007). Along with intensive agricultural practices, suppression of prairie wildfires and the creation of roadway ditches have also contributed to cattails' spread (Leitch et al. 1997). WS removes cattails by aerially spraying gylphosate on wetlands to benefit farmers.

Removing cattails can benefit some species such as black terns (Linz et al. 1994, Linz and Blixt 1997), certain ducks (Linz et al. 1994, Linz et al. 1996a), some aquatic invertebrates (Linz et al. 1999), rails, and shorebirds (Leitch et al. 1997). Other species such as black birds and marsh wrens (Linz et al. 1996b), aquatic invertebrates (Henry et al. 1994, Leitch et al. 1997), fur-bearing species, white-tailed deer (Leitch et al. 1997), and non-migratory birds (Leitch et al. 1997) are harmed by cattail removals because they utilize these habitats during the winter. Despite its widespread use, the PEIS discloses that glyphosate is toxic to fish – "the Roundup formulation (41% a.i. [active ingredient]) was three to 42 times more toxic to aquatic organisms than the technical grade material" and the toxicity increases with temperature rises – it is doubly toxic to rainbow trout at 17° C as it is at 7° C (Appendix P, p. 217).

Ralston et al. (2007) write that current management cattail-removal activities occur on about one percent of wetlands, but "the affects of these management actions on wildlife populations, however, are largely unknown." But Ralston et al. (2007) apparently find this acceptable because they write, "waterfowl are generally considered to be of economic value; whereas, high blackbird populations can cause significant damage in local areas."

Amphibian populations are rapidly declining and pesticides have been strongly implicated (Hayes et al. 2006). Because most studies have only concentrated on a single pesticide, biologists argue that risks have been grossly underestimated with regards to the role of pesticides and amphibian declines (Hayes et al. 2006). Even low concentrations of pesticides can harm amphibians (Hayes et al. 2006). Frogs exposed to pesticides have retarded growth and less capacity for foraging, predator avoidance, and fecundity -- and this poses alarming population-wide implications (Hayes et al. 2006). Davidson et al. (2007) suggest that environmental contaminants and disease have contributed to amphibians' population declines and that sub-lethal doses suppress immune systems that facilitate epidemics. Apparently, no studies have looked at how glyphosate may influence amphibian populations.

In sum, glyphosate is toxic to organisms but the consequences of its use are largely unknown. Yet, WS has sprayed this plant defoliant over 61,000 wetland acres in North and South Dakota and hopes to spray 32,000 acres more in the next four years (USDA 2008). WS claims that glyphosate benefits waterfowl and sunflower growers, but it has largely ignored the body of scientific literature we cite here that has issued since 1997. This information shows that this product may be highly harmful to species (especially species considered threatened or endangered) and the environment—including wetland habitats. Use of this toxicant likely contravenes several federal statutes including the MBTA, CWA, the ESA, and others. WS must supplement its 1994/1997 PEIS to include an analysis of this toxicant.

viii. Sodium Nitrate/Nitrite

Sodium and potassium nitrates are combined with sulfur and carbon in canisters that are ignited and used as rodenticides, predacides, or insecticides in burrows or dens (EPA 1991) in a practice WS calls "denning." Target species include rodents (moles, ground squirrels, woodchucks, prairie dogs, and pocket gophers), skunks, coyotes, red foxes, and ground-nesting wasps (EPA 1991). The EPA considers gas cartridges as a Category II toxicant – the second highest degree of toxicity on a scale of four. Because this pesticide is used in burrows and dens, many non-target species, such as desert tortoises, black-footed ferrets, and burrowing owls are susceptible to unintentional poisoning.

Sodium nitrate explodes when heated to 1,000 degrees and produces the toxic fumes of nitrous oxide and sodium oxide (EPA 1991). The gas released is carbon monoxide. Nitrite converts the blood's hemoglobin to methemoglobin, which does not carry oxygen (EPA 1991).

WS uses large gas cartridges, which agents bury in dens to asphyxiate pups of target mammals. EPA Registration Number: 56228-21 (April 1996). Large gas cartridges, only allowed for asphyxiating coyotes, red foxes, and striped skunks, are comprised of a mixture of sodium nitrate (53 percent), charcoal (29 percent), and inert ingredients (19 percent). The EPA's label for the cartridges warns that it will burn with vigor until empty and could cause severe burns and start a fire. It further warns against inhaling, and if symptoms occur (headache, nausea, dizziness) to lie down, stay warm, and breathe pure oxygen if available. This label requires specific considerations for black-footed ferrets, Fresno kangaroo rats in southern Utah, Hualapai Mexican voles, and blunt-nosed leopard lizards. It also requires that WS not harm red and gray wolves (but does not warn against poisoning Mexican gray wolves or San Joaquin kit foxes).

Small gas cartridges, EPA Registration Number 56228-02 (November 2005), are used for the following rodent species: woodchucks, yellow-bellied marmots, ground squirrels, black-tailed prairie dogs, white-tailed prairie dogs, and Gunnison's prairie dogs (now a candidate species in the montane portion of its range). This label specifically warns about harm to burrowing owls (from May through July), Fresno Kangaroo rats, giant kangaroo rats, Stephen's kangaroo rats, Tipton kangaroo rats, Point Arena mountain beavers, San Joaquin kit foxes, Hualapai Mexican voles, Morro Bay kangaroo rats, Utah prairie dogs, Coachella Valley fringe-toed lizards, Island night lizards, blunt-nosed leopard lizards, San Francisco garter snakes, eastern indigo snakes, and gopher tortoises (but not desert tortoises). The contents of the small canister are nearly the same as the large: sodium nitrate (53 percent), charcoal (28 percent), and 19 percent inert ingredients.

WS's PEIS includes analysis of effects of gas cartridges on the following protected species: kangaroo rats, protected mice, Point Arena mountain beavers, gray wolves, New Mexican ridged-nosed rattlesnakes, San Francisco garter snakes, desert and gopher tortoises, Santa Cruz long-toed salamanders, Island night lizard, black-footed ferrets, San Joaquin kit foxes, blunt-nosed leopard lizards, and Utah prairie dogs (Appendix P, p. 249-252). The PEIS failed to analyze for Mexican wolves.

Any animal in the burrow or den at the time of exposure is likely to die when gas cartridges are used, which is particularly problematic if protected species are present. The EPA specifically mentions burrowing owls, which are ground-nesting birds subject to MBTA protections. WS admits, "because it may be difficult for users to determine the presence of some non-targets within an underground burrow, *the label may not be stringently followed in all situations*, and some non-target individuals may be killed" (emphasis added, Appendix P, p. 250).

The AVMA claims that carbon monoxide causes a loss of consciousness without pain or discomfort or even awareness, and death is rapid if correct concentrations are used (AVMA 2007). While the AVMA claims that sodium nitrate canisters can provide a humane death, there are other problems from use of this: many non-target species, including species that are classified as threatened or endangered, may be killed with this toxicant because they are used in underground burrows or dens. Because of this, WS must engage in a new NEPA process that includes a review of the significant new information concerning the efficacy and use of sodium nitrate.

ix. Strychnine

Strychnine, which is bitter, odorless, crystalline, and highly toxic, can kill a wide range of taxa. It comes from the plant *Strychnos nux vomica*, which grows in southern Asia and Australia (CDC 2003). The EPA rates strychnine as a Category I toxicant, the most acute class (EPA 1996a). It affects neurons, switching off muscles and resulting in severe and painful convulsions until breathing is stopped (CDC 2003).

In 1972, strychnine was banned as used for killing predators, and in 1973 for killing skunks (EPA 1996b). In 1988, a federal district court judge banned the above-ground use of strychnine because the EPA and Department of Interior could not show that this substance could be kept away from protected species, especially bald eagles, wolves, grizzly bears, migratory birds and other wildlife.

FIFRA requires that strychnine be used in a manner that could only kill targeted species because it will kill anything that ingests a lethal dose. The EPA, U.S. Department of the Interior, and American Farm Bureau appealed the 1988 decision. The appellate court upheld the lower court's ruling with regards to the ESA, but not the MBTA and the Bald and Golden Eagle Protection Act (EPA 1996b). After the courts' decisions, however, the FWS issued several biological opinions (i.e. on black footed-ferrets and bald eagles), which essentially left the above-ground usage injunction in place (EPA 1996b).

The EPA's re-registration eligibility decision for strychnine claims that its use profile is for pocket gophers only (EPA 1996a). It can be used to protect orchards, agricultural crops, for forestry, and outside of residential dwellings (EPA 1996b). The 1994 PEIS suggests that WS is using strychnine for all below-ground rodents such as gophers, prairie dogs, and ground squirrels (Appendix P, p. 220). The steam-rolled oat formulation was used to poison pocket gophers, ground squirrels, and prairie dogs in Nebraska, New Mexico, and Oregon for the period 1988 to 1991 to protect livestock feed, alfalfa, turf, trees, and rangeland (Appendix P, 227). Therefore, WS's documents must reflect agency compliance with EPA's new requirements for strychnine.

The PEIS has two conflicting positions on strychnine and secondary poisoning. In the first, it claims that strychnine is the only compound that can cause "significant" secondary hazards to raptors, and it recommends immediate above-ground carcass removal as a mitigation measure (Appendix P, 11). Later, the PEIS contends that raptors are less likely to be poisoned by strychnine than other scavengers because they generally "eviscerate prey and remove the poisoned gastrointestinal tract prior to ingestion" (Appendix P, 222). More current studies and the EPA concur with WS's first finding.

Pocket gophers feed on tree shoots that are concentrated in forest plantations, and so strychnine baits are used to kill them (Arjo et al. 2006). Some non-target species such as chipmunks and deer mice can ingest strychnine, die above ground, and cause secondary poisonings to both terrestrial and aerial species—especially species that cache large quantities of carcasses (Arjo et al. 2006). Strychnine baits are directly lethal to songbirds and cause secondary poisoning to raptors (Knopper et al. 2006). The EPA found that strychnine is highly toxic to birds, small mammals, and some fish (EPA 1996b).

The PEIS admits that the steam-rolled oat formulation, which is used below ground, can directly harm the following non-target species: mice, jumping mice, yellow pine chipmunks, black-tailed jackrabbits, and cottontails. The PEIS adds, "some small mammals that consume bait underground are found dead on the surface and do present a secondary hazard to other scavengers and predators" (Appendix P, p. 234). Secondary poisonings could kill cats, dogs, and possibly the following protected species: ocelot, jaguarundi, northern aplomado falcon, bald eagle, and peregrine, wolves (Ibid.).

Grain, usually steam-rolled oats and milo, is mixed with strychnine and commonly used to exterminate pocket gophers, ground squirrels, and prairie dogs. The PEIS states that strychnine can affect any bird or mammal that ingests bait and that predators and scavengers are at risk for secondary poisoning.

Threatened and endangered species have also been killed by strychnine. That list includes Attwater's prairie chickens, whooping cranes, bald eagles, now-delisted peregrine falcons, northern aplomado falcons, jaguarundi, ocelots, and wolves (PEIS 1994).

To reduce the threat of secondary poisoning, the USDA recommends that the carcasses of poisoned birds and mammals be picked up following bait application and "unused bait" be removed (PEIS 1994). The potential or realized death for wildlife is considered acceptable and indeed inevitable as long as the primary targets are pocket gophers, ground squirrels, or prairie dogs, all of which are ecologically important rodents and increasingly imperiled.

Strychnine, even if used only below ground, can have deleterious effects on non-target species. It can cause mortality to any subject that ingests a lethal dose, whether directly or indirectly through secondary poisonings. Given the enormous hazards associated with strychnine, and WS's poor track record, Congress should revoke WS's ability to use this dangerous toxicant. At the very least, WS must analyze the most recent data on strychnine in its new NEPA analysis.

x. <u>Zinc Phosphide</u>

Zinc phosphide is a dull, grayish black inorganic compound used as a rodenticide throughout the world (Shivaprasad and Galey 2001). According to the EPA, zinc phosphide can only be used to poison rodents such as mice, chipmunks, ground squirrels, prairie dogs, voles, moles, rats, muskrats, nutria and gophers; and lagomorphs such as black-tailed jackrabbits and jackrabbits (EPA 1998). It is available in two forms: 1) over-the-counter for below-ground baits use, *or* 2) as restricted use, above-ground baits (Poppegna et al. 2005). Zinc phosphide is formulated as a bait in solid, dust, granular, pellet, tablet, or wettable powder (EPA 1998).

The EPA allows for liberal use of this toxicant both indoors (for "spot treatments," including where food is handled) and outdoors (around burrows, underground, in orchards, vineyards, and on various croplands and rangelands and in non-crop areas). Zinc phosphide can also be applied broadly, even aerially. The EPA suggests that these broadcast applications allow for coverage over vast areas of land. This agency believes that by allowing "limited broadcast" applications, people may refrain from using toxicants that are more hazardous (EPA 1998). WS suggests that zinc phosphide is usually applied by certified applicators that are not federal agents (Appendix P, p. 254). Pre-baiting is required because of bait shyness—the taste and odor is offensive (Mason and Littin 2003) (Appendix P, p. 254). Zinc phosphide has no known antidote (Mason and Littin 2003). WS must discuss in a new PEIS how it will mitigate unintentional poisoning by zinc phosphide to species, and how to prevent this poison from being exposed to humans.

The EPA assumes that grass exposed to zinc phosphide and then fed to livestock, does not appear as a residue in either milk or meat (EPA 1998). The EPA considers "nonfood" areas to include alfalfa, barley, dormant berries, oats, sugar maple, wheat, no-till corn, macadamia nut orchards, and in orchards and groves that are dormant (EPA 1998). The EPA considers "food areas" to include rangeland grasses, sugarcane, and grapes (artichokes and sugar beets have special California registrations) (EPA 1998).

Zinc phosphide works by interacting with stomach acids to produce phosphine gas which inhibits cytochrome oxidase (an enzyme that helps in respiration) (Mason and Littin 2003). Zinc phosphide has no antidote (Mason and Littin 2003). The toxicity of zinc phosphate varies among species and is dependent on a species' ability to vomit—rodents cannot, and this allows increased selection for rodents (Poppegna et al. 2005). Because stomach acids aid the release of phosphine gas when the bait is ingested, whether or not a subject has a full or empty stomach affects toxicity as well (Poppegna et al. 2005).

Hearts and brains, which require oxygen, are particularly susceptible to impairment (Mason and Littin 2003). Death results from pulmonary edema and hypertension, cardiac failure, and respiratory collapse (Mason and Littin 2003). Phosphine can damage livers and kidneys (Mason and Littin 2003). According to Shivaprasad and Galey (2001), zinc phosphide poisoning creates a bi-phasic mechanism of action. One part is responsible for a rapid release of phosphine gas, and the other acts more slowly, in the gastrointestinal tract, probably resulting in gastroenteritis and other lesions.

Necropsies of rodents show acute swelling in the intestinal tract, gastric ulcers, chemical corrosion, blood in the trachea and lungs, and coronary and liver congestion (Mason and Littin 2003). Rodents exhibit signs of diarrhea, respiratory distress, and depression (Mason and Littin 2003). Poisoned rodents use their hind feet to kick at their stomachs and demonstrate other signs of pain (Mason and Littin 2003). Death is either rapid, 4 to 24 hours, or prolonged, up to three days (Mason and Littin 2003). In delayed cases, liver damage occurs (Mason and Littin 2003).

In a study that reported domestic fowl deaths, authors found lesions including hemorrhage, pulmonary congestion, liver degeneration, heart muscle degeneration, and nephrosis

(Shivaprasad and Galey 2001). Shivaprasad and Galey (2001) write that such lesions have been previously described in dogs, cats, birds, and humans due to zinc phosphate poisoning (they cite: Orr, 1952; Stephenson, 1967; Stowe et al. 1976; Casteel and Bailey, 1986; Osweiler et al 1987).

WS's PEIS distinguishes between "primary" non-target species, granivorous birds and mammals (rodents, lagomorphs, and deer), and those that are secondarily poisoned (e.g., a crow that consumes a poisoned mouse) (Appendix P, p. 263). Non-target subjects can involve several taxa, including humans.

A tiny amount of bait, even a single swallow, could be fatal to a child (EPA 1998). This fact is more alarming considering the fact that there are no known antidotes to zinc phosphate poisoning (Mason and Littin 2003). To mitigate this, the EPA requires that dye and bittering agents be added to this bait (EPA 1998). It is unclear whether bittering agents would prevent children from trying this toxicant—especially if they are attracted to the color.

Poppegna et al (2005) report that this compound is toxic to wild birds, small mammals, and freshwater fish. They report that there have been several cases of non-target wildlife and domestic animal intoxication, including winter-stressed wild turkeys (Poppegna et al. 2005). Geese are "particularly sensitive" to zinc phosphide baits, nutria are the "most sensitive," and the least sensitive are desert kit fox (Appendix P, p. 255). In addition, the WS's PEIS identifies protected species such as whooping cranes, woodland caribous, bald eagles, the now-delisted peregrine falcons, and Aleutian Canada geese as potentially vulnerable to zinc poisoning.

The effects of such intoxication are hard to determine since not all non-target species are found because zinc phosphide acts slowly, and thus poisoned animals may leave the baited areas before dying (Appendix P, p. 263). For instance, a barley field poisoned to kill moles burned several months after the zinc phosphide was applied and the uneaten bait was exposed and resulted in the deaths of at least 455 geese in California (Appendix P, p. 264). The PEIS acknowledges that all the geese that were exposed may not have been found.

Studies show that some birds are repelled by zinc phosphide while others swallow the bait only to regurgitate it (Erickson and Urban 2004). Laughing doves died two hours after eating zinc phosphide bait, even though they had regurgitated the bait 20 minutes after ingestion (Erickson and Urban 2004). In a study of red-winged blackbirds, 14 out of 15 died after eating 1:1 mixture of baited (2 percent active ingredient) and untreated corn (citing Schafer et al. 1970). While a wide range of species is susceptible to zinc phosphide poisoning from directly consuming the bait, others may die as a result of secondary poisonings.

WS suggests that secondary non-target species can include predators and scavengers such as ferrets, mongooses, coyotes, kit foxes, mink, black vultures, bald eagles, golden eagles, and great horned owls (Appendix P, p. 264). It then claims that these species are not vulnerable to secondary poisoning because they vomit (Appendix P, p. 264).

In several raptor studies, none of the 19 birds-including great horned owls, spotted eagle owls, kestrels, bald eagles, black vultures, carrion crows, a magpie, and a jay died, but signs of intoxication were noted in several individuals (Erickson and Urban 2004). This is noteworthy because sublethal toxic effects can harm individuals and cause changes in populations processes including survival and reproduction (Pauli and Buskirk 2007). Even minor decreases in an individual raptor's fitness can result in mortality. Sublethal lead exposure in raptors, for example, can increase risk of collisions with power lines, decrease weight, and muscle mass, which could result in the animal's death (Craighead and Bedrosian 2008). Sublethal effects from other toxicants could also harm individuals making then vulnerable to such accidents. A FWS's biological opinion states that zinc phosphide-treated oats may cause some prairie dogs to die above-ground, thus potentially exposing bald eagles, making them "vulnerable to predation or severe weather events during migration" (FWS 1992).

WS's PEIS claims "there is no true secondary toxicity" (Appendix P, p. 256) because zinc phosphide is not stored in muscle or tissues, but this is incorrect. A zinc phosphide-poisoned carcass may hold the toxicant in the gut for several days, which may transfer the poison to a scavenger (Appendix P, p. 256). Dogs and cats are particularly susceptible to secondary poisoning (Appendix P, p. 261). In fact, the PEIS itself admits that, "secondary poisoning to predators and raptors is possible, especially if the chemical is not assimilated into the target species" (Appendix P, p. 255).

Brown et al. (2002) help tease out this contradiction. They consider the risk of secondary poisoning from consuming dead mice low since phosphine gas breaks down and does not accumulate in the muscle tissue. Secondary poisoning, however, is dependent upon how the poisoned subject is consumed (i.e., whether or not it is disemboweled before eating). Some studies that Brown et al. (2002) reviewed showed that when poisoned rodents were fed to potential predators, they developed no visible signs of intoxication (citing Parker and Hannan-Jones 1996). In other studies, crows succumbed to secondary poisoning from ingesting poisoned mice. It therefore appears that, if a predator consumes the digestive system of a poisoned subject, it can die from secondary effects from zinc.

WS's PEIS examined different formulas of zinc phosphide and determined their efficacy and toxicity hazards. For the rat control (63 percent formula) for example, the PEIS said that black and Norway rats were poisoned in 5 states between 1988 and 1991. WS applied this formula in rat burrows, in and around houses and buildings. It determined that dogs and cats were susceptible to secondary poisoning (Appendix P, p. 261), and it could affect whooping cranes, bald eagles, and peregrine falcons (Appendix P, p. 262). In other situations, WS applied zinc phosphide to kill ground squirrels for crop protection; it killed ground squirrels, pocket gophers, and voles to protect pastures; it killed prairie dogs to protect rangelands, crops, pastures, and turf; and finally it killed chipmunks, mice, and squirrels in Vermont to protect maple sap tubing.

In their study, Brown et al. (2002) saw a small decrease in mice numbers despite aerial distribution of the bait in three study sites (80–130 ha). They postulate that although the poison was killing the mice in their study area, there was only a small decrease because new animals migrated into the already-poisoned fields. They propose that if the baiting were to happen at the time of sowing, the field, as well as its perimeter, be baited. This kind of broadcasting may prevent mice from migrating, but these actions create more susceptibility to non-target species (Brown et al. 2002). In addition, they suggest that the average effective bait life of zinc phosphide is 133 days when kept dry, but only 18 days in wet conditions. Also, zinc phosphide baits can deteriorate to sublethal doses, which make mice sick and create aversions to the bait.

The PEIS suggests that the breakdown rate of zinc phosphide in soils is dependent upon soil moisture and pH. Residual zinc phosphide "is not expected to accumulate in the soils between applications or in animal tissues" (Appendix P, p. 254). The PEIS identifies alarming water-borne issues. The 63 percent concentrate used to kill muskrats and nutria involves a special method: material is applied on rafts floating on water and "could therefore represent a direct route of exposure via the water" (Appendix P, p. 254). Zinc phosphide could then runoff the raft into the body of water, particularly if there is rain. WS admits, because of the amount of toxicant used, "the amount of off-site transport of zinc would be significant; environmental modeling is warranted for this active ingredient" (Appendix P, p. 255).

In sum, as the EPA indicates, zinc phosphide is widely used and distributed and can even be aerially broadcast. Rodents, unable to vomit, die painful and stressful deaths from zinc phosphide ingestion. Death can either be relatively quick or prolonged. Unintended primary and secondary poisoning events have been documented: cats and dogs, and wildlife. Children can die from a single swallow. Zinc phosphide is a dangerous chemical with no known antidote.

While WS claims it does not apply this toxicant much, others do and so it must consider all cumulative impacts associated with zinc. The PEIS, because it is so dated, must be issued anew. It must consider all cumulative and site-specific effects of zinc phosphide use to people, pets, and wildlife.

8. *Detrimental Effects of Aerial Gunning*

Aerial gunning, shooting animals from planes or helicopters, occurs on both private and public lands—including forests, deserts, sage steppes, canyon lands, and prairies. The federal government, some states (i.e., Wyoming and South Dakota), and private individuals conduct this practice under the auspices of the Airborne Hunting Act. 16 USC § 742j-1. While WS's PEIS states, "flight operations are conducted close to ground level and at low airspeeds" (Appendix P, 33), a myriad of fatal and injurious accidents have plagued the program (Keefover-Ring 2008). In addition, the practice is inhumane, expensive, and biologically unsound. A federal agent has even shot at people on the ground (Sheriff's Office, Sierra County, CA 1997). The 1994/1997 PEIS fails to consider fully the environmental effects of this activity. Additionally significant new information on the environmental effects of aerial gunning has developed since the PEIS requiring a new NEPA process be conducted.

While practiced year-round, the height of WS's aerial gunning activities occur in the late winter and early spring. The goal is to remove as many coyotes as possible from an area before livestock are pastured, and particularly to eliminate breeding coyotes, with their needs to provision their pups (Mitchell et al. 2004). From 2001-2007, WS reports that it gunned 252,713 animals from the air. Of that number, 210,306 were coyotes, or 83 percent of the total animals killed by aerial gunning. Other animals killed from aerial gunning operations include badgers, bears, birds, bobcats, house cats, feral goats and hogs, foxes, and wolves. While WS claims that it targets the individual animal involved in livestock depredation, it cannot back this declaration.

Neither the PEIS nor any state EA has taken a "hard look" at the aerial gunning program as is required by the NEPA. Only Colorado WS has revealed the annual amount of hours spent aerial gunning. WS's Colorado PDM EA (October 2005) shows that WS spends an average of 778 hours aerial gunning in Colorado per year in nine counties, (in addition to the efforts of others, which the EA failed to examine).

Aerial gunning is inhumane. Records from WS show that gunners with poor marksmanship skills can wound animals rather than killing them, and sometimes it can take several passes and multiple shots before animals are killed. Also, breeding animals that are killed leave dependent young behind to starve. The PEIS states that although "this method is highly selective for specific target animals," mishaps can occur. Some animals "may be mistakenly identified" or they may "inadvertently enter the path of fire during harassment activities" (Appendix P, 34).

Aerial gunning is biologically unsound. Low-flying aircraft, with their loud punctuating gunshots, stress wildlife. Studies indicate that aircraft noise (including "severe low-frequency sound"), turbulence, and vibrations can even damage the hearing of birds, deer, bighorn sheep, pronghorn, and a whole host of other species (Pepper et al. 2003). The appearance of aircraft can cause flight responses and cause animals to expend energy to escape perceived threats. If food is in short supply, it may alter an animal's chance for survival or affect reproduction (Pepper et al. 2003).

Studies on wildlife responses to overflights have included changes in cardiac response, body temperature changes, flushing responses, and bird-aircraft collisions. While some animals may habituate to noise—especially if it is not novel—others do not (Pepper et al. 2003). Many animals must rely on sound to find food, avoid predators, reproduce, or find offspring (Pepper et al. 2003). Studies have shown that some animals flee when frightened—especially ungulates that have no cover for hiding, such as caribou. The heart rates of mountain sheep and desert mule deer have increased, and as a result, a flight response is common and can require wildlife to waste large amounts of calories to flee perceived harms. In the event of food shortages or other causes of stress, overflights can severely impair some species (Pepper et al. 2003).

WS must conduct site-specific and temporal analysis of its aerial gunning operations to determine whether it will affect ungulates on their winter range, or over critical habitat for various species including Southwest willow flycatchers or lynx. WS must consider the above studies that have issued since 1997 both on a programmatic and site-specific level.

If aerial gunning is concentrated in the winter and early spring months into a handful of counties as it is in Colorado, WS must consider how its aerial gunning operations affect wildlife populations in those counties. Furthermore, WS failed to consider cumulative effects on wildlife populations from private aerial gunning operations, which are also likely concentrated in the same areas—the areas where there are likely the greatest concentrations of native wildlife.

Aerial gunning is unsafe. Flight crews risk physical injury (Appendix P, 34) and death (Keefover-Ring 2008). Since 1979, WS has experienced at least 52 aircraft crashes or accidents. The result: approximately 30 injuries and 10 fatalities to federal agents (Keefover-Ring 2008). Non-federal entities (states and individuals) have crashed even more (Keefover-Ring 2008). Flying close to the ground while chasing coyotes, foxes, or wolves has resulted in pilots colliding into powerlines, trees, or land formations. Also, because they are only a few feet off of the ground, aircraft have difficulty recovering from unexpected gusts of wind or even wakes of air turbulence created by the aerial-gunners' own craft (Keefover-Ring 2008). This tally of accidents, gleaned from public records, is new information since the 1997 PEIS was released and must be considered as part of a new NEPA process.

In June 2007, after a crash in Utah that resulted in two fatalities to WS agents, WildEarth Guardians petitioned the Deputy Director and asked that the program cease because of the inherent safety problems to federal employees. WS ignored this request, but then crashed again three months later. In that accident, the pilot and gunner sustained injuries. In November 2007, WS announced it was undertaking a national safety review because of the "wake" of several accidents, including aerial gunning accidents. The team conducting the aerial gunning safety review gave WS a "gold standard" for its operations (discussion supra).

Aerial gunning is expensive. The cost of aerial guns and helicopters is several hundred dollars per hour (Wagner and Conover 1999). Colorado WS claims it kills an average of 3 coyotes per hour (WS CO PDM EA Oct. 2005 at 61). This suggests that aerial gunning is extraordinarily expensive; especially since aviation fuel prices are climbing sharply. The overhead of maintaining this program should be considered cost-prohibitive, and taxpayers should not be forced pay for it, especially when the program does little to help the livestock industry (discussion supra). WS should prepare a cost-benefit analysis as part of its new PEIS.

Airborne hunting is particularly problematic for humane, biological, and social reasons. Aerial gunners kill thousands of animals annually, but spook and harass many times more individual animals. Aerial gunners have even threatened members of the public on the ground. WS puts the very lives of public employees in jeopardy. Since 1979, WS agents or contractors have had over 50 accidents. Aerial gunning is simply an irresponsible use of tax dollars and the federal government's time and resources. None of these issues were adequately addressed by the 1994/1997 PEIS and there has been substantial new information on aerial gunning that requires a new NEPA process. Studies show that WS's lethal program does not work and that it harms wildlife. The agency has not developed a sufficient cost-benefit analysis to justify this program—especially in light of all of its accidents. For all of these reasons, WS must engage in a new NEPA analysis, including the studies concerning aerial gunning and aircraft overflights that we have cited here.

9. *Harm to Threatened, Endangered, Rare, and Sensitive Species*

Over the past ten years, WS has reported that is has killed increasing numbers of endangered species for a total of 2,481 individuals. The average annual number of endangered species killed between 1996 and 2004 was 177.5. In comparison the average number of endangered species killed between 2005 and 2007 was 294.3, representing a 66 percent increase in the numbers of endangered species killed in the past three years (2005-2007) as compared to the previous nine (1996-2004). Especially noteworthy is the number of wolves. Mexican wolves are considered the most endangered mammal in North America because the entire wild population is made up of approximately 52 individuals (Mexican Wolf Blue Range Reintroduction Project, 2007). WS killed four individuals in 2007. Because of the increase in the numbers of endangered species in the mortality, WS must take a hard look at its program—especially its negative effects on endangered species, as is required by NEPA.

Since the 1994/1997 PEIS issued, the FWS has issued numerous biological opinions concerning the WS's program and species it may affect, including but not limited to: Alabama beach mice, Anastasia Island beach mice, Choctowatchee beach mice, Perdido Key beach mice, Key Largo cotton mice, southeastern beach mice, salt marsh harvest mice, Alabama cavefishes, Aleutian Canada geese, alligators, amber darters, American crocodiles, American burying beetles, Hawaiian stilts, woodland caribous, arroyo toads, Attwater's prairie-chickens, bald eagles, bayou darters, black-capped vireos, black-footed ferrets, blackside daces, blunt-nosed leopard lizards, brown pelicans, bull trouts, California clapper rails, California condors, California least tern, snowy plovers, Canada lynx, Cape Fear shiners, Columbian white-tailed deer, Delmarva fox squirrels, desert tortoises, Eastern cougar, Eastern indigo snake, Eskimo curlews, flattened musk turtles, Florida panthers, fountain darters, Fresno kangaroo rats; Morro Bay kangaroo rats;

Tipton kangaroo rats; giant kangaroo rats; Key Largo woodrats, gray bats, gray wolves, green turtles, grizzly bears, Haulapai voles, Hawaiian common moorhens, Hawaiian coots, Hawaiian ducks, Hawaiian geese, Hawaiian stilts, Hualapai Mexican voles, Indiana bats, Interior least terns, jaguars, jaguarundis, Kemp's ridley turtles, hawksbill sea turtles, Lahontan cutthroats, large Kauai thrushes, Laysan finches, least Bell's vireo, southwestern willow flycatcher, least terns, leatherback turtles, leopard darters, light-footed clapper rail, loggerhead turtles, Louisiana black bears, masked bobwhites, Mississippi sandhill cranes, Molokai thrushes, Mona boas, Mona ground iguanas, Monito geckos, Mt. Graham red squirrels, Newell's Townsend's shearwaters, Nihoa finches, Nihoas, millerbirds, northern aplomado falcons, northern flying squirrels, Northern Idaho ground squirrels, ocelots, Ozark cavefish, Ozark bats, pallid sturgeon, peregrine falcons (now delisted), piping plovers, Puerto Rican nightjars, Puerto Rican parrots, Puerto Rican plain pigeons, red wolves, red-bellied turtles, roseate tern, San Francisco garter snakes, San Joaquin kit foxes, San Marcos gambusia, shortnose sturgeons, slackwater darters, slender chubs, small Kauai thrushes, smoky madtoms, snail darters, Sonoran pronghorns, spotfin chubs, spotted owls, tidewater goby, Utah prairie dog, Ute ladies' tresses, Virginia big-eared bats, Waccamaw silversides, western prairie fringed orchids, whooping cranes, wood storks, Wyoming toads, yellowfin madtoms, yellow-shouldered black birds, and Yuma clapper rails. The FWS is concerned that WS's activities could potentially harm these species.

Moreover, in December 2008, the FWS released a proposed rule to remove the rusty blackbird and the Mexican (Tamaulipas) crow from the list of species allowed to be killed as part of the "blackbird group."

As a result of FWS's biological opinions, and proposed actions to protect some members of the blackbird group, WS must prepare a new or supplemental EIS that analyzes how its program will affect and/or harm these rare, threatened, or endangered species. This new EIS should also analyze harms to at least the following species: kit foxes, swift foxes, wolves, bobcats, lynx, mountain lions, black-footed ferrets, American martens, river otters, wolverines, black bears, and grizzly bears.

a. Kit Fox (*Vulpes macrotis*)

Smaller than swift foxes (*Vulpes velox*), kit foxes range in the West in habitats characterized by desert shrub, saxicoline brush, juniper-sagebrush, and rimrock habitats (Fitzgerald 1994a). Like swift foxes, they dig their own dens and diet on lagomorphs, rodents, and birds (Fitzgerald 1994a). Kit fox populations are in decline because of historic predator and rodent control (Meaney et al. 2006). NatureServe indicates they are "critically imperiled" in Colorado, Idaho, Oregon; "vulnerable" in California, Nevada, and Utah; and "apparently secure" in Arizona, New Mexico, Texas—although no populations studies have been conducted in these states (Meaney et al. 2006). Their populations continue to decline because of fragmentation of habitat, oil and gas development, ORV usage, and domestic livestock grazing (Meaney et al. 2006). They are still hunted and trapped in Arizona, New Mexico, and Texas (Meaney et al. 2006).

Since 2004, WS has killed between 30 and 40 individuals each year. Since kit foxes are fossorial, the agency may unwittingly kill more (see, for example, the discussions on aluminum phosphide and zinc phosphide). In denning operations, sodium nitrate canisters will asphyxiate all co-habitants in a burrow. In the years 2004 to 2007, WS killed 147 kit foxes. Because of the precarious state of kit foxes across most of its range, WS must undertake a new national NEPA analysis that takes a hard look at how WS's operations affect kit foxes and their populations.

b. Swift Fox (*Vulpes velox*)

Swift foxes are a tiny, rare grassland species, weighing between 1.5 and 3 kilograms (3.3 to 6.6 pounds) (Fitzgerald et al. 1994a). Adequate den sites seem to be a primary factor limiting swift fox populations (Kintigh and Anderson 2005). In a northeastern New Mexico study, preferred den sites were at higher elevations than the surrounding area—to allow for drainage—and in close proximity to prairie dog towns (Kintigh and Anderson 2005).

Swift foxes generally hunt at night (Fitzgerald et al. 1994a), and their diet consists of insects (usually grasshoppers when available), lagomorphs (cottontails and jack-rabbits), a variety of rodents (ground squirrels, prairie dogs, pocket gophers, and mice), birds, lizards, and vegetation (Kitchen et al. 1999). During the day, swift foxes spend much of their time around their dens (Kitchen et al. 1999).

Although coyotes are an important swift fox predator (Schauster et al. 2002a, Kamler et al. 2003, Kitchen et al. 2005, McGee et al. 2006), swift foxes do not avoid coyotes' home ranges and are able to cohabit spatially with coyotes (Kitchen et al. 1999). Kitchen et al. (1999) also found that the two species, although they eat many of the same things, specialize on different food items seasonally and with great variation, and so are able to successfully compete.

Prior to settlement by Europeans, swift foxes were abundant across short-and mixed-grass prairies of North America (Schauster et al. 2002b, Kamler et al. 2003, Finley et al. 2005). During the 19th century, however, tens of thousands of swift fox pelts were bartered at trading posts (Schauster et al. 2002b). Later, the cultivation of the Great Plains and predator-killing activities (involving broadcast toxicants—such as Compound 1080, sodium cyanide, and strychnine—shooting, trapping, and predation by domestic dogs) forced swift foxes into dramatic decline (Schauster et al. 2002a, 2002b). They were largely extirpated (Fitzgerald et al. 1994a). In the 1950s, swift fox populations reportedly began to recover after poisoning campaigns lessened; researchers speculate they benefited most after Compound 1080 was banned in 1972 (Schauster et al. 2002a).

In February 1992, swift fox were petitioned for listing as endangered under the ESA. In response, ten states formed the Swift Fox Conservation Team (SFCT) (Stuart and Wilson 2006). In 1995, the FWS determined that their listing was warranted, but precluded, citing other FWS priorities. In 1997, the SFCT wrote an assessment and drafted a conservation plan. As a result, in 2001, the FWS removed swift fox as a candidate for listing under the ESA despite its precarious status in most states.

Currently, the core area for swift fox populations is found in Colorado, Kansas, and Wyoming—although they are patchily distributed (Schauster et al. 2002a). NatureServe considers them "presumed extirpated" in Manitoba and Minnesota; "critically imperiled in parts of Alberta, Saskatchewan, North Dakota, South Dakota, and Oklahoma; "imperiled" in Wyoming, Nebraska, and New Mexico; and "vulnerable" in Montana, Colorado, Kansas, and Texas. Researchers consistently comment that swift foxes are naïve and easily trapped (Boggis 1977, Fitzgerald et al. 1994a, 1994b). Swift foxes tolerate humans, and research animals have walked into traps over and again, and when released would not panic, but would walk away a few meters and then sit and groom themselves (Loy 1981). In a study on the Pawnee National Grasslands of Colorado, trappers were an important cause of mortality (Fitzgerald et al. 1983). Researchers caught animals that had missing feet as a result of swift foxes being caught in traps intended for coyotes (Fitzgerald et al. 1983). Despite their removal from the ESA candidate list, swift foxes are far from recovered, and they continue to face persecution by WS and others.

In the years 2004 to 2007, WS killed 92 swift foxes. Because swift foxes are rare, and their populations likely imperiled in the long term, WS must assess whether its program adversely affects swift fox populations as part of a new NEPA analysis that takes into account all the new data collected on swift foxes, as cited in this section herein.

c. Wolves (*Canis lupis*)

Wolves have been recovered to just five percent of their historic range. Yet, lethal predator-control measures, and now recreational hunting activities in the Northern Rockies, threaten the success of wolf recovery programs. By reducing wolves in their core areas, the ability for individuals to disperse into suitable habitat outside of reintroduction zones is also diminished. The Southern Rocky Mountain ecoregion, particularly Colorado and Utah, remains starved of wolves. Because dispersal opportunities are diminished due to hunting and control measures, recovery into the Southern Rockies has not occurred.

In the past decade, predator-control activities have resulted in the indiscriminate death of wolves. A sampling of some of these fatal events demonstrates that WS predator-control activities and persons acting as vigilantes may adversely affect wolf recovery:

Sodium Cyanide M-44 incidents resulting in death of wild wolves:

- January 1995, Priest River, Idaho (uncollared).
- May 1997, Alder, Montana.
- April 1998, Alder, Montana.
- December 1998, Powell, Wyoming.
- In Spring 2001, South Dakota (confirmed by forensic tests (Brokaw 2002)).
- January 2007, two uncollared wolves near Riggins, Idaho.
- December 4, 2008, a radio-collared wolf was killed by a “legally placed M-44” near Cokeville, Wyoming.

Compound 1080 Incidents resulting in death of wild wolves (data from FWS):

- March 31, 1999, Idaho (wolf i.d. B-29-M BL—illegal poisoning).
- May 16, 1999, Idaho (wolf i.d. B-51-F BL—illegal poisoning).
- August 29, 2000, Idaho (wolf i.d. B-37-F GR—illegal poisoning).
- August 29, 2000, Idaho (suspected 1080) (wolf i.d. B-89-F GR—illegal).
- December 2, 2000, Idaho (wolf i.d. B-96-M GR—illegal).
- May 19, 2003, Idaho (wolf i.d. B-143-M GR—illegal).
- January 2004, Clayton, Idaho.

Furthermore, WS and FWS justify wolf killing on the basis that it increases human tolerance for wolves in the U.S. This has not been the case, as evidenced by the preliminary delistings of wolves, which have largely occurred as the result of states’ pressure to remove regulatory protections.

Although most wolves in the United States are protected under the ESA, WS has killed almost 2,500 wolves in the years between 1996 and 2007. Because the WS's program has caused immense mortality in wolf populations, and because a vast new body of research shows that wolves are vital to ecosystem functions and biological diversity, WS must take a hard look at its negative effects on wolf populations—both site specifically and cumulatively—as part of a new NEPA analysis.

d. Bobcats (*Lynx rufus*)

Historically overexploited, bobcats were listed on Appendix II of Convention on International Trade in Endangered Species (CITES) in 1975 (Woolf and Hubert 1998, Sunquist and Sunquist 2002). Bobcats and lynx appear similar—thus the Colorado Division of Wildlife has taken steps in consultation with the FWS to prevent the incidental take of lynx by bobcat hunters and trappers.

Even with these international CITES guidelines, bobcat populations are subject to liberal state-level hunting and trapping regulations. WS has killed 8,704 bobcats in the years 2004 to 2007. As part of a new NEPA analysis, WS must determine if its lethal control program harms bobcat populations.

e. Lynx (*Lynx canadensis*)

Historically, lynx were easily trapped and poisoned (Schenk 2001, Schenk and Kahn 2002). While they apparently continue to flourish in Canada and Alaska, according to NatureServe, their future in the Lower 48 looks bleak; they rank in the U.S. as either "critically imperiled" or "presumed extirpated." Lynx are listed as a threatened species under the ESA.

The Colorado Division of Wildlife reintroduced 218 lynx in the years between 1999 and 2006 into southwestern Colorado. Over 100 kittens have been born in that time, and the animals have dispersed across several states, especially Wyoming, Utah, and New Mexico. The Division of Wildlife could not document kitten births for 2007 or 2008, and link the decline in the birth rate to a decline in Colorado's snowshoe hare population.

Despite these reintroduction efforts, the August 23, 2005 biological opinion from the FWS fails to limit traps, snares, and M-44s in occupied lynx habitat in Colorado. WS uses leghold traps, neck snares, M-44s, and hound hunting either in known lynx habitat or corridors where they are dispersing. Lynx are easily trapped, and historically were wiped out because of widespread poisoning campaigns (Schenk 2001, Schenk and Kahn 2002).

Although mitigation measures for traps and snares are discussed in the 2005 biological opinion, no effective mitigation can be made for M-44s, which are inherently indiscriminate. Lynx could potentially trigger an M-44 as their close relative bobcats (*Lynx rufus*) are occasionally killed by M-44s. In 2004, for example, WS killed 5 bobcats with M-44s. Moreover, FWS considers M-44s a hazard to other cats such as Florida panthers, ocelots, and jaguarundis (FWS 1993). Cats are known to scavenge (Bauer et al. 2005) and thus the scented bait of an M-44 could lure the lynx.

Lynx prefer to live and den in old growth forests with large-downed trees at high altitudes. Reproduction and recruitment is the key to their survival. Lynx receive no ESA protections in

New Mexico,[15] and thus are subject to indiscriminate traps and poisons set by WS and others. Because the status of lynx in the U.S. is precarious at best, the 2005 biological opinion for Southern Rockies lynx woefully deficient, and the last comprehensive analysis WS undertook was in 1994/1997, the agency must undergo a new rigorous NEPA analysis to ensure that its program does not harm individual lynx or their populations.

f. Mountain Lions (*Puma concolor*)

Mountain lions generally occur in low densities because they are an obligate carnivore and their food is patchily distributed across arid landscapes (Logan and Sweanor 2001). Mountain lions are extraordinarily unsocial and territorial (Logan and Sweanor 2001). Lions establish "home areas"—territories that move along with prey migrations. Males' home ranges are generally larger than those established by females (Logan and Sweanor 2001). Male and female home areas may overlap each other, but lions avoid each other until the female is available for breeding. Subadult lions must strike out and find their own home ranges. They must establish a territory in suitable habitat either by inhabiting a vacant territory or out-competing a resident lion for a territory. Intra-specific strife over competition for territories leads to high levels of mortality in a lion population (Logan and Sweanor 2001).

If the lion in a home range is removed or killed, the vacancy likely will attract a younger, dispersing animal (Lambert et al. 2006). Younger lions are more likely to have negative interactions with humans than older animals (Beier 1991, Murphy et al. 1999). Ironically, exploiting lion populations can exacerbate negative interactions between mountain lions and people or livestock (Lambert et al. 2006). Sport hunting can change the demographics (sex and age structure) and density of a mountain lion population (Anderson and Lindzey 2005, Stoner et al. 2006, Robinson et al. 2008). Over-hunting a lion population can change a population age structure to one with more young adults or juveniles (Lambert et al. 2006, Stoner et al. 2006, Robinson et al. 2008). The removal of 40 percent of the nonjuvenile population for four years or more reduces the number of individuals in a population, and creates a demographic structure that is younger, produces fewer kittens, and is socially unstable (Stoner et al. 2006). High harvest rates on adult females harms a population's ability to recruit new members (Anderson and Lindzey 2005). Therefore, both hunting and predator-control programs could potentially destabilize a lion population, which could, ironically, lead to increased human and mountain lion conflicts (*see e.g.,* Lambert et al. 2006).

According to a host of mountain lion biologists, "no scientific evidence" exists that sport hunting reduces the risk of lion attacks on humans (Cougar Management Guidelines Working Group 2005). Mountain lions typically avoid people (Sweanor et al. 2008), and hunting them to prevent future attacks is therefore a notion unsupported in the scientific literature (Cougar Management Guidelines Working Group et al. 2005). In Colorado, since 1890, there have been only two confirmed fatalities from lions and both took place in the 1990s (Baron 2005, Keefover-Ring 2005a, b). Nationwide, 18 fatalities have occurred between 1890 and June 2008. Approximately 100 non-fatal lion attacks have occurred in the U.S. in the past 100 years (Beier 1991, 1992, Fitzhugh 2003).

---

[15] In 2008, FWS issued a positive finding on a petition to list the lynx in New Mexico. 73 Fed. Reg. 76990-76994. Under court order, FWS must complete a full status review on the lynx by December 2009 to determine whether it warrants ESA listing in New Mexico.

The numbers of attacks is very low because mountain lions generally do not view people as prey. If they did, there would certainly be more attacks, because mountain lions are skilled ambush predators and are capable of taking down an animal many times their own size, such as adult elk (Hansen 1992, Logan and Sweanor 2001). Furthermore, common sense precautions in lion country, such as traveling in groups, mindfulness of small children's proximity, and aggressively facing down a lion can curtail or reduce risks (Beier 1991, Fitzhugh 2003).

Mountain lions live in low densities because their food sources are dispersed across arid landscapes. Unsocial, mountain lions, and particularly males, engage in fights with each other over territories and mates resulting in natural population culling. While mountain lions are an ambush predator, they rarely have interactions with humans. Sport hunting and control actions may actually increase negative human and lion interactions because of disruption of social structures. Alternatively, precautions while living or recreating in lion country can reduce conflicts.

In the years 2004 to 2007, WS killed 1,371 mountain lions. Because a huge literature on mountain lions has been published since the 1994/1997 PEIS, WS must undertake a new NEPA analysis to ensure that its program does not destablize or harm mountain lion populations.

g. Black-Footed Ferret (*Mustela nigripes*)

One of the most endangered mammals in North America, the black-footed ferret, has been protected since 1964 and was included on the initial list of endangered species under the precursor to the ESA. The black-footed ferret is a prairie dog obligate species, meaning that without prairie dogs, no ferrets could persist (Miller et al. 1996; Miller et al. 2000). Its imperiled status is directly linked to the eradication of prairie dogs, on which the ferret depends for over 90 percent of its diet and its shelter needs. The ferret has been the subject of intensive captive breeding and reintroduction efforts (Miller et al. 1996).

Although a ferret recovery plan was developed by 1978, ferret recovery efforts generally have not been successful (Dobson and Lyles 2000). The recovery plan, revised in 1988, calls for establishing at least ten wild, self-sustaining ferret populations of 30 or more breeding adults each throughout the species' original range (FWS 1988). Of the six primary ferret reintroduction sites in the United States (Wyoming, Montana, South Dakota, Arizona, Colorado, and Utah), ferrets are likely self-sustaining only at Shirley Basin, Wyoming. Conata Basin, South Dakota, once a productive site for ferrets, is now threatened by sylvatic plague and extensive poisoning by the Forest Service.

Presently, not enough prairie dog complexes meet the black-footed ferret reintroduction criteria to fulfill the minimum recovery plan goals. Yet, WS continues to actively poison the ferret's habitat and prey base, prairie dogs, and disseminate poisons for private prairie dog control. According to the FWS, pesticides that are used to kill "prairie dogs and other mammals or that are toxic directly or indirectly to mammals are likely to continue to adversely impact the black-footed ferret either through direct toxicity or indirectly through the loss of the ferrets' food source" (FWS 1993).

Ferrets have theoretically enjoyed federal protection for the past 37 years at the cost of multiple millions of taxpayer dollars. That protection, and the accompanying costly captive breeding program, has proven entirely inadequate, as it has not involved fundamental protections for the ferret's lifeline, the prairie dog. Ferret recovery requires prairie dog conservation, including an end to federal- and state-poisoning programs.

WS engages in predator-control activities to purportedly enhance black-footed ferret protections. Studies (discussion supra) show that predator control on coyotes can cause unintended consequences that may actually harm the species the agency is trying to protect. For these reasons, WS must undergo a new NEPA analysis to determine if its predator-control activities cause unintended harms, i.e. coyote population irruptions from control measures that may harm black-footed ferrets, as part of it new NEPA analysis. WS also must consider the harm its prairie dog control operations and its dissemination of poisons for prairie dog control have on black-footed ferret conservation activities.

h. American Marten (*Martes americana*)

Marten, an interior-forest carnivore, inhabiting mid- to late-successional dense forest, are associated with conifer-dominated, closed canopy forests with complex vertical structure (Powell 1994, Powell and Zielinski 1994). As urban development and land uses such as timber extraction encroaches upon suitable habitat, trapping this interior forest species to habitat islands (Small et al. 2003). Though martens are found in coniferous forests, they are not likely found in forests less than 100 years old, canopy cover of less than 30%, with low vertical complexity and coarse woody debris of less than 25% (Potvin and Breton 1997, Potvin et al. 2000, Payer and Harrison 2003).

Marten population dynamics, genetic variation across populations, and distribution as a function of various landscape types is largely unknown, and studies showed lower densities of marten populations in logged versus uncut boreal forests in Ontario (Thompson 1994). Marten populations in the Pacific Northwest have contracted in distribution and density (Zielinski et al. 2001, Zielinski et al. 2005).

Life history characteristics of marten, as with all mustelids, make populations vulnerable to stochastic events and more vulnerable to disturbances and harvesting. Martens occur primarily in northern boreal forests characterized by low productivity due to highly seasonal and often extreme annual variation in environmental conditions. The suite of physiological responses to these variable and severe conditions has been called a "bet hedging" strategy (Ferguson and Lariviere 2002). Marten as well as long-tailed weasels (*Mustela frenata*) and short-tailed weasels (*Mustela erminea*) have short gestations after delayed implantation, long periods of lactation, long inter-birth intervals, large home ranges for their size, and energetics which require them to remain active all winter and hunt constantly. Marten are not sexually mature until their 2nd year, and may reproduce only every other year, depending on conditions. These characteristics make most martens particularly vulnerable to habitat disturbance and adult mortality (Ferguson and Lariviere 2002, 2004).

Light trapping pressure can cause high mortality and significantly affect marten populations in Newfoundland, Canada (Schneider 1997). Though carnivores are more vulnerable to extinction than other mammals, martens (and fishers) are even more vulnerable to local extirpation (Zielinski et al. 2005).

i. River Otters (*Lontra canadensis*)

River otters are rare in the West. Their long-term survival can easily be jeopardized by anthropogenic threats because they are reliant on free-flowing rivers, which are subject to drought and anthropogenic threats. Their persistence is far from certain, and thus unmitigated predator damage management by WS can effect their populations.

j. Wolverine (*Gulo gulo*)

Wolverines historically occupied the northern and high-elevation forests of the lower 48 states along the West Coast (Cascades and Sierra Nevada Ranges), Rocky Mountains (Canada border south into Arizona and New Mexico), the Lake States and Northeast. Data on current wolverine distribution and numbers in the contiguous United States are not comprehensive, but there is scientific consensus that: (1) wolverine range and numbers have decreased dramatically since pre-Columbian times due to human activities and developments, (2) wolverines currently number fewer than 1,000 across the lower-48 states, and (3) these occur in populations that are increasingly fragmented and isolated both from each other and from wolverine populations in Canada.

At the continental scale, wolverines are now believed to be extirpated from the entire northern tier of the contiguous United States except the northern Rocky Mountains and portions of the Northwest, and extirpated across the southern region of Canada from the Atlantic west to the Canadian Rockies (e.g., Hash, 1987). Within the contiguous United States, the best available information indicates that current wolverine range has been reduced to small, fragmented populations in the northern Rockies and Northwest (western Montana, Idaho, Washington State, Oregon and Wyoming), although remnant populations may persist in the south-central Rockies (Colorado, Utah), the Sierra Nevada Range, the Lake States (Michigan) and possibly the Northeast (Maine). There are few estimates of wolverine numbers in the published literature, but extrapolating from the best available information indicates an estimated population of fewer than 750 wolverines in the lower 48, including an estimated 400-600 in the U.S. northern Rocky Mountains, and perhaps 100 across the Northwest and Sierra Nevada. Despite two listing attempts because of these low and declining populations, FWS has yet to list wolverines.

Wolverines exist at even lower densities than other mid-sized carnivores. One of its limiting factors is the relative scarcity of predators that provide carrion for wolverines: "Not a hunter, [the wolverine] depends on wolves and other predators to provide carrion" (Banci, 1994; p. 100). Wolverine diet can also be provided by avalanches, starvation, and other factors. The wolverine's ability to move impressive distances across rugged and inhospitable terrain provides hope that seemingly disparate populations may be connected, but also presents the challenge of protecting wolverines across vast unprotected areas—making them susceptible to traps and M-44s, for instance.

Banci (1994) suggests that wolverines are not prolific reproducers: "Reproductive rates are low and sexual maturity delayed, even in comparison with other mammalian carnivores" (p. 108). Years when food is scarce may inhibit litter production if females are in poor nutritional condition. Some observers have speculated that lack of suitable denning habitat may also inhibit reproduction. Female wolverines do not breed during their first summer, while males remain sexually immature until after their first two years (Banci 1994). The results from field research in the lower 48 states and southern Canada indicate very low reproductive rates, to the extent they have been determined.[16] WS must examine the impacts of its activities on wolverines in a new PEIS.

k. Black Bears (*Ursus americanus*)

Black bears, the third largest carnivore in North America (behind grizzly and polar bears), survive mainly on plant materials. Black bears prefer forest habitat for forage and movement. They disperse seed and nutrients and create biological diversity by creating small-scale disturbances that open up the forest canopy. Unfortunately, bear habitat is disappearing due to unprecedented rates of suburban and urban growth. Roads spider-webbing into once pristine habitat makes it easier for hunters and poachers to kill bears (Craighead 2002), and roads increase the opportunity for vehicle-bear collisions.

In arid climates such as Colorado, Nevada, Arizona, and New Mexico, bears are slow to recruit new members to their population and are vulnerable to over-exploitation. A Colorado study showed the females do not breed until they are almost five years of age, and the birth interval comes every two years—depending on sufficient food availability (Beck 1991). In the Pacific Northwest, bears begin to breed at three or four years of age. Stochastic events such as food failures, droughts, or late frosts can decrease forage and increase human-bear conflicts. Winter can add further stresses to a population: adults that start hibernation without adequate nutrition may die in the den, and females that breed in the summer months may not give birth in the spring because bears have an incredible capacity to limit their own populations: If a mother is in poor physical condition during hibernation, her body will absorb the fetuses.

Arizona state officials expressed concerns that WS had killed too many black bears in certain counties. It also complained to the GAO that instead of checking traps daily, WS officials left bears in traps for several days and as a result the bears were dehydrated and had to be euthanized (GAO 1990, p. 15). WS also kills bears because they come into conflicts with humans and because they girdle saplings in even–age timber plantations in the Northwest. In the years 2004 to 2007, WS killed 1,582 black bears.

When food availability in the backcountry is scarce, bears may migrate to urban fringes, where they may become accustomed to human food sources and then be killed – either as "nuisance" animals or because of motor-vehicle collisions (Beckmann 2002). Yet, the literature on human-bear conflicts is crystal clear about institutionalizing the usage of bear-proof trash containers to prevent negative bear and human interactions (Beckmann and Berger 2003, Beckmann et al. 2004, Masterson 2006).

Stepped up trash enforcement regimes drastically reduce human-bear conflicts.[17] Clashes between humans and bears come from a lack of law enforcement remedies that discourage intentional or unintentional wildlife feeding (Beckmann and Berger 2003, Masterson 2006).

In addition to conflicts in urban or exurban areas, WS kills bears that damage trees. The timber industry plants even-age stands of trees in the Pacific Northwest that encourage bears to peel bark in the springtime to obtain sugar. While altering the conformation and age of trees would

[16] Discussion on wolverines, courtesy of Dave Gaillard, Defenders of Wildlife.
[17] Personal communication, Randy Hampton, Public Information Officer, Colorado Division of Wildlife, and Wendy Keefover-Ring of WildEarth Guardians (10/2/07).

lead to significant reduction of bark-peeling behavior by bears (and increase biodiversity), the timber industry prefers to have WS kill hundreds of bears each year often using bait, dogs, and body-gripping traps.

Because black bears are slow to reproduce, are seriously affected by drought and habitat loss, and because they are easily over-hunted, land management agencies, wildlife agencies, and WS have a special obligation to ensure that black bear populations are protected and conserved. Communities must pass and enforce ordinances to prevent the intentional or unintentional feeding of bears, and the timber industry should modify the composition of its tree plantations to discourage bark-peeling behaviors in even-age tree stands. As part of a new NEPA analysis, WS must look at site-specific and cumulative effects to black bear populations from its work. It must incorporate the body of new literature published on black bears since the 1994/1997 PEIS issued.

l. Grizzly Bears (*Ursus arctos horribilis*)

Grizzly bears, the second largest carnivore in North America—behind polar bears—have large home ranges that include shrub cover, forested land and open areas. Home ranges average between 73 and 414 square kilometers but can be as large as 2,600 square kilometers. Grizzly bears primarily rely on vegetation for sustenance, but occasionally scavenge, fish, or hunt. They are important seed and nutrient dispersers in ecosystems and initiate small-scale disturbances. An umbrella species, grizzly bear populations and habitats continue to shrink from anthropogenic threats.

Historically, grizzly bears ranged in Western North America from the top of Mexico to Canada and Alaska, but, according to NatureServe are "presumed extirpated" across most of their former range (Saskatchewan, Manitoba, North Dakota, South Dakota, Minnesota, Nebraska, Kansas, Oklahoma, Texas, Colorado, New Mexico Utah, Arizona, Nevada, Oregon, and California), are "critically imperiled" in Washington, Idaho, and Wyoming; "imperiled" in Montana; "vulnerable" in Alberta, British Columbia, and the Yukon, but are "secure" in Alaska. According to NatureServe, the North American grizzly bear population likely numbers over 30,000 in Alaska, over 21,000 in Canada, but less than 1,500 in the Lower 48.

In 1975, all grizzly bear populations in the Lower 48 (Yellowstone, Northern Continental Divide, Selkirk, Cabinet-Yaak, North Cascades, and Bitterroot) were listed as threatened under the ESA. In 1991, the FWS found that the North Cascades bears were warranted but precluded from receiving an upgrade to endangered protections, even though the population consisted of less than 20 animals. In 1999, the Selkirk population was also warranted but precluded from receiving endangered species status because of higher priority listings.

On March 22, 2007, the FWS delisted the Yellowstone Distinct Population Segment and determined that grizzly bears were recovered in that region. In April 2007, the FWS initiated a five-year review of all grizzly populations in the Lower 48 states. Ironically, the Selway-Bitterroot has no bears at all and the FWS has acknowledged that a reintroduction is necessary but unfeasible because of a lack of funding. Despite FWS' purported recovery efforts, grizzly bear populations are teetering on the brink of extinction in the contiguous United States. Grizzly bears are susceptible to sodium cyanide-M-44 ejecting devices. Although one collared animal was discovered killed by an M-44, more deaths could go undocumented if the animals are uncollared. WS reports killing two grizzly bears in 2005. Historically, indiscriminate predator-control activities led to grizzly bear population decline. Today, human-caused mortality is the single largest contributor of grizzly bear deaths. Sheep-raising particularly attracts grizzly bears (Wilson et al. 2006), and therefore is inappropriate in grizzly bear country given that the species is nearly extirpated. Because WS's predator-control activities could cause unintended mortalities to grizzly bears, no indiscriminate means such as M-44s or traps should be used in their territories. WS must take a hard look at its program to ensure that it does not harm individual grizzly bears or their populations as part of its new NEPA analysis.

m. **Prairie Dogs** (*Cynomys ludovicianus*, *gunnisoni*, *leucurus*, and *parvidens*)

Substantial new information exists for WS to consider in a new PEIS regarding prairie dogs. It must use this new information to assess results of its shooting and poisoning activities on prairie dogs. Black-tailed prairie dogs (*Cynomys ludovicianus*) have declined by 98 to 99 percent over the past century. Currently, prairie dogs face cumulative threats from plague, habitat destruction, shooting, and poisoning. FWS designated this species a candidate for ESA listing from February 2000 until August 2004 (65 FR 5476-5488, 69 FR 51217-51226). In August 2007, WildEarth Guardians and other conservation groups submitted an extensive petition to list the species under the ESA (WildEarth Guardians 2007), and FWS issued a positive finding on this petition in December 2008 (73 FR 73211-73219). FWS determined that plague, inadequate regulatory mechanisms, and poisoning may threaten this species (WildEarth Guardians 2007).

Gunnison's prairie dogs (*Cynomys gunnisoni*) have also declined by 98 to 99 percent. In February 2004, WildEarth Guardians and 73 co-petitioners, including scientists, home builders, realtors, religious organizations, and a wide variety of others, petitioned FWS for listing of this species (WildEarth Guardians et al. 2004). In February 2008, FWS designated the Gunnison's prairie dog as a candidate for ESA listing in the montane portion of its range (73 FR 6660-6684). FWS found that plague is the primary threat to Gunnison's prairie dogs and that poisoning and shooting compound the effects of plague. 73 FR 6660 at 6674.

Likewise, the white-tailed prairie dog (*Cynomys leucurus*) has suffered extensive declines. Center for Native Ecosystems and other conservation groups petitioned to list the white-tailed prairie dog under the ESA in July 2002 (Center for Native Ecosystems et al. 2002). FWS is due to issue a finding on that petition by June 2010. 73 FR 24910-24911. Of note: a recent population viability analysis commissioned by the Colorado Division of Wildlife (2008) for Gunnison's and white-tailed prairie dogs demonstrated that poisoning is a threat to these species, as is shooting within the breeding season. Colorado provides a shooting closure for these species during their breeding season on public lands.

To the extent that WS is involved in any activities that control Utah prairie dogs (*Cynomys parvidens*), a federally threatened species, it must also examine those activities in a new EIS.

In addition to harms to prairie dogs, shooting and poisoning of prairie dogs negatively affects other wildlife. Many authors have described the keystone role that prairie dogs play in their ecosystem such as providing prey and habitat to a wide variety of associated wildlife (see full discussion in WildEarth Guardians et al. 2007 at pp. 18-20). Kotliar et al. (1999) found that approximately 140 species are likely to benefit from prairie dogs and the habitat they create. Kotliar (2000) also found that prairie dogs play a unique role in their habitats that is not performed by other species. Miller et al. (2000) affirm broad scientific recognition of the prairie dog's keystone role. Miller et al. (2007) provide an overview of the need to conserve prairie dogs and the folly of lethal prairie dog control. Recent books substantiating the need to conserve prairie dogs and the prairie dog ecosystem include Hoogland (2006) and Slobodchikoff et al. (2009).

In light of this new information, WS must examine in a new PEIS any poisoning and shooting of prairie dogs it conducts, and its dissemination of poisons and fumigants labeled for prairie dog control. These activities are contributing to the imperilment of prairie dogs and the prairie dog ecosystem, which WS must consider in a new analysis.

10. *National Security Hazards*

In 2002, Congress passed the Public Health Security and Bioterrorism Preparedness and Response Act, which required the Secretary of Agriculture to regulate biological agents that could "through acts of bioterrorism" affect the domestic agricultural economy (USDA OIG 2006). To prevent terrorists from causing domestic harm, the USDA issued a safety document for farmers. In it, the Department expressed concerns about the safety of the milk supply, crops, aircraft used to spray pesticides, greenhouses, cattle, and poultry (USDA 2006). In addition, Congress and oversight agencies are likely concerned by food and water safety issues. WS uses biological agents, such as strychnine and Compound 1080, that could easily taint water and food.

Between 2002 and 2006, WS failed numerous federal audits for its failure to safely inventory, store, and control access to harmful biological agents. In 2007, WS itself acknowledged that it has endured a "wake of accidents," and in 2008, the Environmental Protection Agency (EPA) warned Wildlife Services of its failure to comply with another federal pesticide safety law.

In 2002, the OIG found that APHIS had lost 60 pounds of strychnine-treated bait and over 2,000 sodium cyanide capsules (USDA OIG 2002). The following year, WS apparently found these missing and highly dangerous toxins, but it failed to put in place an adequate chemical inventory and tracking system (USDA OIG 2004a). In her 2002 statement before Congress, Joyce Fleishman, Acting Inspector General for the USDA, reported that she found the Animal and Plant Health Inspection Service unaccountable at a state level for its inventory and control of its hazardous pesticides and drugs used on wildlife (Fleischman 2002).

In a 2004 OIG report, Assistant Inspector General Robert Young found WS in the same predicament. Materials had been stored in such a way as they could be stolen and used for unauthorized purposes, and they posed a safety threat (USDA OIG 2004a). That year, the Inspector General found that WS's aircraft were not secured from potential terrorists (USDA OIG 2004b).

In 2005 and 2006, the USDA OIG again failed WS in audits because the agency was not in compliance with the Bioterrorism Preparedness and Response Act. In the first, the OIG found that WS had not secured "dangerous biological agents and toxins" (USDA OIG 2005). In the second, the OIG found that WS was not in compliance with regulations; unauthorized persons had access to toxicants; individuals using toxicants had inadequate training; and that inventories of hazardous toxicants were open to theft, transfer, or sale (USDA OIG 2006). Of the sites OIG visited, none were in compliance (USDA OIG 2006).

In 2007, WS's aerial gunning program crashed twice. In June, a Utah operation ended in two fatalities, and then in September, a Texas operation resulted in two serious injuries (see www.goAGRO.org). Embarrassed by subsequent media attention, WS acknowledged its operational problems across its entire program in November. It stated:

> In the wake of several accidents in WS' programs, WS is conducting a nationwide safety review focusing on aviation and aerial operations, explosives and pyrotechnics, firearms, hazardous chemicals, immobilization and euthanasia, pesticides, vehicles, watercraft, and wildlife disease activities. The review will be conducted by subject matter experts from WS, federal and state government, and private industry. We expect the review to be completed in the next year.

After WS's November 2007 disclosure, WildEarth Guardians (then Sinapu) and Public Employees for Environmental Responsibility (PEER) requested that WS conduct the national safety review with public transparency. WS dismissed our concerns. In a November 14th response, Deputy Administrator William Clay wrote that the agency itself would select auditors who "demonstrated professional expertise" and who were "unaffiliated" with the agency. WS planned to embed the outside auditors with agency insiders. Mr. Clay told WildEarth Guardians and PEER that the public would have the opportunity to "read the final [national safety review] document" upon completion. The safety review issued on August 4, 2008. The document failed to look at public safety issues—an enormous omission given the Inspector General reports—but it did look at employee safety matters. In the instance of the aerial gunning program, for instance, the report found that the agency operated in the highest caliber and worthy of a "gold standard." The report stated:

> It is the opinion of the Aviation Resource Management Survey (ARMS) Team that the WS aviation program is being operated in a safe, efficient, and effective manner. The WS aviation program meets the requirements of the ICAP [Interagency Committee on Aviation Policy] Gold Standard Certificate program (USDA 2008b).

Despite its self-congratulating appraisal, the WS aviation safety review team recommended that the agency make several new hires to increase the safety capacity of the aerial gunning program. On its face, the review invites suspicion because aerial gunning is an inherently dangerous practice because agents fly at low speed close to the ground, and as we demonstrate herein, the agency has been involved in numerous accidents that have resulted in serious injuries and fatalities.

In March 2008, the EPA dispatched a notice of warning letter to WS pursuant to FIFRA because it had improperly placed M-44s on federal public lands in Utah. As a result of WS's negligence, Sam Pollock, a FWS biologist, who was rabbit hunting with his dog, Jenna, was exposed to sodium cyanide after Jenna had asphyxiated and died. Jenna triggered an unmarked M-44 device. Mr. Pollock witnessed Jenna gagging, frothing, and vomiting, and then saw the spent M-44. After handling Jenna's body, Mr. Pollock reported symptoms consistent with cyanide poisoning.

In sum, WS's lack of control over its lethal biological agents has directly harmed people, and has led to several failed audits from federal oversight agencies that have expressed concern about WS's failure to comply with the Bioterrorism Act. The aerial gunning program has caused the death or physical impairment of its own employees. Its flawed use, storage, and tracking system of lethal toxicants has led two federal agencies to sanction WS. It even acknowledged that it has experienced a "wake of accidents" and called for a national safety review, the outcome of which, because of its closed-door process, its failure to look at public safety issues, and recommendations, seems less than a scrupulous inspection. Because its program endangers the public—and recklessness documented by the OIG indicates threats to national safety, its own employees, and the environment, WS must undergo a rigorous new NEPA analysis of its program. This is significant new information under NEPA, and the agency must, for instance, decide to whom it hands out Compound 1080 livestock protection collars given the current threat to national security.

11. *Collisions and Disease*

In the PEIS, under its "Health and Human Safety Analysis," WS analyzes aircraft collisions with wildlife, and wildlife as disease vectors to humans such as rabies and plague (Ch 1, p. 4; Ch 3, p. 25-27). Since the PEIS issued, the Centers for Disease Control has noted in a 2004 report that animal-vehicle collisions cause many injuries and fatalities each year. In 2000, 6.1 million motor vehicle accidents occurred. Of that number, 247,000 or four percent, resulted from direct collisions or from avoidance maneuvers, according to the Centers for Disease Control.[18] Large domesticated animals, such as cattle or horses, caused 12 percent of animal and vehicular crashes. Domestic livestock are important vectors of disease to wild ungulates include bovine viral diarrhea, brucellosis, blue tongue, chronic wasting disease, scabies, and tuberculosis (Williams and Barker 2001). WS must consider this new information as part of its new environmental analysis.

12. *Human Overpopulation and the Extinction Crisis*

The United Nations predicts that the human population may increase by two to four billion people by 2050 (Gaston 2005). Humans did not reach the one billion mark until about 1800, but now it could only take approximately 13 years to increase the human population by a billion (Gaston 2005). The current human population is already at levels beyond is optimally sustainable; it is "three to four orders of magnitude larger than the mean for other mammalian special of comparable body mass and trophic level" (Fowler, 2005, p. 65.) The result: health problems to ecosystems, other species, and to individual humans themselves. Because of anthropogenic causes, the extinction rate of species is on a level never before experienced, except for periods of historic mass extinctions. A force of nature, humans have caused nearly one-fourth of all mammals on the planet to be at severe risk for extinction (Cardillo et al. 2004).

In order to address the extinction crisis, government must readily address the overarching problem of too many humans on the planet and their effects on species, trophic cascades, ecosystems, and the biosphere itself. Government cannot worry about the delicacy of addressing what may seem a taboo subject. It must wade in and manage the human population problem. Social systems that is, our "political, educational, industrial, ethical, technologic, religious, psychological, social, economic, and behavioral" need to be instituted to curb human overpopulation (Fowler 2005, p 66). Failure to act will result in unintended consequences such as starvation, disease, war, and other means of social disturbance (Fowler 2005). As a species upon the planet that requires functioning, healthy ecosystems, our failure to address this key problem will ensure that in the long run that most species and natural systems will become

[18] http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5330a1.htm.

unhealthy, unsustainable, and we will lose biological diversity—a planetary crisis is at hand. With species loss, ecosystem services will decline or disappear.

Avoiding risk is the key to good management practice; yet, the human population has reached proportions that are extreme and well beyond the "normal range of variation within such distributions" (Fowler 2005, p. 60). The human overpopulation problem is both "abnormal" and "pathologic" (Fowler 2005). Overpopulation has created feedback systems that have resulted in disease, compromised immune systems, and other sicknesses to humans themselves (Fowler 2005). The human overpopulation issue also includes our reliance upon domestic animals and plants, species also in numbers far above what is sustainable (Fowler 2005).

The current species extinction rate is considered "largely unprecedented outside periods of mass extinction" (Gaston 2005, p. 239). When humans increase their densities, the preservation of natural areas become more difficult; the numbers of threatened species increase; global extinction rates increase; non-native species invasions increase—resulting in changes to species assemblages; and biological diversity decreases (Gaston 2005).

Human-caused extinctions result from habitat loss and fragmentation, loss of dispersal corridors, overhunting, poaching, the spread of invasive species, the change in species assemblages; changes in ecosystem function, disease, sickness, and a host of other problems (Cardillo et al. 2004, Gaston 2005). Biologists predict that the number of threatened bird and mammals will increase to 7 percent by 2020 and to 14 percent by 2050 (McKee et al. 2004). Already, nearly one quarter of the world's mammals are at "high risk of extinction" with top carnivores reeling from these effects (Cardillo et al. 2004).

Most species, including humans, converge on 25 "global biodiversity hotspots" because these places provide the most availability of environmental energy (Gaston, 2005, p. 240). The prevalence of humans and large-bodied vertebrates results in the decline of those latter species, even when protected areas are near (Gaston 2005). Human population size and density is "positively correlated with levels of forest loss and fragmentation," the transformation of lands, and the increase in non-native species (Gaston 2005). Other biologists have determined that human population density is important, but the speed of mechanized habitat destruction may be more important (Cardillo et al. 2004).

Species are typically driven to extinction by the combination of "deterministic factors" such as habitat loss and overexploitation and "stochastic factors" such as environmental catastrophes (O'Grady et al. 2006). Of stochastic events, inbreeding depression is the most dire to wild species (O'Grady et al. 2006). Inbreeding depression is an enormous threat to species of mammals and birds whose populations number less than 1,000, however, even in populations that have more than 1,000 members, inbreeding can be a serious problem over the long term (O'Grady et al. 2006). Four biological traits can account for extinction risk to carnivores: small available geographic range; low population densities; length of gestation (confers ability to recover because of the speed of life history); and dependence on prey species themselves in decline.

Without curbing human population density, not only will species become extinct, ecological systems will become simpler and less functional. The loss of ecosystem services will harm will humans, the environment, and the planet. WS must consider this significant new information and integrate it into a new programmatic environmental analysis.

13. *Global Warming: Migration, Extirpation, & Phenology Problems*

The Earth's temperature has warmed by 0.6 °C over the past century and may increase between one and six degrees in the next century (Wilmers and Getz 2005). The rate of climate change in this century is unusually rapid, which may prevent species to adapt (Sheikh et al. 2007). Climate change may be localized or widespread and it can affect food chains, nutrient flows, and the circulation of both the atmosphere and ocean currents (Sheikh et al. 2007). Scientists have predicted that climate change will result in increased temperatures, stochastic weather events, and changes in precipitation (Sheikh et al. 2007).

Ecosystems that are devoid of keystone species or have small numbers of species may experience greater climate change effects (Wilmers and Getz 2005). Species that live in tropical zones may benefit from greater warming and precipitation (Sheikh et al. 2007). Wildlife respond to global warming by moving their ranges northward, and by shifting breeding and migration patterns (Burns et al. 2003). In national parks of the U.S., Burns et al. (2003) predict that species will go extinct, including a 19 percent loss of carnivores—especially fishers, martens, and ringtails, 44 percent of rodent species, and 22 percent Chiropteran species (bats).

As warming occurs, Burns et al. (2003) predict that there will not be, however, a "drastic loss" of species from their current habitats, but a "fundamental change in community structure as species associations shift due to influxes of new species" (p. 11,476). As a result of these changes, a shift in the trophic dynamics will change too (Burns et al. 2003). Predator-prey interactions will be altered, mammal communities will shuffle, breeding dates and producers' flowering and budding will alter feeding patterns, and the abundance of species in different trophic levels will change (Burns et al. 2003).

The phenology (the relationship between climate and bird migration, plant flowering, and pollination) may be out of synch. Mismatches between precipitation, flowering, budding and pollination could lead to extinctions, such as the case of two populations of checkerspot butterflies (Sheikh et al. 2007). New assemblages of species will alter ecosystem functionality (Graumlich et al. 2007). The need for improved corridors and connectivity is important to prevent extinctions, but less likely because of the cost of protecting areas has become increasingly expensive (Hannah 2008).

Some pathogens could increase their range (i.e. chytrid fungus that affects frogs—causing extinctions of harlequin frogs, for example) (Sheikh et al. 2007). Species' range shifts can be harmful. The mountain pine beetle, which used to feed mainly on lodgepole pine has now shifted to white bark pine and could harm rare grizzly bears. Invasive plants could threaten biodiversity and ecosystem integrity (Pearson and Dawson 2005).
Because the literature on global warming is enormous, we focus here on carnivores.
A shift in global temperatures may especially affect species that hibernate such as black and grizzly bears. Mammalian carnivores that are continuously active (e.g., wolves and foxes) may fare better than species that are seasonally inactive (e.g., skunks and badgers) (Humphries et al. 2004).

In the Yellowstone ecosystem, wolves act as a buffer to climate change by not only creating greater amounts of carrion, but making it available year round – as opposed to winters when only the deep snow acts as the culling agent. The scavengers that benefit include bald and golden eagles, grizzly bears, ravens and magpies, and coyotes (Wilmers and Getz 2005). Wolves therefore benefit numerically rare species such as grizzlies and eagles. Wilmers and Getz (2005) write, "wolves extend the timescale over which scavenger species can adapt to the changing environment" (p. 574). Wolves may be important in protecting threatened species such as grizzly bears, whose major food source, whitebark pine, is disappearing also because of global warming (Constible et al. 2008).

Carnivores that live in biological islands, that is, they are cut off from their metapopulations, such as the pine martens and lynx in southeastern Canada and northeastern United States, will be greatly harmed with global warming events (Carroll 2007). A decrease in snowfall make these two species in these regions vulnerable to sympatric carnivores such as fishers, which compete with martens, and coyotes, which compete with lynx (Carroll 2007). Lynx are often caught in snares intended for coyotes (Carroll 2007).

To protect these vulnerable species from the effects of global warming, Carroll (2007) suggests that wildlife managers create bioregional conservation plans, and protect vulnerable populations by reducing trapping not only in their core areas but in critical linkages.

Because global warming will change ecosystems and species' abilities to survive, mitigation planning must begin (Sheikh et al. 2007). Critical habitat as defined by the ESA, habitat conservation planes, and biological opinions for species will have to be redone (Sheikh et al. 2007). Because global warming will dramatically change a host of events we describe here, WS must consider this new information as part of a new environmental analysis.

14. *Social Perceptions of Wildlife*

A Utah WS agent, who shoots coyotes from aircraft for a living, unknowingly confessed to a reporter in a Moab bar, "'no one wants you to see this shit. It's a killing floor'" (Ketchum 2008). William Bleazard, a pilot for WS, wrote about an aerial-gunning mission:

> …the first coyote went down and we both wrongly assumed he was dead, the second was still in the pass and as we crossed over him Bruce fired two times and missed. It took four more runs . . . to kill the second coyote it took several passes to finally dispatch this wounded coyote . . . we must have made eight or ten runs before making the killing shot (USDA Aerial-Gunning FOIA response, 1998 WS Incident Report).

WS's approach to wildlife management is to kill as many animals in an area as possible to prevent potential future conflicts (Mitchell et al. 2004). As we have discussed, biologists have condemned this as the "sledgehammer" approach to wildlife management.

Most Americans prefer to observe animals in their natural habitats, rather than use them for utilitarian purposes (Kellert and Smith 2000, Teel et al. 2002, FWS 2007). The 1990 GAO report found that WS's programs, with its "heavy emphasis on protecting sheep from coyotes," has created rifts (GAO 1990, p. 15). Conservationists and wildlife agencies "have charged that these programs constitute an inappropriate direct subsidy to the wool industry" (GAO 1990, p. 15). Specifically, these two entities found that WS's activities were ineffective, that losses to livestock growers were exaggerated, that carnivores had "equal right to exist on public lands," and that livestock losses should be borne by the producers who "use public lands in an already heavily subsidized manner" (GAO 1990, p 15).

Yet, WS in its 1994/1997 PEIS describes wildlife as a "renewable natural resource and is managed accordingly" (Chapter 1, 3). WS's PEIS strongly tracks towards utilitarian values: Its analyses are biased towards killing animals for the benefit of those in agribusiness, rather than balancing the public's interests in wildlife management.

People hold various and complex values around wildlife. Independent researchers offer a nuanced look. Kellert (1996) and Kellert and Smith (2000) have described nine categories of wildlife values.

Aesthetic	attraction for animals and nature
Dominionistic	subdues and masters nature and wildlife
Humanistic	affection and emotional affinity for nature
Moralistic	shows a moral or ethical responsibility for conservation
Naturalistic	gains pleasure from viewing animals in their natural environment
Negativistic	anxious, fearful, or indifferent to nature
Scientific	studies the function of organisms and their habitats
Symbolic	constructs meanings to communicate about nature
Utilitarian	materialistic interest in exploitation of animals and nature

They also add gender, education levels, and geographic location (urban vs. rural) into the mix. To oversimplify their findings, Kellert and Smith (2000) generally determined that women, those with more education, and those that live in a urban settings show more aesthetic, humanistic, moralistic, naturalistic, and scientific wildlife values. On the other hand, the authors found that men, those educated only through high school, and rural occupants more likely held utilitarian and domionistic feelings. On the whole, most people express humanistic and moralistic attitudes (Kellert 1996).

The GAO discovered that WS's agents "feel considerable pressure" to develop non-lethal control methods because of a "changing environment where experts in the field see the loss or diminishing acceptance of traditional control tools like guns, traps, and poisons" (GAO 2001, p. 38). Despite these findings, humaneness issues vex WS. That is because its kill methods are inherently indiscriminate, over-reaching, cruel, and not in keeping with the mores of a changing society. Further, WS even kills federally-protected, non-target species, a practice which most find objectionable.

WS stated in its PEIS that "humaneness is an individual's perception" and individuals "perceive" humaneness "differently" (PEIS, Chapter 3, p. 81). The PEIS notes that livestock producers believe it is "inhumane" when coyotes kill "defenseless" sheep by "attaching at the throat" and "suffocating" and causing "respiratory failure" (PEIS Chapter 3, p. 81). Sheep are not the only victims in this document, so are "unprotected flightless birds" that die from hungry red foxes; nefarious beavers "flood" and "displace" other wildlife; and ravens that "eat the eye out of a ewe" that has "laid down" to lamb (PEIS, Chapter 4, p. 129-30). Invoking Biblical language, the PEIS attempts to paint some wildlife as "pests" and "vermin," thus cultivating the atmosphere necessary to justify its own merciless operations.

Recently, Christian groups have re-entered the debate on the subject of values and the natural world. Roman Catholics and Evangelical Protestants started a movement called "Creation Care," and have excoriated the wanton "exploitation and destruction" of animals and the environment for purely capitalist purposes,[19] which may now surprise the writers of the PEIS.

The PEIS seems consumed with anti-predator despair. The agency laments when predators act like predators (i.e., foxes eating birds). Yet predation is important for ecosystem health. Philosopher Stephen R. L. Clark (1997) writes, "the hyena is not cruel in eating a zebra alive, for he is only seeking food, not the enjoyment of power or the distress of his victim" (p. 17). Clark warns that, "it is simply sentimental to be upset by such a sight" (Clark 1997, p. 17). In the natural world, predators kill, and it is necessary. While caribou herds "may be spared the pain of wolves" the unintended consequences of a "population explosion will lead to overgrazing, disease, famine and a population crash" (Clark 1997, p. 19).

WS's PEIS recounts "inhumane" acts by coyotes, beavers, foxes, and crows, but absolves the agency's own cruel acts through the claim that scientific research has not developed "objective, quantitative measures of pain or stress" for animals (Chapter 3, p. 81). In a puzzling circle of arguments, WS unsuccessfully tries to justify the inherent cruelty of its lethal control program.

Yet, WS admits to some of it problems. Non-target species can be killed if they are attracted to baits set out for a different quarry, and if, in the instance of traps, a non-target species is of a similar size or weight as the intended animal, or if they are in the wrong place, mishaps occur (Chapter 3, p. 46). The PEIS states, "deer or pronghorn antelope may accidentally step on leg-hold traps set for coyotes" (Chapter 3, p. 47). Moreover, WS unintentionally kills threatened or endangered species (Chapter 3, p. 47). As we demonstrate throughout the lethal toxicants section below, many non-target species, including protected species, can be inadvertently killed because of the non-specific nature of these methods.

Animals viewed as "pests" often have their welfare ignored (Littin et al. 2004, Littin and Mellor 2005). In its environmental analyses, WS has failed to assess the duration or intensity of "pain, distress or suffering," and the numbers of animals involved (Littin et al. 2004, Littin and Mellor 2005) in its lethal control program.

Pain comes in different forms, and is typically considered acute, chronic, or severe and is considered a "subjective experience" that generally manifests emotionally or behaviorally (Mori 2007). We have known at least since the 13th Century that animals feel pain—just like humans, because of similar central nervous systems (Mighetto 1991, Mori 2007). Mori (2007) argues that the path towards reduction or even the abolishment of pain depends on the humans' sense of responsibility and civility. Because of the body of available knowledge gathered over the past several centuries, WS cannot hide behind its spurious claim that animal pain is subjective and mysterious to human researchers (e.g., Chapter 3, p. 81).

The American Veterinary Medical Association's (AVMA) (2007) Guidelines on Euthanasia clearly define pain and stress and provide sound direction on what constitutes a good death (i.e., duration, method, and mental wellbeing of the subject). The Guidelines provide specific considerations for wild animals such as little handling so they are not roused by sight, sound, or

[19] See for example, a 2005 *Washington Post* story concerning a 30-million member call to action for creation, http://www.washingtonpost.com/wp-dyn/articles/A1491-2005Feb5.html (last viewed February 15, 2008). See also, Pope Benedict XVI's April 2005 inaugural mass. He stated, "the earth's treasures no longer serve to build God's garden for all to live in, but they have been made to serve the powers of exploitation and destruction." http://www.vatican.va/holy_father/benedict_xvi/homilies/documents/hf_ben-xvi_hom_20050424_inizio-pontificato_en.html (last viewed February 15, 2008).

tactile stimulants. Distressed wild animals exhibit behavioral and physiologic responses such as vocalizations, struggling, aggression, salivation, urination, defecation, pupil dilation, tremors, or spasms (AVMA 2007).

The Guidelines are clear about how to cause death. It should be conducted with the utmost respect, free of pain or stress (AVMA 2007, p. 1). A stress-free and painless death might involve the loss of consciousness before the loss of motor activity. Paralysis prior to unconsciousness is not considered euthanasia and those unacceptable agents of death include "depolarizing and nondepolarizing muscle relaxants, strychnine, nicotine, and magnesium salts" (AVMA 2007, p. 6). When using poisons, species-level data must be gathered; one cannot make assumptions that "absorption, distribution, metabolism, excretion, and pathophysiological effects of poison" can be appropriately extrapolated to other species (Littin et al. 2004, p. 3). Paparella (2006) raises the issue that almost all rodenticides are inhumane because they cause "severe pain and suffering, usually lasting for days" (p. 51). Anticoagulates and aluminum and zinc phosphides are extremely inhumane (Paparella 2006). Common sense dictates that the duration of suffering should be quick, and does not include the regaining consciousness prior to death (Littin et al. 2004, Littin and Mellor 2005).

As we described, WS's aerial gunning operations are not within the recommended guidelines for euthanasia. The admission by a federal agent that "it's a killing floor" should give federal policy-makers pause (Ketchum 2008). Why is the federal government involved in such barbaric acts? And acts that ultimately cost human life, as we have described.

For some wildlife, some trapping and poisoning methods cause stress and pain for long durations. In the coming pages, we show how WS is clearly out of step with suggestions by the AVMA and other researchers concerned by the quality of death. Research shows that most Americans prefer to watch wildlife, and many spend billions of dollars in that pursuit each year.

Because a vast literature concerning animals, their welfare, and their experience while in pain has issued, WS must undertake a new NEPA analysis that uses this literature to inform its discussions – a discussion that cannot be limited by utilitarian values.

IV. SUGGESTIONS FOR SUPPLEMENTAL PEIS

Beyond incorporating the latest scientific studies on the aforementioned topics, WildEarth Guardians further suggests that the upcoming supplemental PEIS include a comprehensive "hard look" to all potentially significant environmental impacts flowing from the Animal Damage Control Program, as well as a thorough cumulative impacts analysis and an objective cost-benefit analysis.

A. <u>WS Must Take a Hard Look at its Animal Damage Program</u>

WildEarth Guardians asserts that in order to comply with NEPA, WS must take a hard look at the following points in its upcoming EIS:

- The number and species of animals WS will capture/kill and by what method. How killing harms localized populations, harms metapopulations, and disrupts species assemblages.

- How WS's activities harm trophic cascades, which affect ecosystem functions, including ecosystem services.

- How WS's activities contribute to the extirpation and extinction of species.

- How aircraft affects wildlife, including noise pollution and visual disruptions to animals' foraging, courtship, feeding behaviors, all of which affect survival.

- The time of year aerial gunning will occur and the duration of each operation.

- Effects of aerial gunning on threatened, endangered, candidate, and sensitive species.

- The aesthetic experience of outdoor recreationists in areas where aerial gunning and other lethal wildlife control operations are conducted.

- The ethics and efficacy of using fertility controls on wild populations.

- Effects of pesticides and other contaminants from WS's activities to land, air, or water.

- Probability of secondary poisonings from pesticides to people, pets, and non-target wildlife.

- Extent of non-target poisonings (including humans) from Compound 1080 because of loss of collars, scavengers eating tainted meat, and improper disposal of 1080-contaminate articles and harms to soil, water, scavengers etc.

B. <u>WS Must Analyze all Cumulative Impacts & Connected Actions</u>

WildEarth Guardians also asserts that in order to comply with NEPA, WS must analyze its Animal Damage Control Program within the context of the following activities:

- Livestock grazing.

- Trail and recreational use expansion.

- Human-wildlife conflicts, including over-killings, habituation, and collisions.

- Extractive uses, such as logging operations, mineral exploration, ski industry expansions, oil and gas, agriculture, and private development.

- Increase in private land ownership of formerly public lands.

- Food source declines.

- Decline in corridors and increased fragmentation.

- Reduction in the quality and quantity of watersheds.

- Forest thinning and fire suppression.

- National security and public and employee safety.
- Global warming.
- Hunting changes in phenotypes of species—selecting for less fit individuals (see e.g., Singer and Zeigenfuss 2002, Darimont et al. 2009).
- Spread of diseases.
- Invasive plants and animals.
- Hunting, trapping, poisoning, and poaching of wildlife populations.
- Alternative energy development.
- Human overpopulation.

C. <u>WS Must Conduct Full Analysis of Costs and Benefits</u>

WildEarth Guardians further asserts that in order to comply with NEPA, WS must undertake a thorough and realistic cost-benefit analysis of its Animal Damage Program.

Through sloppy inventory management, poor systems management in the field, WS has endangered people, pets, and non-target species—including those that are specially protected by state and federal laws. It has lost Compound 1080 livestock protection collars, it has left dangerous toxicants and aircraft vulnerable to theft, and has been duly censured by the OIG on numerous occasions for national security concerns. It has harmed people directly and indirectly from sodium cyanide M-44s, resulting in censure from the EPA in the last several months. At least 10 WS agents have been killed in the line of duty because of aerial gunning accidents; likely more agents have been killed from mishaps with explosives, firearms, and toxicants. WS has killed tens of millions of animals. It has caused the extirpation of several species, and places species on a path towards extinction. Even once-common birds are disappearing in the U.S., and WS must shoulder blame because of its rampant toxicant program. These are some of the costs of the WS's program.

Despite these considerable mishaps, WS's budget has grown. In the years 2004 to 2006, it spent an average of $103.3 million annually, but in 2007, spent $117.3, a 14 percent increase. Over the last four years, the agency spent a total of $427 million to kill 8.4 million animals. WS's funds are more than half from federal taxes, and less than half from cooperators (which includes state and county taxes and contributions from agribusiness) (GAO 2001). It spends more than 70 percent on operations, about 15 percent on research, and 12 percent on administration (GAO 2001).

In the states where WS spent heavily in 2007 (with the exception of Washington), large numbers of coyotes were killed: Texas spent the most at $13.8 million to kill 19,123 coyotes, California came in second on expenditures, spending $6 million to kill 7,759 coyotes. Wyoming, fifth place in spending at $3.8 million, killed the second most coyotes in the nation: 10,915 (See Table below).

State	Budget in Millions of Dollars	Total Animals Killed	Coyotes Killed
TX	13.8	76,246	19,123
CA	6.0	64,293	7,759
UT	4.0	192,904	4,888
OK	3.9	58,375	5,544
WY	3.8	15,582	10,915
MT	3.6	10,025	9,251
WA	3.3	310,125	608
NM	3.2	11,924	4,568
NV	3.0	113,692	7,447
ID	2.7	173,859	4,693

There is a correlation in WS expenditures and the numbers of coyotes killed. Therefore, predator control must be a focal point in the new WS's EIS. As we discussed herein, the GAO (2001) found that few livestock operators lose livestock to predators; losses are concentrated to only a few operators. Moreover, the USDA-NASS shows that most livestock losses come from weather, disease, illness, and birthing problems, but not predation. Predators killed 0.18 percent of cattle and approximately 3 percent of sheep (discussion supra). Most expenses involved in sheep raising, 77 percent, are attributable to the price of hay of wages, and the market on lambs (Berger 2006). Most of these killing activities do little to address systemic problems and the result is a continual and mounting death toll each year, because WS relies on extermination techniques rather than innovative and ethical non-lethal methods. In short, predator control programs are an unwise use of public funding.

Cost-benefit analyses that simply look at the value of the livestock killed by carnivores, but not other measures such as the value of livestock losses in the face of mitigation measures are far too simplistic (Baker et al. 2008). Livestock losses are variable not only between producers, but on the same producer over time (Baker et al. 2008). Cost-benefit analyses must also consider if lethal methods create compensatory versus additive mortality, the variability of livestocks' market value and demand, livestock replacement costs, and the fluctuating costs of animal control programs (Baker et al. 2008, p. 144). Authors found that pre-emptively killing the most predators in an area, can lead to increased immigration rates, increase the potential for introducing new diseases into an area, and increase female fecundity and juvenile survival (Baker et al. 2008).

The GAO (2001) "found no independent studies that rigorously assessed the costs and benefits of the Wildlife Services program," instead, the only studies conducted were by the agency itself or with collaborating researchers (p. 3-4, 27, 32, 35-36). WS's cost-benefit ratios have heretofore excluded factors such as ecosystem services that wildlife and functioning ecosystems provide.

WS's PEIS correctly asserts that livestock or crop losses caused by wildlife are unevenly distributed among individual producers, but for some, the losses are significant (Chapter 3, p. 53). The GAO (2001) affirms this. However, the GAO further notes that:

> . . . although average losses to predators are small compared to overall losses from other causes, such as weather and disease, the damages are not evenly distributed over time or over area. Thus, using a single average statistic to infer overall program effectiveness would not accurately reflect the distributional variations (GAO 2001, p. 36).

In other words, the GAO's investigations reveal that few livestock producers are harmed by wildlife, most losses stem from weather or disease, and WS cannot prove that its program provides any meaningful benefits to the very producers it claims to help. Yet, WS maintains that its predator-killing program prevents livestock losses. Even the GAO disputes this fundamental notion:

> . . . we found no independent studies that rigorously assessed the costs and benefits of the WS program; the only studies that we found were conducted by or in collaboration with WS scientists and researchers (GAO 2001, p. 27).
>
> * * *
>
> Because of the nature of cost-benefit studies in general, their results should be viewed with some caution. Inherent difficulties bedevil any attempt to quantify the costs and benefits of a program designed to prevent damage. *Key among these difficulties are (1) projecting the degree of losses that would have occurred absent the program*, (2) valuing those losses, and (3) valuing the program benefits. Moreover, in some instances, the relevancy of *data available for quantifying the costs and benefits* associated with WS's activities may be *limited by the data's age* (GAO 2001, p. 35, emphasis added).

The WS program benefits agribusiness, but not the taxpayer, wildlife recreationists, or those who hold values concerning wildlife that are not from the dominionistic/utilitarian frame. WS conducts pro-emptive killing on wildlife species to prevent livestock and crop losses. The WS program, with its emphasis on killing, habitat manipulation (i.e. cattail poisoning) is expensive, unnecessary, and enormously problematic as we have discussed throughout. WS harms wildlife populations and the environment. Yet, there are no independent studies that show that WS costs are beneficial (GAO 2001), and WS uses a simplistic notion that livestock saved are the only value in a cost-benefit analysis.

The expedient solution is to employ long-term, non-lethal methods such as guard animals and night sheds. But WS seldom institutes those methods. According to the GAO, "although written program policies call for field personnel to give preference to non-lethal control methods when practical and effective, field personnel use lethal methods to control livestock predators" (GAO 1995, p. 4). An earlier GAO report made the same determination; it stated there was "little evidence" that program personnel were using non-lethal methods but instead were reliant upon lethal methods (GAO 1990, p. 16). In 2000, the GAO found that WS spent only 15 percent of its budget on research (GAO 2001). These data are old because WS's annual budgets, although available online, do not itemize research expenditures—although the agency should routinely make this information publicly transparent. The GAO's investigations postdate WS's NEPA; therefore, as part of a new NEPA process, WS must fully and adequately disclose improvements, if any, it has made on the front of using non-lethal methods and how it spends its considerable annual budgets.

D. WS Must Provide Public Accountability and Conduct Scoping

On January 20, 2009, President Barack Obama stated in his inaugural address:

> And those of us who manage the public's dollars will be held to account, to spend wisely, reform bad habits, and do our business in the light of day, because only then can we restore the vital trust between a people and their government.

WS must heed the President's pledge. For far too long it has operated in secrecy. Since 2001, WildEarth Guardians has, for example, questioned the agency about sums spent on its controversial aerial gunning program. Despite the Freedom of Information Act (FOIA) and the intervention of Congressman Mark Udall, we have been unable to obtain a response. Public accountability is not WS's strong suit.[20] The economic data in WS's 1994/1997 PEIS come from 1987 and 1988—data that were outdated when the PEIS went to print, but are now woefully obsolete (PEIS Table 3-13, Chapter 3, p. 52). In addition, WS's budgets are opaque and not in the electronic reading room.

A 2001 GAO report helps dispel some of WS's budgetary mysteries:

> In fiscal year 2000, the program spent about $80.6 million in funds: about $42.3 million in congressional appropriations and about $38.3 million in funds from clients. Of the total funding, research spent about $12.2 million or 15 percent; operations spent about $59 million, or 73 percent; and program administration spent about $9.5 million or 12 percent (GAO Nov. 2001, p. 7).

In 2000, WS spent about $9 million on developing non-lethal methods to control wildlife (GAO Nov. 2001). The GAO's data, now eight years old, illuminate by percentages how WS outlaid its funds for 2000. Before this GAO report, WS's research budget was unknown. This is especially a concern because the public deserves to have its tax dollars spent on developing ethically-responsible, non-lethal means.

The only information that shows the benefits of the WS's Animal Damage program come from the agency itself. Meanwhile, independent research biologists and an economist have decried the breadth of the killing because of the environmental harms, the non-selectivity, and the failure to benefit the sheep industry—where most of WS's spends its resources. The GAO plainly disputes that the costs associated with WS's program have any measurable benefit, and that the data relied on by the agency are dated. Therefore, WS must take all these new studies and oversight

[20] As an example, in July 2000 Sinapu (now WildEarth Guardians) requested documents concerning WS's safety review of its aerial gunning program under FOIA. WS responded in October 2007—long the past the statutory 2 working-day deadline. The response was incomplete (a major report was missing) and 82 pages were redacted.

In March 2007, Sinapu and Forest Guardians (now WildEarth Guardians) sent WS a demand letter requesting that the agency post their 2005 and 2006 online as required by the FOIA and pursuant to a federal court's order. WS at first balked, but eventually published the data. In 2008, WS posted 53 reports for states and territories, but failed to conduct a national accounting, prompting WildEarth Guardians to do the work in a spreadsheet in order to undertake an analysis on behalf of the public (Barnard 2008 a,b).

investigations into account as part of a new NEPA analysis.

As such, we further request that WS undertake an objective cost-benefit analysis that specifically addresses the following questions:

- What are the overall costs/burdens of the Animal Damage Control Program?
- What are the Monetary Benefits of the Program?

Lastly, we request that WS fully engage the public when undertaking its new NEPA process for the Animal Damage Control Program.

Although NEPA and other public disclosure laws encourage open government action and decision-making, WildEarth Guardians has been consistently troubled with WS's seeming aversion to transparency. Despite the fact that WS's highly controversial Animal Damage Control Program costs taxpayers millions of dollars annually, WS systematically disregards public disclosure laws and hinders public access to agency information. It is our sincere hope that WS will now abandon this culture of secrecy, and abide by both the letter and spirit of NEPA.

V. CONCLUSION

WS spends over $100 million annually to kill more than one million animals each year. In so doing, it continues to rely on the 1994/1997 PEIS, which is both too narrow in scope and woefully outdated to support its Animal Damage Control Program. Because NEPA and its implementing regulations require federal agencies to supplement their environmental analyses in either of these circumstances, WildEarth Guardians asserts that WS must immediately revamp its Animal Damage Control PEIS and cease all activities carried under this PEIS unless and until it complies with federal law.

VI. REFERENCES

American Society of Mammalogists. 1999. Resolution on Mammalian Predator Control in the United States, Letter from Dr. O.J. Reichman, President, American Society of Mammalogists to Defenders of Wildlife. 2000.

American Veterinary Medical Association. 2007. AVMA Guidelines on Euthanasia.

Andelt, W. F. 1996. Carnivores. Pages 133-155 *in* P. R. Krausman, editor. Rangeland Wildlife. Society for Range Management, Denver.

Anderson, C. R. and F. G. Lindzey. 2005. Experimental evaluation of population trend and harvest composition in a Wyoming cougar population. Wildlife Society Bulletin 33:179-188.

Antone, R. 2008. Birds by the bagful a surprise. Yakima Herald-Republic, Yakima.

Arjo, W. M., K. K. Wagner, D. L. Nolte, R. S. Stahl, and J. J. Johnston. 2006. Potential non-target risks from strychnine-containing rodent carcasses. Crop Protection 25:182-187.

Baker, Philip J., Luigi Boitani, Stephen Harris, Glen Saunders, Piran White. 2008. Terrestrial carnivores and human food production: impact and management. Mammal Rev. 38:123-166.

Baker, S. E., S. A. Ellwood, R. Watkins, and D. W. MacDonald. 2005a. Non-lethal control of wildlife: using chemical repellents as feeding deterrents for the European badger (*Meles meles*). Journal of Applied Ecology 42:921-931.

Baker, S. E., S. A. Ellwood, R. W. Watkins, and D. W. Macdonald. 2005b. A dose-response trial with ziram-treated maize and free-ranging European badgers (*Meles meles*). Applied Animal Behaviour Science 93:309-321.

Baker, S. E., P. J. Johnson, D. Slater, R. W. Watkins, and D. W. MacDonald. 2007. Learned food aversion with and without an odour cue for protecting untreated baits from wild mammal foraging. Applied Animal Behaviour Science 102:410-428.

Ballard, W. B., D. Lutz, T. W. Keegan, L. H. Carpenter, and J. C. deVos. 2001. Deer-predator relationships: a review of recent North American studies with emphasis on mule and black-tailed deer. Wildlife Society Bulletin 29:99-115.

Banci, Vivian. 1994. Wolverine. Pp. 99-127 *In* L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, tech eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Dept. of Agriculture, Forest Service, Gen. Tech. Rep. RM-254.

Barnard, J. 2008a. Agency agrees to total up wildlife kill. Associated Press.

Barnard, J. 2008b. Agency makes it tough to keep tabs on animal kills. Associated Press.

Baron, D. 2005. A Response to Mountain Lions, Myths, and Media. Environmental Law 35:1095-1101.

Bauer, J., K. Logan, L. Sweanor, and W. Boyce. 2005. Scavenging behavior in puma. Southwestern Naturalist 50:466-471.

Beck, T. D. 1991. Black Bears of West-Central Colorado. Colorado Division of Wildlife: Technical Publication 39.

Beckmann, J. P. 2002. Changing Dynamics of Black Bear Population: Causes and Consequences.*in* Defenders of Wildlife: Carnivores 2002, Monterey, California.

Beckmann, J. P. and J. Berger. 2003. Rapid Ecological and Behavioural Changes in Carnivores: the Responses of Black Bears (*Ursus americanus*) to Altered Food. The Zoological Society of London 261:207-212.

Beckmann, J. P., C. W. Lackey, and J. Berger. 2004. Evaluation of deterrent techniques and dogs to alter behavior of “nuisance” black bears. Wildlife Society Bulletin 32:1141-1146.

Beier, P. 1991. Cougar Attacks on Humans in the United States and Canada. Wildlife Society

Bulletin 19:403-412.
Beier, P. 1992. Cougar Attacks on Humans: An Update and Some Further Reflections. Pages 365-366 *in* 15th Vertebrate Pest Conference. University of California, Davis.
Belant, J. L. and T. W. Seamans. 1999. Alpha-chloralose immobilization of rock doves in Ohio. Journal of Wildlife Diseases 35:239-242.
Belant, J. L., L. A. Tyson, and T. W. Seamans. 1999. Use of alpha-chloralose by the Wildlife Services program to capture nuisance birds. Wildlife Society Bulletin 27:938-942.
Berger, K. M. 2006. Carnivore-Livestock Conflicts: Affects of Subsidized Predator Control and Economic Correlates on the Sheep Industry. Conservation Biology 20:751-761.
Blackwell, B. F., E. Huszar, G. M. Linz, and R. A. Dolbeer. 2003. Lethal control of red-winged blackbirds to manage damage to sunflower: An economic evaluation. Journal of Wildlife Management 67:818-828.
Boggis, C. 1977. Swift fox habitat in north central Colorado. Colorado State University, Fort Collins.
Brenner, K. 2005. West Marin ranchers cut damage from predators the humane way. Marin Independent Journal.
Bright, J. and J. Hervert. 2005. Adult and fawn mortality of Sonoran pronghorn. Wildlife Society Bulletin 33:43-50.
Brown, P., L. Chambers, and G. Singleton. 2002. Pre-sowing control of house mice (*Mus domesticus*) using zinc phosphide: efficacy and potential non-target effects. Wildlife Research 29:27-37.
Burns, C. E., K. M. Johnston, and O. J. Schmitz. 2003. Global climate change and mammalian species diversity in U.S. national parks. PNAS: Proceedings of the National Academy of Sciences 100:11474-11477.
Butcher, G. S. and D. K. Niven. 2007. Combining Data from the Christmas Bird Count and the Breeding Bird Survey to Determine the Continental Status and Trends of North America Birds. Audubon.
Cardillo, M., A. Purvis, W. Sechrest, J. L. Gittleman, J. Bielby, and G. M. Mace. 2004. Human Population Density and Extinction Risk in the World's Carnivores. PLOS Biology **2**:0909-0914.
Carpenter, J. W., O. H. Pattee, S. H. Fritts, B. A. Rattner, S. N. Wiemeyer, J. A. Royle, and M. R. Smith. 2003. Experimental lead poisoning in turkey vultures (Cathartes aura). Journal of Wildlife Diseases 39:96-104.
Carroll, C. 2007. Interacting effects of climate change, landscape conversion, and harvest on carnivore populations at the range margin: Marten and Lynx in the northern Appalachians. Conservation Biology 21:1092-1104.
Center for Disease Control. May 14, 2003. Strychnine Fact Sheet.
Center for Native Ecosystems. 2002. Petition to list the white-tailed prairie dog under the Endangered Species Act. Submitted to U. S. Fish and Wildlife Service July 11, 2002.
Clark, S. R. L. 1997. Animals and their Moral Standing. Routledge, London.
Colorado Division of Wildlife. 2008. Draft Colorado Gunnison's and White-tailed Prairie Dog Conservation Plan. Draft issued September 2008. Population Viability Analysis, prepared by Philip S. Miller of the IUCN/SSC Conservation Breeding Specialist Group, is at Appendix G.
Constible, J. M., L. H. Sandro, and R. E. Lee. 2008. Carrion - It's what's for dinner: Wolves reduce the impact of climate change. American Biology Teacher 70:95-102.
Craighead, D. and B. Bedrosian. 2008. Blood lead levels of common ravens with access to big-game offal. Journal of Wildlife Management 72:240-245.
Connolly, G. and U.S. Department of Agriculture - Animal and Plant Health Inspection Service -

Wildlife Services. 1998. Technical Bulletin for the Sodium Fluoroacetate (Compound 1080) Livestock Protection Collar. EPA Registration No. 56228-22.
Conover, M. R. 2001. Effect of hunting and trapping on wildlife damage. Wildlife Society Bulletin 29:521-532.
Cougar Management Guidelines Working Group, T. Beck, J. Beecham, P. Beier, T. Hofstra, M. Hornocker, F. Lindzey, K. Logan, B. Pierce, H. Quigley, I. Ross, H. Shaw, R. Sparrowe, and S. Torres. 2005. Cougar Management Guidelines. WildFutures, Brainbridge Island, WA.
Crabtree, R. and J. Sheldon. 1999. Coyotes and canid coexistence in Yellowstone. Pages 127-163 *in* T. Clark, A. P. Curlee, S. Minta, and P. Kareiva, editors. Carnivores in Ecosystems: The Yellowstone Experience. Yale University Press, New Haven, CT.
Craighead, D. and B. Bedrosian. 2008. Blood lead levels of common ravens with access to big-game offal. Journal of Wildlife Management 72:240-245.
Craighead, L. 2002. Wildlife-related Road Impacts in the Yellowstone to Yukon Region *in* Transportation Networks and Wildlife, Spokane, WA.
Crooks, K. R. and M. E. Soule. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563-566.
Curtis, Paul D., Daniel J. Decker, Rebecca J. Stout, Milo E. Richmond, and Cynthia A. Loker. 1997. Human Dimensions of Contraception in Wildlife Management. In Ed. Terry Kreeger, USDA-APHIS, Contraception in Wildlife Management. Technical Bulletin No. 1853: 247-255.
Cypher, B. L. and K. A. Spencer. 1998. Competitive interactions between coyotes and San Joaquin kit foxes. Journal of Mammalogy 79:204-214.
Darimont, Chris, Stephanie Carlson, Michael Kinnison, Paul Paquet, Thomas Reimchen, and Christopher Wilmers. 2009. Human Predators outpace other agents of trait change in the wild. PNAS.org 106:952-954.
Davidson, C., M. F. Benard, H. B. Shaffer, J. M. Parker, C. O'Leary, J. M. Conlon, and L. A. Rollins-Smith. 2007. Effects of chytrid and carbaryl exposure on survival, growth and skin peptide defenses in foothill yellow-legged frogs. Environmental Science & Technology 41:1771-1776.
Dobson, A. and A. Lyles. 2000. Ecology - Black-footed ferret recovery. Science 288:985.
Eason, C. 2002. Sodium monofluoroacetate (1080) risk assessment and risk communication. Toxicology 181:523-530.
Edge, R. The United States Bureau of Destruction and Extermination: The Misnamed and Perverted 'Biological Survey. Rosalie Barrow Edge Manuscript Collection, Denver, CO.
Environmental Protection Agency - Office of Prevention - Pesticides - and Toxic Substances. 1991a. RED Facts: Inorganic Nitrate/Nitrite (Sodium and Postassium Nitrates).
Environmental Protection Agency - Office of Prevention - Pesticides - and Toxic Substances. 1991b. Reregistration Eligibility Document Inorganic Nitrate/Nitrite (Sodium and Potassium Nitrates).
Environmental Protection Agency - Office of Prevention - Pesticides - and Toxic Substances. 1995a. R.E.D. Facts: Sodium Fluoroacetate.
Environmental Protection Agency - Office of Prevention - Pesticides - and Toxic Substances. 1995b. Reregistration Eligibility Decision: Starlicide (3-chloro-p-toluidine hydrochloride).
Environmental Protection Agency - Office of Prevention - Pesticides - and Toxic Substances. 2007. Reregistration Eligibility Decision for 4-aminopyridine
Environmental Protection Agency - Office of Prevention - Pesticides - and Toxic Substances. July 1996a. R.E.D. Facts: Strychnine.

Environmental Protection Agency - Office of Prevention - Pesticides - and Toxic Substances. July 1996b. Reregistration Eligibility Decision: Strychnine.
Environmental Protection Agency -Office of Prevention - Pesticides - and Toxic Substances. 1998. Reregistration Eligibility Decision: Zinc Phosphide.
Erickson, W. and D. Urban. 2004. Potential Risks of Nine Rodenticides to Birds and Nontarget Mammals: a Comparative Approach. Environmental Protection Agency - Office of Pesticides Programs-Environmental Fate and Effects Division.
Fagerstone, K. 2002. Professional Use of Pesticides in Wildlife Management—An Overview of Professional Wildlife Damage Management. Proceedings of the Vertebrate Pest Conference.
Ferguson, S. and S. Lariviere. 2002. Can comparing life histories help conserve carnivores? Animal Conservation **5**:1-12.
Ferguson, S. and S. Lariviere. 2004. Is mustelid life history different? Page 279 *in* D. J. Harrison, A. K. Fuller, and G. Proulx, editors. Martens and fishers (Martes), in human-altered environmentas: An international perspective. Springer, New York.
Finkel, M. 1999. The Ultimate Survivor. http://audubonmagazine.org/coyote/index.html Audubon. National Audubon Society.
Finley, D. J., G. C. White, and J. P. Fitzgerald. 2005. Estimation of swift fox population size and occupancy rates in eastern Colorado. Journal of Wildlife Management 69:861-873.
Fitzgerald, J., R. Loy, and M. Cameron. 1983. Status of Swift Fox on the Pawnee National Grassland, Colorado. Page 21, Greeley.
Fitzgerald, J., R. Loy, and M. Cameron. 1994a. Furbearer management analysis: A report submitted to the Department of Natural Resources, Colorado Division of Wildlife. University fo Northern Colorado, Greeley.
Fitzgerald, J., C. Meaney, and A. Armstrong. 1994b. Swift fox (*Vulpes velox*). Pages 310-312, and 349 Mammals of Colorado. University Press of Colorado, Niwot.
Fitzhugh, E. L. 2003. Lessening the Impact of a Puma Attack on a Human *in* Seventh Mountain Lion Workshop, Jackson, WY.
Fleischman, J. N. 2002. Statement of Joyce N. Fleischman, Acting Inspector General, U.S. Department of Agriculture. Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies.
Fowler, C., W. 2005. Sustainability, Health, and the Human Population. EcoHealth **2**:58-69.
Gaston, K. J. 2005. Biodiversity and extinction: species and people. Progress in Physical Geography **29**:239-247.
Gilbert, F. 1981. Worldwide furbearer conference proceedings. Pages 1599-1611, Frostburg, MD.
Gill, R. B. 1999. Declining Mule Deer Populations in Colorado: Reasons and Responses: A Report to the Colorado Legislature. Colorado Division of Wildlife, Denver.
Goel, A. and P. Aggarwal. 2007. Pesticide poisoning. National Medical Journal of India 20:182-191.
Goncharov, N. V., R. O. Jenkins, and A. S. Radilov. 2006. Toxicology of fluoroacetate: a review, with possible directions for therapy research. Journal of Applied Toxicology 26:148-161.
Goodrich, J. M. and S. W. Buskirk. 1995. Control of abundant native vertebrates for conservation of endangered species. Conservation Biology 9:1357-1364.
Graumlich, L. J., M. S. Cross, J. Hilty, and J. Berger. 2007. Adapting to Climate Change: Reconsidering the Role of Protected Areas and Protected Organisms to Western North America. Eos Trans. AGU, Fall Meet. Suppl. 88.
Gulson, B. L., J. M. Palmer, and A. Bryce. 2002. Changes in blood lead of a recreational shooter.

The Science of the Total Environment 293:143-150.
Hannah, L., Eds Richard Ostfeld and William H. Schlesinger. 2008. Protected Areas and Climate Change. Annals of the New York Academy of Sciences: The Year in Ecology and Conservation Biology (p. 201-212).
Hansen, K. 1992. Cougar: The American Lion. Northland Publishing, Flagstaff, AZ.
Hardison, D. W., L. Q. Ma, T. Luongo, and W. G. Harris. 2004. Lead contamination in shooting range soils from abrasion of lead bullets and subsequent weathering Science of the Total Environment 328:175-183.
Harris, S., C. D. Soulsbury, and G. Iossa. 2005. Trapped by bad science: The Myths behind the International Humane Trapping Standards: A Scientific Review. International Fund for Animal Welfare.
Hash, Howard S. 1987. Wolverine. *Pp. 683-694 In* M. Novak et al., eds. Wild furbearer management and conservation in North America.. Toronto, Ontario: Ontario Trappers Association and Ministry of Natural Resources.
Hayes, T. B., P. Case, S. Chui, D. Chung, C. Haeffele, K. Haston, M. Lee, V. P. Mai, Y. Marjuoa, J. Parker, and M. Tsui. 2006. Pesticide mixtures, endocrine disruption, and amphibian declines: Are we underestimating the impact? Environmental Health Perspectives 114:40-50.
Henke, S. E. and F. C. Bryant. 1999. Effects of coyote removal on the faunal community in western Texas. Journal of Wildlife Management 63:1066-1081.
Henry, C. J., K. F. Higgins, and K. J. Buhl. 1994. Acute Toxicity and Hazard Assessment of Rodeo®, X-77 Spreader®, and Chem-Trol® to Aquatic Invertebrates. Archives of Environmental Contamination and Toxicology 27:392-399.
Hiltz, M. and L. D. Roy. 2000. Rating killing traps against humane trapping standards using computer simulations *in* 19^{th} Vertebrate Pest Conference.
Hoffman, N. October 1, 2007. Sheep v. Sheep. High Country News, Paonia.
Hoogland, J. L. 2006. Ed. Conservation of the black-tailed prairie dog. Island Press: Washington D. C.
Hooke, A. L., L. Allen, and L. K. P. Leung. 2006. Clinical signs and duration of cyanide toxicosis delivered by the M-44 ejector in wild dogs. Wildlife Research 33:181-185.
Humphries, M. M., J. Umbanhowar, and K. S. McCann. 2004. Bioenergetic prediction of climate change impacts on northern mammals. Integrative and Comparative Biology 44:152-162.
Iossa, G., C. D. Soulsbury, and S. Harris. 2007. Mammal trapping: a review of animal welfare standards of killing and restraining traps. Animal Welfare 16:335-352.
ISO 10990-4. 1999. Animal (mammal) traps: Part 4: Methods for testing killing trap systems used on land or underwater. Geneva, Switzerland.
Jacobs, W. W. Undated. Blackbird Pesticide Registrations and Registration Requirements. <aphisweb.aphis.usda.gov/wildlife_damage/nwrc/symposia/blackbirds_symposium/jacobs.pdf>.
Johnston, J. J., M. J. Holmes, A. Hart, D. J. Kohler, and R. S. Stahl. 2005. Probabilistic model for estimating field mortality of target and non-target bird populations when simultaneously exposed to avicide bait. Pest Management Science 61:649-659.
Jones, D. and S. Rodriguez. 2003. Restricting the Use of Animal Traps in the United States: An Overview of Laws and Strategy. http://www.animallaw.info/policy/poanimallawindexvol9.htm.
Kamler, J., W. Ballard, E. Fish, P. Lemons, K. Mote, and C. Perchellet. 2003a. Habitat use, home ranges, and survival of swift foxes in a fragmented landscape: conservation implications. Journal of Mammalogy 84:989-995.
Kamler, J. F., W. B. Ballard, E. B. Fish, P. R. Lemons, K. Mote, and C. C. Perchellet. 2003b.

Habitat use, home ranges, and survival of swift foxes in a fragmented landscape: Conservation implications. Journal of Mammalogy 84:989-995.
Keefover-Ring, W. 2005a. Mountain Lions, Myths, and Media: A Critical Reevaluation of The Beast in the Garden. Environmental Law 35:1083-1093.
Keefover-Ring, W. 2005b. Final Words about Beasts and Gardens. Environmental Law 35:1103-1106.
Keefover-Ring, W. 2007. Sinapu et al.'s Petition to the Environmental Protection Agency to Ban Sodium Cyanide (M-44) and Sodium Flouroacetate (Livestock Protection Collars), Docket number, EPA-HQ-OPP-2007-0944.
Keefover-Ring, W. 2008. AGRO: A Coalition to End Aerial Gunning of Wildlife. http://www.goagro.org/.
Kellert, S. and C. Smith. 2000. Human Values Toward Large Mammals. Ecology and management of large mammals in North America. Prentice Hall, Upper Saddle River, NJ.
Kellert, S. R. 1996. The Value of Life. Island Press, Washington, D.C.
Kemsley, J. N. 2007. Getting the Lead Out of Bullets: Tungsten-tin composite provides alternative for hunters. Chemical and Engineering News 85:10.
Ketchum, C. 2008. America's Secret War on Wildlife: A federal agency keeps the West safe for cows by killing coyotes, wolves, bears, and pet dogs. Men's Journal 16:49-51.
Kintigh, K. and M. Anderson. 2005. A den-centered analysis of swift fox (*Vulpes velox*): Habitat characteristics of northeastern New Mexico. American Midland Naturalist 154:229-239.
Kitchen, A., E. Gese, S. Karki, and E. Schauster. 2005. Spatial ecology of swift fox social groups: from group formation to mate loss. American Society of Mammalogists 86:547-554.
Kitchen, A., E. Gese, and E. Schauster. 1999. Resource partitioning between coyotes and swift foxes: space, time and diet. Canadian Journal of Zoology 77:1645-1656.
Kotliar, N. B., B. W. Baker, A. D. Whicker, and G. Plumb. 1999. A critical review of assumptions about the prairie dog as a keystone species. Environmental Management. 24: 177-192.
Knopper, L. D., P. Mineau, A. M. Scheuhammer, D. E. Bond, and D. T. McKinnon. 2006. Carcasses of shot Richardson's ground squirrels may pose lead hazards to scavenging hawks. Journal of Wildlife Management 70:295-299.
Knowlton, F. F. 1972. Preliminary Interpretations of Coyote Population Mechanics with Some Management Implications. Journal of Wildlife Management 36:369-&.
Knowlton, F. F., E. M. Gese, and M. M. Jaeger. 1999. Coyote depredation control: An interface between biology and management. Journal of Range Management 52:398-412.
Lambert, C. M. S., R. B. Wielgus, H. S. Robinson, D. D. Katnik, H. S. Cruickshank, R. Clarke, and J. Almack. 2006. Cougar Population Dynamics and Viability in the Pacific Northwest. Journal of Wildlife Management 70:246-254.
Larkin, R. P., T. R. VanDeelen, R. M. Sabick, T. E. Gosselink, and R. E. Warner. 2003. Electronic signaling for prompt removal of an animal from a trap. Wildlife Society Bulletin 31:392-398.
Lee, R., J. Yoakum, B. O'Gara, T. Pojar, and R. Ockenfels. 1998. Pronghorn Management Guide, Proc. 1998-18th Biennial Pronghorn Antelope Workshop. Pronghorn Antelope Workshop, AZ Game and Fish, and Arizona Antelope Foundation, Inc.
Leitch, J. A., G. M. Linz, and J. F. Baltezore. 1997. Economics of cattail (Typha spp.) control to reduce blackbird damage to sunflower. Agriculture Ecosystems & Environment 65:141-149.
Leopold, A. 1949, Reprint 1977. A Sand County Almanac. Ballantine Books, New York.
Linz, G. M. and D. L. Bergman. 1996. DRC-1339 Avicide Fails to Protect Ripening Sunflowers.

Crop Protection 15:307-310.
Linz, G. M., D. L. Bergman, D. C. Blixt, and W. J. Bleier. 1994. Response of Black Terns (*Chlidonias-niger*) to Glyphosate-Induced Habitat Alterations on Wetlands. Colonial Waterbirds 17:160-167.
Linz, G. M., W. J. Bleier, J. D. Overland, and H. J. Homan. 1999. Response of invertebrates to glyphosate-induced habitat alterations in wetlands. Wetlands 19:220-227.
Linz, G. M. and D. C. Blixt. 1997. Black Terns benefit from cattail management in the northern Great Plains. Colonial Waterbirds 20:617-621.
Linz, G. M., D. C. Blixt, D. L. Bergman, and W. J. Bleier. 1996a. Response of ducks to glyphosate-induced habitat alterations in wetlands. Wetlands 16:38-44.
Linz, G. M., D. C. Blixt, D. L. Bergman, and W. J. Bleier. 1996b. Responses of Red-winged Blackbirds, Yellow-headed Blackbirds and Marsh Wrens to glyphosate-induced alterations in cattail density. Journal of Field Ornithology 67:167-176.
Linz, G. M., M. J. Kenyon, H. J. Homan, and W. J. Bleier. 2002. Avian use of rice-baited corn stubble in east-central South Dakota. International Biodeterioration & Biodegradation 49:179-184.
Linz, G. M., G. A. Knutsen, H. J. Homan, and W. J. Bleier. 2004. Attractiveness of brown rice baits to non-target birds in harvested corn and soybean fields. Pest Management Science 60:1143-1148.
Littin, K. E. and D. J. Mellor. 2005. Strategic animal welfare issues: ethical and animal welfare issues arising from the killing of wildlife for disease control and environmental reasons. Revue Scientifique Et Technique-Office International Des Epizooties 24:767-782.
Littin, K. E., D. J. Mellor, B. Warburton, and C. T. Eason. 2004. Animal welfare and ethical issues relevant to the humane control of vertebrate pests. New Zealand Veterinary Journal 52:1-10.
Lloyd, B. D. and S. M. McQueen. 2000. An assessment of the probability of secondary poisoning of forest insectivores following an aerial 1080 possum control operation. New Zealand Journal of Ecology 24:47-56.
Lofholm, N. 3/15/01. Residents work to halt pet poisonings. Denver Post.
Lofholm, N. 4/12/01. Memorial Honors Poisoned Pets. Denver Post, Denver.
Logan, K. A. and L. L. Sweanor. 2001. Desert puma: evolutionary ecology and conservation of an enduring carnivore. Island Press, Washington, DC.
Lomax, B. 2008. Tracking the Bighorns. Smithsonian 38:21-24.
Loy, R. 1981. An ecological investigation of the swift fox (*Vulpes velox*) on the Pawnee National Grasslands, Colorado. University of Northern Colorado, Greeley.
Marks, C. A., L. Allen, F. Gigliotti, F. Busana, T. Gonzalez, M. Lindeman, and P. M. Fisher. 2004. Evaluation of the tranquilizer trap device (TTD) for improving the humaneness of dingo trapping. Animal Welfare 13:393-399.
Marks, C. A. and R. Wilson. 2005. Predicting mammalian target-specificity of the M-44 ejector in south-eastern Australia. Wildlife Research 32:151-156.
Martin, G. R. and L. E. Twigg. 2002. Sensitivity to sodium fluoroacetate (1080) of native animals from north-western Australia. Wildlife Research 29:75-83.
Martin, G. R., L. E. Twigg, N. J. Marlow, W. E. Kirkpatrick, D. R. King, and G. Gaikhorst. 2002. The acceptability of three types of predator baits to captive non-target animals. Wildlife Research 29:489-502.
Mason, G. and K. E. Littin. 2003. The humaneness of rodent pest control. Animal Welfare 12:1-37.
Masterson, L. 2006. Living with Bears: A Practical Guide to Bear Country. PixyJack Press, LLC, Masonville, CO.

McGee, B., W. Ballard, and K. Nicholson. 2006. Importance of artificial escape cover for increasing swift fox populations in northwest Texas in Eds. J. Stuart and S. Wilson, Swift Fox Conservation Team: Annual Report for 2004. Swift Fox Conservation Team, Santa Fe, New Mexico and Lincoln, Nebraska.

McKee, J. K., P. W. Sciullia, C. D. Foocea, and T. A. Waite. 2004. Short Communication: Forecasting global biodiversity threats associated with human population growth. Biological Conservation **115**:161-164.

Meaney, C. A., M. Reed-Eckert, and G. P. Beauvais. 2006. Kit Fox (*Vulpes macrotis*): A Technical Conservation Assessment: Prepared for the USDA Forest Service - Rocky Mountain Region - Species Conservation Project. USDA Forest Service - Rocky Mountain Region.

Meretsky, V. J., N. F. R. Snyder, S. R. Beissinger, D. A. Clendenen, and J. W. Wiley. 2000. Demography of the California Condor: Implications for reestablishment. Conservation Biology 14:957-967.

Mezquida, E. T., S. J. Slater, and C. W. Benkman. 2006. Sage-Grouse and indirect interactions: Potential implications of coyote control on Sage-Grouse populations. Condor 108:747-759.

Mighetto, L. 1991. Wild animals and American environmental ethics. University of Arizona Press, Tucson.

Miller, B., R. P. Reading, and T. W. Clark. 2000. Black-footed Ferret *in* B. Miller, R. P. Reading, and T. W. Clark, editors. Endangered animals: a reference guide to conflicting issues. Greenwood Press, Westport, Conn.

Miller, B., R. P. Reading, and S. Forrest. 1996. Prairie night: black-footed ferrets and the recovery of endangered species. Smithsonian Institution Press, Washington.

Miller, B., R. Reading, J. Hoogland, T. Clark, G. Ceballos, R. List, S. Forrest, L. Hanebury, P. Manzano, J. Pacheco, and D. Uresk. 2000. The role of prairie dogs as keystone species: Response to Stapp. Conservation Biology. 14: 318-321.

Miller, Brian J., Richard P. Reading, Dean E. Biggins, James K. Detling, Steve C. Forrest, John L. Hoogland, Jody Javersak, Sterling D. Miller, Jonathan Proctor, Joe Truett, and Daniel W. Uresk. 2007. Prairie dogs: an ecological review and current biopolitics. Journal of Wildlife Management 71: 2801-2810.

Mitchell, B. R., M. M. Jaeger, and R. H. Barrett. 2004. Coyote depredation management: current methods and research needs. Wildlife Society Bulletin 32:1209-1218.

Mori, B. 2007. Bioethics between pain and welfare. Veterinary Research Communications 31:65-71.

Mosnier, A., D. Boisjoly, R. Courtois, and J. P. Ouellet. 2008. Extensive predator space use can limit the efficacy of a control program. Journal of Wildlife Management 72:483-491.

Murie, A. and U.S. Department of the Interior. 1940. Ecology of the Coyote in the Yellowstone. Fauna of the National Parks of the United States, Series No. 4, U.S. Government Printing Office.

Murphy, K., P. I. Ross, and M. Hornocker. 1999. The Ecology of Anthropogenic Influences on Cougars. Pages 77-100 *in* T. Clark, A. P. Curlee, S. Minta, and P. Kareiva, editors. Carnivores in Ecosystems. Yale University Press, New Haven.

Murray, Brian T. Feds Promise Better Notice About Bird Kills. January 30, 2009. New Jersey Star Ledger. <nj.com/news/ledger/jersey/index.ssf?/base/news-12/1233293208132600.xml&coll=1>.

Muth, R. M., R. R. Zwick, M. E. Mather, J. F. Organ, J. J. Daigle, and S. A. Jonker. 2006. Unnecessary source of pain and suffering or necessary management tool: Attitudes of conservation professionals toward outlawing leghold traps. Wildlife Society Bulletin

34:706-715.
National Research Council. 1997. Wolves, bears, and their prey in Alaska. National Academy Press, Washington, D.C.
Office of the Sheriff of Sierra County California. 8/18/97. Sierra County Sheriff's Office Crime Report.
O'Grady, J. J., B. W. Brook, D. H. Reed, J. D. Ballou, D. W. Tonkyn, and R. Frankham. 2006. Realistic levels of inbreeding depression strongly affect extinction risk in wild populations. Biological Conservation **133**:42-51.
Oltrogge, V. 2002. Lead Replacement Technologies in Projectiles. Pages 1-11 *in* Defenders of Wildlife, Carnivores 2002, Monterey, California.
Oogjes, Glenys. 1997. Ethical aspects and dilemmas of fertility control of unwanted wildlife: an animal welfarist's perspective. Reproduction, Fertility and Development 9:165-6.
Pain, D. J., C. Bavoux, and G. Burneleau. 1997. Seasonal blood lead concentrations in marsh harriers (*Circus aeruginosus*) from Charente-Maritime, France: Relationship with the hunting season. Biological Conservation 81:1-7.
Paparella, M. 2006. Rodenticides - An animal welfare paradox? The development of more humane rodenticides is urgently needed. Altex-Alternativen Zu Tierexperimenten 23:51-52.
Pauli, J. N. and S. W. Buskirk. 2007. Recreational shooting of prairie dogs: A portal for lead entering wildlife food chains. Journal of Wildlife Management 71:103-108.
Payer, D. C. and D. J. Harrison. 2003. Influence of forest structure on habitat use by American marten in an industrial forest. Forest Eoclogy and Management **179**:145-156.
Pearson, R. G. and T. P. Dawson. 2005. Long-distance plant dispersal and habitat fragmentation: identifying conservation targets for spatial landscape planning under climate change. Biological Conservation 123:389-401.
Pepper, C. B., M. A. Nascarella, and R. J. Kendall. 2003. A review of the effects of aircraft noise on wildlife and humans, current control mechanisms, and the need for further study. Environmental Management 32:418-432.
Petel, A. M. V., R. Kirkwood, F. Gigliotti, and C. Marks. 2004. Adaptation and assessment of M-44 ejectors in a fox-control program on Phillip Island, Victoria. Wildlife Research 31:143-147.
Pluhar, Evelyn. 1995. Beyond Prejudice: The Moral Significance of Human and Nonhuman Animals. Durham: Duke University Press.
Pojar, T. M. and D. C. Bowden. 2004. Neonatal mule deer fawn survival in west-central Colorado. Journal of Wildlife Management 68:550-560.
Poppegna, R., A. Ziegler, P. Habecker, D. Singletary, M. Walter, and P. Miller. 2005. Zinc Phosphide Intoxication of Wild Turkeys (*Meleagris gallopavo*). Journal of Wildlife Diseases 41:218-223.
Potvin, F., L. Belånger, and K. Lowell. 2000. Marten habitat selection in a clear-cut boreal forest. Conservation Biology **14**:854-857.
Potvin, F. and L. Breton. 1997. Short-term effects of clearcutting on martens and their prey in the boreal forest of western Quebec.*in* Martes: taxonomy, ecology, techniques and management. Proceedings of the Second International Martes Symposium, Alberta, Edmonton.
Powell, R. A. 1994. Structure and spacing of Martes populations.*in* S. W. Buskirk, A. S. Harestad, M. G. Rapheal, and R. A. Powell, editors. Martens, sables, and fishers: biology and conservation. Cornell University Press, Ithaca.
Powell, R. A. and W. J. Zielinski. 1994. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine. General Technical Report RM-254. U.S.

Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Proulx, G. and M. W. Barrett. 1991. Evaluation of the Bionic Trap to Quickly Kill Mink (*Mustela-Vison*) in Simulated Natural Environments. Journal of Wildlife Diseases 27:276-280.

Proulx, G. and M. W. Barrett. 1993. Field Testing the C120-Magnum Trap for Mink. Wildlife Society Bulletin 21:421-426.

Ralston, S. T., G. M. Linz, W. J. Bleier, and H. J. Homam. 2007. Cattail distribution and abundance in North Dakota. Journal of Aquatic Plant Management 45:21-24.

Raza, S. K. and D. K. Jaiswal. 1994. Mechanism of Cyanide Toxicity and Efficacy of Its Antidotes. Defense Science Journal 44:331-340.

Redig, P. 2002. Lead Poisoning in Bald Eagles in the Upper Midwest. Page 119 *in* Defenders of Wildlife, Carnivores 2002, Monterey, California.

Riley, S. P. D., C. Bromley, R. H. Poppenga, F. A. Uzal, L. Whited, and R. M. Sauvajot. 2007. Anticoagulant exposure and notoedric mange in bobcats and mountain lions in urban southern California. Journal of Wildlife Management 71:1874-1884.

Ripple, W. J. and R. L. Beschta. 2006. Linking a cougar decline, trophic cascade, and catastrophic regime shift in Zion National Par. Biological Conservation 133:397-408.

Robinson, H.S, R.B. Wielgus, H.S. Cooley, S.W. Cooley. 2008. Sink populations in carnivore management and immigration in a hunted population. Ecological Applications 14:1028-1037.

Robinson, M. J. 2005. Predatory Bureaucracy: The Extermination of Wolves and Transformation of the West. University Press of Colorado, Boulder.

Rocky Mountain Animal Defense vs. Colorado Division of Wildlife et al. 2001. Plaintiff Rocky Mountain Animal Defense's Reply in Support of Motion to Modify the Court's March 6, 2001, Order and Request for Expedited Ruling Because of Two Imminent Poisonings. Jennifer Melton.

Sanborn, W. 2002. Lead poisoning of North American wildlife from ammunition and tackles. HawkWatch International, Inc., Salt Lake City, Utah.

Sawyer, H. and F. Lindzey. 2002. Review of Predation on Bighorn Sheep (Ovis canadensis). Prepared for Wyoming Animal Damage Management Board, Wyoming Domestic Sheep and Bighorn Sheep Interaction Working Group, Wyoming Game and Fish Department.

Schauster, E., E. Gese, and A. Kitchen. 2002a. Population ecology of swift fox (*Vulpes velox*) in southeastern Colorado. Canadian Journal of Zoology 80:307-319.

Schauster, E. R., E. M. Gese, and A. M. Kitchen. 2002b. An evaluation of survey methods for monitoring swift fox abundance. Wildlife Society Bulletin 30:464-477.

Schenk, T. 2001. Post-Release Monitoring of Lynx Reintroduced to Colorado: Annual Report for the U.S. Fish and Wildlife Service. Colorado Division of Wildlife.

Schenk, T. and R. Kahn. 2002. Lynx Reintroduction: Report to Wildlife Commission.

Schneider, R. 1997. Simulated spatial dynamics of martens in response to habitat succession in the wetern Newfoundland Model Forest.*in* Martes: taxonomy, ecology, techniques and management. Proceedings of the Second International Martes Symposium, Alberta, Edmonton.

Schoch, D. 2001. Lead Bringing Down Condors. Denver Post (reprinted from the L.A. Times), Denver.

Seamans, T. W. and J. L. Belant. 1999. Comparison of DRC-1339 and alpha-chloralose to reduce herring gull populations. Wildlife Society Bulletin 27:729-733.

Seglund, Amy, Thomas DeLiberto, and Bruce Kimball. March 2000. "Evaluation of Cabergoline as a Reproductive Inhibitor for Coyotes (*Canis latrans*)." Proc. 19th

Vertebrate Pest Conference, San Diego: 319-324.
Shivaprasad, H. and F. Galey. 2001. Diphacinone and zinc phosphide toxiticy in a flock of Peafowl. Avian Pathology 30:599-603.
Shivik, J. A., K. S. Gruver, and T. J. DeLiberto. 2000. Preliminary evaluation of new cable restraints to capture coyotes. Wildlife Society Bulletin 28:606-613.
Shivik, J. A., D. J. Martin, M. J. Pipas, J. Turnan, and T. J. DiLiberto. 2005. Initial comparison: jaws, cables, and cage-traps to capture coyotes. Wildlife Society Bulletin 33:1375-1383.
Shivik, J. A., A. Treves, and P. Callahan. 2003. Nonlethal techniques for managing predation: Primary and secondary repellents. Conservation Biology 17:1531-1537.
Sheikh, P. A., M. L. Corn, J. A. Leggett, and P. Folger. 2007. CRS Report for Congress: Global Climate Change and Wildlife. Congressional Research Service. Order Code RS22597:1-6.
Singer, FJ, LC Zeigenfuss. 2002. Influence of trophy hunting and horn size on mating behavior and survivorship of mountain sheep. Journal of Mammalogy 83:682-697.
Slabaugh, S. 2008. Bird die-off causes a flap in Winchester: Man who discovered starlings lives next door to CAFO. Palladium-Item, Richmond, VA.
Slobodchikoff, C.N., Bianca S. Perla, and Jennifer L. Verdolin. 2009. Prairie Dogs: Communication and Community in an Animal Society. Cambridge, MA: Harvard University Press.
Small, M. P., K. D. Stone, and J. A. Cook. 2003. American martes (*Martes americana*) in the Pacific Northwest: Population differentiation across and landscape fragmented in time and space. Molecular Ecology **12**:89-103.
Smith, D. W., P. O. Rolf, and D. B. Houston. 2003. Yellowstone after Wolves. Bioscience 53:330-340.
Sovada, M. A., A. B. Sargeant, and J. W. Grier. 1995. Differential Effects of Coyotes and Red Foxes on Duck Nest Success. Journal of Wildlife Management 59:1-9.
Stolzenburg, W. 2006. Us or Them. Conservation in Practice 7:14-21.
Stoner, D., M. , M. L. Wolfe, and D. Choat. 2006. Cougar Exploitation Levels in Utah: Implications for Demographic Structure, Population Recovery, and Metapopulation Dynamics. Journal of Wildlife Management 70:1588-1600.
Stuart, J. and S. Wilson. 2006. Introduction and Overview in Eds. J. Stuart and S. Wilson, Swift Fox Conservation Team Annual Resport for 2004. Swift Fox Conservation Team, Santa Fe, New Mexico and Lincoln, Nebraska.
Sunquist, M. and F. Sunquist. 2002. Bobcat (*Lynx rufus*). Pages 185-200. Wild Cats of the World.
Sweanor, L., K. Logan, J. Bauer, and W. Boyce. 2003. Puma and humans in and around Cuyamacha Rancho State Park, San Diego County, California. Wildlife Health Center, School of Veterinary Medicine, University of California Davis, Davis.
Teel, T. L., R. S. Krannich, and R. H. Schmidt. 2002. Utah stakeholders' attitudes toward selected cougar and black bear management practices. Wildlife Society Bulletin 30:2-15.
Thompson, I. D. 1994. Marten populations in uncut and logged boreal forests in Ontario. Journal of Wildlife Management **58**:272-280.
Treves, A. and K. U. Karanth. 2003. Human-carnivore conflict and perspectives on carnivore management worldwide. Conservation Biology 17:1491-1499.
U.S. Department of Agriculture. 2006. Pre-Harvest Security Guidelines and Checklist 2006.
U.S. Department of Agriculture - Animal and Plant Health Inspection Service. 2001. Tech Note: M-44 User Tips.
U.S. Department of Agriculture - Animal and Plant Health Inspection Service - Animal Damage Control. 1994. Final Environmental Impact Statement.

U.S. Department of Agriculture - Animal and Plant Health Inspection Service - Wildlife Services. 2002. USDA Performance and Accountability Report for FY 2002.
U.S. Department of Agriculture - Animal and Plant Health Inspection Service - Wildlife Services. 2008. FY 2007 Monitoring Report and Amendment to the EA for Management of Blackbird Species to Reduce Damage to Sunflower, Corn, and Other Small Grain Crops in the Prairie Pothole Region of North Dakota and South Dakota.
U.S. Department of Agriculture - National Agricultural Statistics Service. 2005a. Cattle.
U.S. Department of Agriculture - National Agricultural Statistics Service. 2005b. Sheep.
U.S. Department of Agriculture - National Agricultural Statistics Service. 2005c. Sheep and Goats Death Loss.
U.S. Department of Agriculture - Office of Inspector General. 2004a. Audit Report: Animal and Plant Health Inspection Service, WS's Controls Over Hazardous Materials Inventory.
U.S. Department of Agriculture - Office of Inspector General. 2004b. Audit Report: Security Over Animal and Plant Health Inspection Service's Owned and Leased Aircraft.
U.S. Department of Agriculture - Office of Inspector General. 2005. Animal and Plant Health Inspection Service, Evaluation of the Implementation of the Select Agent or Toxin Regulations, Phase I. Report No. 33601-2-AT.
U.S. Department of Agriculture - Office of Inspector General. 2006. Audit Report: Animal and Plant Health Inspection Service, Evaluation of the Implementation of the Select Agent or Toxin Regulations, Phase II. Report No. 33601-3-AT.
U.S. Department of Interior-Bureau of Land Management. October 2004. Proposed Revisions to Grazing Regulations for the Public Lands: Final Environmental Impact Statement FES 04-39.
U.S. Department of Interior - Fish Wildlife Service. 1988. Black-Footed Ferret Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado:1-154.
U.S. Department of Interior - Fish Wildlife Service. 1993. Biological Opinion: Effects of 16 Vertebrate Control Agents on Threatened and Endangered Species.
U.S. Department of the Interior - Fish and Wildlife Service and U.S. Department of Commerce - U.S. Census Bureau. November 2007. 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. . <http://wsfrprograms.fws.gov/Subpages/NationalSurvey/2006_Survey.htm>.
U.S. General Accounting Office. 1990. Wildlife Management: Effects of Animal Damage Control Program on Predators.
U.S. General Accounting Office. 1995. Animal Damage Control Program: Efforts to Protect Livestock from Predators.
U.S. General Accounting Office. Nov. 2001. Wildlife Services Program: Information on Activities to Manage Wildlife Damage. GAO, Washington, D.C.
USDA Aerial-Gunning FOIA response. 1998 WS Incident Report.
Wagner, K. K. and M. R. Conover. 1999. Effect of preventive coyote hunting on sheep losses to coyote predation. Journal of Wildlife Management 63:606-612.
Watkins, B., J. Olterman, and T. Pojar. 2002. Mule Deer Survival Studies on the Uncompahgre Plateau, Colorado 1997-2001. Colorado Division of Wildlife.
Watson, M. 1990. Rancher Use of Livestock Protection Collars in Texas, Proceedings of the Vertebrate Pest Conference.277-280.
White, C. 2005. Hunters ring dinner bell for Ravens: Experimental evidence of a unique foraging strategy. Ecology 86:1057-1060.
White, C. 2006. Indirect effects of elk harvesting on ravens in Jackson Hole, Wyoming. Journal of Wildlife Management 70:539-545.
WildEarth Guardians (formerly Forest Guardians), Biodiversity Conservation Alliance, Center

for Native Ecosystems, and Rocky Mountain Animal Defense. 2007. Petition to List the Black-tailed Prairie Dog under the Endangered Species Act. Submitted to the U.S. Fish and Wildlife Service on August 1, 2007.

WildEarth Guardians (formerly Forest Guardians) and 73 co-petitioners. Petition to List the Gunnison's Prairie Dog under the Endangered Species Act. Submitted to the U.S. Fish and Wildlife Service on February 23, 2004.

Wilmers, C. C., and W. M. Getz. 2005. Gray Wolves as Climate Change Buffers in Yellowstone. PLOS Biology 3:571-576.

Williams, Elizabeth and Ian K. Barker. 2001. Diseases of Wild Mammals. Ames: Iowa State Press.

Wilson, S. M., M. J. Madel, D. J. Mattson, J. M. Graham, and T. Merrill. 2006. Landscape conditions predisposing grizzly bears to conflicts on private agricultural lands in the western USA. Biological Conservation 130:47-59.

Witmer, G. and K. Fagerstone. 2003. The Use of Toxicants in Black-Tailed Prairie Dog Management: An Overview. Proceedings of the 10th Wildlife Damage Management Conference.

Woolf, A. and G. F. Hubert. 1998. Status and Management of Bobcats in the United States over Three Decades: 1970s-1990s. Wildlife Society Bulletin 26:287-293.

Woronecki, P. P. and L. T. William. 1993. Status of Alpha Chloralose and Other Immobilizing/Chemicals within the Animal Damage Control Program. Pages 123-127 Sixth Eastern Wildlife Damage Control Conference. Proc. East. Wildl. Damage Control Conf., Lincoln, NE.

Zielinski, W. J., K. M. Slauson, C. R. Carroll, C. J. Kent, and D. G. Dudrna. 2001. Status of American Martens in coastal forests of the Pacific States. Journal of Mammalogy **82**:478-490.

Zielinski, W. J., J. William, R. L. Truex, F. V. FSchlexer, L. A. Campbell, and C. R. Carroll. 2005. Historical and contemporary distributions of carnivores in forests of the Sierra Nevada, California, USA. Journal of Biogeography.