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CARNIVORE MANAGEMENT

After their eradication from most of the conterminous United States, large carnivore populations, including grizzly bears (*Ursus arctos horribilis*), mountain lions/cougars (*Puma concolor*), and gray wolves (*Canis lupus*), increased in the last quarter century. However, most of the conservation successes associated with large carnivore recovery came about because of federal, Endangered Species Act protections, as opposed to state-led efforts. Large carnivores are often viewed by ungulate hunters as competitors, and carnivore management activities are generally unprofitable for state agencies, creating an incentive to reduce or even minimize carnivore populations with aggressive lethal management. This problem arises, in part, because the ecosystem services carnivores provide are not monetized—or for that matter, even well understood. A review of recent legislative actions in the American West concerning wolves supports the idea that some states are attempting to systematically minimize wolf populations in response to real and/or perceived effects on wild ungulate populations and domestic livestock production. Actions aimed at reducing or minimizing carnivores in order to increase ungulate hunting opportunities could be lessened by: (a) diversifying sources of funding for wildlife management, (b) broadening public involvement efforts to include so-called "non-consumptive" stakeholders, and (c) formally recognizing a duty to conserve wildlife as a public trust asset.

A Brief History of Carnivore Eradication in the United States: 1630–1930

It is useful to reflect upon our history with large carnivores (hereafter, carnivores) when attempting to understand current approaches to carnivore management. Policy aimed at wolf eradication can be traced back to the efforts of Solon of Greece, who

established a bounty for wolves in the sixth century B.C. (Fritts et al. 2003). Wolf bounties in what is now the United States predate the formation of our federal government by well over a century; the first known bounty was established in 1630 by the Massachusetts Bay Colony (Mech 1970; Young 1944). Other colonies soon followed suit, and bounties for wolves and other predators followed man's westward expansion across North America. According to Lopez:

The New England experience with the wolf was repeated as settlers moved west through the eastern hardwood forests. . . . Bounties were enacted, wolf drives took place, pits were dug, poison and traps were set out. . . . By the time the settlers reached the edge of the Great Plains, they could turn and see behind them a virtually wolfless track, hundreds of miles wide, that stretched all the way back to the Atlantic seaboard. (1978, 174)

But bounties were not exclusive to wolves. Danz (1999, 116) noted that by the time the forty-eighth state was admitted to the Union, "all but one, Nevada, had, at one time or another, established a bounty on the cougar." Efforts to deal with losses from carnivores took many forms: "Initially, embattled land or livestock owners would attempt to deal with predation issues by themselves through reactive hunting efforts, carcass baiting, poisoning, and trapping" (Danz 1999, 114). If these measures failed, professional hunters were often employed, and bounties were used to enhance such efforts (Danz 1999; Lopez 1978).

Throughout the nineteenth century the federal government was conspicuously absent in these eradication efforts. Wildlife are generally considered resources of states (Blumm and Ritchie 2005), and wildlife problems were typically left for state and local governments to handle. That changed in 1915 when Congress appropriated \$125,000 for the control of wolves and coyotes (Feldman 2007). Pressure to expand federal control efforts quickly escalated—in 1930, the Bureau of Biological Survey requested \$1 million for its predator control efforts—until, in 1931, Congress passed the National Animal Damage Control Act, which directed the federal government to "conduct campaigns" directed at the "destruction or control" of predatory animals. On the floor of the U.S. Senate, Senator Kendrick (WY) justified these measures in economic terms, arguing:

The question is whether we would rather have the country overrun with these predator animals, or whether we shall employ the country for higher purposes in the matter of producing meat-food animals. (Lopez 1978, 149)

Interestingly, Senator Kendrick went on to defend his position by touting his record as a wildlife conservationist, arguing, "My record in the State of Wyoming along the line of conserving the wild game of that State is one that at least entitles me to consideration in passing on this question" (Lopez 1978, 149). These comments illustrate the stark dichotomy separating *predatory* wildlife from *wild game* at that time. The latter were viewed as a resource to be conserved, the former as a threat to be eliminated.

Yet, by the time the National Animal Damage Control Act had passed, large carnivores had been mostly eliminated from the contiguous forty-eight states (Feldman 2007). Cougar had been all but eliminated in the eastern United States by the 1870s (McCollough 2011) and grizzly bear were mostly eradicated from the contiguous forty-eight states by 1920, existing only in isolated pockets in the northern Rocky Mountains (Mattson and Merrill 2002). Likewise, wolves, once common, were increasingly scarce throughout the lower forty-eight. Writing in the 1890s, Theodore Roosevelt observed:

Formerly wolves were incredibly abundant in certain parts of the country, notably on the great plains . . . and were regular attendants on the great herds of the bison. . . . Now, however, there is no district in which they are really abundant. The wolfers, or professional wolf-hunters, who killed them by poisoning for the sake of their fur, and the cattlemen, who likewise killed them . . . because of their raids on the herds, have doubtless been the chief instruments in working their decimation on the plains. . . . They have become one of the rarest sights on the plains. (Roosevelt 1900, 215–216)

The situation was different in the intermountain West. Sparse human populations, great expanses of wilderness, and generally rugged terrain made large carnivores harder to locate and kill. Moreover, conflicts with agriculture were more acute. Whereas the fertile ground of the eastern United States was dominated by row crops, the high-altitude, semi-arid West was unsuitable for such crops, so livestock grazing prevailed as the dominant form of

agriculture. Thus, carnivores were at the same time more troublesome and harder to locate and kill. Nonetheless, the combination of state and federal policies—including bounties and professional assistance (by the Bureau of Biological Survey) were enough to rapidly overcome these obstacles. By 1930, wolves, cougars, and grizzly bears were virtually eliminated from the intermountain West (Bangs et al. 1998; Mattson and Merrill 2002; Young 1944). So effective were these efforts that bounties paid in the state of Montana for wolves decreased from more than 4,000 in 1903 to zero in 1927—less than twenty-five years (Riley, Nesslage, and Maurer 2004). Even Yellowstone National Park, which had been set aside explicitly for the protection of wildlife, held no protection for wolves and cougars. The last known wolf den in Yellowstone was destroyed in 1923, the last of the wolves by 1926 (McNamee 1997).

Et Tu, Conservationists?

Notably, these efforts occurred with the support of many naturalists and sportsmen of that time. Theodore Roosevelt, considered by many to be the father of conservation, described wolves as "the arch type of ravin, the beast of waste and desolation" (Roosevelt 1900), while famed naturalist John James Audubon once assisted a farmer who trapped wolves, then severed their tendons and unleashed a pack of dogs upon them (Coleman 2004). Even Aldo Leopold, who is often credited with founding the field of wildlife management (Robinson and Bolen 1984), supported efforts to eradicate wolves and cougars. Speaking in Santa Fe, New Mexico, at a 1920 conference, Leopold argued:

It is going to take patience and money to catch the last wolf or lion in New Mexico. But the last one must be caught before the job can be called fully successful. This may sound like a strong statement . . . but if any of you have lived in the West and see how quickly a piece of country will restock with wolves or lions, you will know what I mean. . . . When they are cleaned out, the productiveness of our proposed refuges and plans for regulation of ~~kill~~, will be very greatly increased. (Meine 1988, 181)

To provide historical context for Leopold's argument, it is again important to distinguish between *game* and *predators*, a legal classification that persists to this day. Game were wildlife that were viewed as useful, especially to those interested

in the emerging activity of sport hunting (i.e., hunting for the purpose of recreation, as opposed to pure subsistence). They were a “crop” to be farmed for sustained use by people (Leopold 1933). Predators were *not* game, but rather, animals that potentially limited game populations—an impediment to obtaining social benefits. While game were deserving of a sporting chance of escape, predators such as wolves and cougars were to be pursued and eliminated mercilessly; as Theodore Roosevelt noted in a letter to a fellow sportsmen concerning wolf hunting, “There was no pretense of giving them fair play. . . . *Wolves were killed for vermin, not for sport*” (Lopez 1978, 154; emphasis added).

Astute observers might point out that the first textbook on wildlife management (i.e., *Game Management*) was not published until 1933, and the *Journal of Wildlife Management*—the first professional journal dedicated to the subject of wildlife management—was first launched in 1937 (Robinson and Bolen 1984). Thus, the eradication of large carnivores in the United States mostly predates the establishment of the institution currently recognized as professional wildlife management. Indeed, despite his earlier advocacy, Leopold’s views about carnivores were rapidly evolving. By the early 1940s Leopold was publicly expressing a very different view regarding efforts to eradicate large carnivores:

It is probably no accident that the near-extirpation of the timber wolf and the cougar was followed, in most big-game states, by a plague of excess deer and elk and the threatened extirpation of their winter browse foods. . . . The wolf is . . . a precision instrument; he regulates not only the number but the distribution of deer. In thickly settled counties we cannot have wolves, but in parts of the north we can and should. (Meine 1988, 458)

Yet, despite the clear regret Leopold expressed for his in part carnivore eradication in *A Sand County Almanac*, it took an action of the federal government, and more than a generation, before policies designed to halt the localized extinctions of these species were put into place.

Hunting to Conserve: The Logic of Wildlife Management in the United States

Federal protection for carnivores finally came about during the 1960s in the form of the Endangered

Species Preservation Act of 1966, a predecessor of the Endangered Species Act. Gray wolves, the Florida panther (*Puma concolor coryi*) and grizzly bear were all listed under the act in 1967 (32 Fed. Reg. No. 48 p. 4001). Despite these new protective measures and apparent changes in public opinion, states often continued to resist protections for carnivores, especially wolves. Thus, for example, Minnesota’s governor and legislature opposed listing the wolf as either threatened or endangered, and passed a resolution calling for wolves to be removed from any protections (48 Fed. Reg. No. 47 p. 9608). Likewise, a proposal to reintroduce wolves into Yellowstone National Park met political opposition by surrounding states (Bangs and Fritts 1996), and despite a 1987 recovery plan calling for wolves’ reintroduction, political opposition stalled recovery efforts until the mid-1990s, when wolves were finally trapped in nearby Canada and physically moved to release sites in Yellowstone and central Idaho (Bangs and Fritts 1996). Opposition to reintroduction was so intense at the time that the Idaho legislature forbade the state fish and game agency from participating in the reintroduction and subsequent monitoring efforts (Nie 2003), while Montana Senator Conrad Burns boldly predicted that were wolves to be restored to Yellowstone, “there will be a dead child within a year” (Fischer 1995, 164). Nevertheless, the reintroduction in Yellowstone and central Idaho prompted quick population expansion and, by 2002, the recovery goals established by the U.S. Fish and Wildlife Service had been met (Bangs 2003)—without any human fatalities. Litigation kept wolves listed for several more years, until Congress acted to remove wolves from Endangered Species Act protections in April 2011 and states resumed management.

Large carnivores were not the only species impacted by human population expansion in the United States. A variety of big-game species (e.g., elk, bison) were depleted by market hunters (Organ et al. 2012), and overhunting in the eastern United States had decimated numerous bird populations (Davis 2006). Wealthy aristocrats and sportsmen such as John Muir, George Bird Grinnell, and Theodore Roosevelt had already begun to organize in response to these threats by founding organizations such as the Sierra Club (Muir), Audubon Society (Grinnell), and Boone and Crockett Club (Roosevelt). These organizations helped motivate politicians to establish laws and preserve lands that could serve as refuges for wildlife and resources for a growing human population (Kline 2000; Organ et al. 2012).

The notion that natural resources—including wildlife—could be conserved and managed for sustained use became part of Roosevelt's Progressive agenda, which included the establishment of wildlife refuges, forest preserves, and top-down management by scientifically trained professionals (Kline 2000). Following the model of professional foresters put in place by the efforts of Roosevelt and Gifford Pinchot, Aldo Leopold developed game management as a science during the 1930s (Robinson and Bolen 1984). Like forestry, Leopold initially viewed game management as a form of agriculture—"the art of making land produce sustained annual crops of wild game for recreational use" (Leopold 1933, 3).

As wildlife populations recovered throughout the twentieth century, state wildlife agencies attempted to build an interested group of "users" by providing opportunities to hunt or trap these animals to those who organized to save them. Peek succinctly summarized the logic of wildlife professionals when it comes to hunting and trapping: "People need an incentive to participate in the management and conservation of [wildlife]. . . . Hunting and trapping seasons provide one such incentive" (see also Treves 2009). The logic that hunting and trapping provide an incentive to conserve wildlife is a cornerstone of wildlife policy in the United States. Thus, as carnivore populations rebounded in the United States, wildlife professionals extended the same logic to their conservation. For example, as justification for removing wolves from the list of federally endangered species, the U.S. Fish and Wildlife Service asserted: "We believe public tolerance of wolves will improve as wolves are delisted and hunters start to see wolves as a trophy animal with value" (76 Fed. Reg. 61,813). The pressing question is whether this condition is actually being met where carnivores are concerned. That is, do the incentives to conserve carnivores that arise under regulated public hunting and trapping outweigh the disincentives (e.g., potential loss of valued big-game hunting opportunities) associated with maintaining carnivore populations?

Wolf Management in the American West: Hunting to Conserve—or Hunting to Minimize?

Wolves, like other carnivores, naturally live at lower densities than their prey, which generally consist of ungulate species commonly hunted by people (e.g., deer, elk; Mech and Boitani 2003). Because of their elusive nature, intelligence, and relatively low

numbers, wary wolves can be extremely difficult to hunt or trap (Mech 2010). To help encourage participation, some states price carnivore-hunting fees relatively low when compared with the ungulate species carnivores prey upon. For example, in Idaho a tag for black bear, cougar, or wolf in 2009 cost \$11.50 for state residents, while deer, elk, and pronghorn tags were roughly two to three times higher for residents (\$19.75, \$30.75, and \$31.25, respectively; see Idaho hunting regs. 2009). Out-of-state hunter fees in Idaho followed the same pattern. From an economic standpoint, this fee structure is counterintuitive—that is, one would expect that the opportunity to hunt a relatively rare animal (i.e., low supply) facing high demand (Idaho sold more than 30,000 wolf tags in 2009–2010 to kill roughly 200 wolves) would be highly valued, and the price of a tag would reflect this value (i.e., low supply and high demand should promote high value). Yet a July 2007 survey that asked Idaho hunters how much they valued wolves relative to other species found that the vast majority of deer and elk hunters valued wolves less than bighorn sheep (89%), moose (88%), elk (91%), and deer (90%)—the very species wolves prey upon (Idaho Wolf Population Management Plan: 2008–2012). Why? The researchers found that 88 percent of hunters agreed with the statement, "Wolves kill too many deer and elk in Idaho," and 92 percent agreed with the statement, "Letting wolf populations grow will greatly impact deer and elk hunting in Idaho" (Idaho Department of Fish and Game 2008, 52–54). Likewise, a 2012 survey of Montana wolf hunters found the most frequently reported reason for purchasing a license was the perception that wolves were adversely impacting other hunting opportunities (Bangs, personal communication).

These data suggest that the conservation of wolves is perceived by hunters as conflicting directly with their interests—specifically, sustaining large, harvestable surpluses of elk and deer—species that are generally valued both as a source of food *and* as trophies. Thus, although low tag fees can help agencies recruit a large number of would-be wolf hunters, their participation is likely to be motivated by a desire to *reduce* wolf numbers (and, by extension, their impact on ungulate species) rather than the desire to conserve wolves. This conclusion is supported by a number of other studies from outside of Idaho that indicate that individuals who hunt wolves generally are not interested in conserving wolves (Ericsson and Heberlein 2003; Treves and

Martin 2011). Indeed, a recent study of residents living within wolf range in the northern Rocky Mountains found 75 percent of nonhunters desired some conditions to be placed on wolf hunting (e.g., only hunt wolves when wolf populations can sustain hunting), but the majority of hunters (56 percent) and three-fourths of bear and wolf hunters opposed *any* restrictions on wolf hunting (Treves and Martin 2011). In sum, agencies' traditional "clientele" do not seem to be particularly interested in wolf conservation—at least, not yet.

Fearful as Predator, Not Valued as Game

The idea that wolves conflict with the interests of some hunters and, by extension, the priorities of state wildlife management agencies is also supported by the recent actions of wildlife agencies in the American West. In February 2009, Idaho Fish and Game (IDFG) conducted an economic impact assessment of wolves on state hunting revenue, where the overall impact of wolves on elk hunting revenue was estimated at between \$7 million and \$24 million (figures from a memo dated February 18, 2009, titled "Your inquiry about wolf impact on other predators and economic impact of wolves to Idaho hunting revenue"; Idaho Department of Fish and Game). The impact analysis assumed that wolf predation on elk would have additive (as opposed to compensatory) effects on the elk population, which would, in turn, negatively impact elk-hunting opportunity, and that the reduction of opportunity would negatively affect license sales. Whether these assumptions are tenable is debatable (see discussion in Brodie et al. 2013); however, their analysis clearly demonstrates that the state is working under the assumption that wolves will negatively affect hunting—and ultimately, funding for Idaho.

A peer-reviewed economic impact analysis recently found that wolves brought roughly \$35 million annually in tourism revenue to Idaho, Montana, and Wyoming via increased visitation to Yellowstone National Park (Duffield, Neher, and Patterson 2008); however, tourism dollars do little to benefit state fish and wildlife agencies directly, as states rely on the sale of hunting and fishing licenses and federal excise taxes on related equipment (Williams 2010).

Thus, while existing evidence indicates that wolves provide economic benefits to western states and communities, these benefits are not accrued by the agencies charged with wolf conservation and

management. Indeed, state wildlife agencies incur additional costs associated with monitoring carnivore populations and managing conflicts with these species, and funds derived from the sale of carnivore hunting and trapping licenses are unlikely to fully offset these costs—especially when they are priced so low. For example, the state of Idaho sold 30,619 resident and 781 nonresident wolf-hunting tags during its 2009–2010 wolf hunting season, for approximately \$500,000 in revenue. This figure is dwarfed by IDFG's own estimate of potentially lost revenue attributed to wolves (i.e., \$7–24 million per year), noted above, which does not include the administrative costs of overseeing the hunt, population monitoring, enforcement, planning, staff time, and so on.

Lack of incentives for wolf conservation are really only relevant to the extent that they affect carnivore policy and management. For evidence of such effects, one might ask how western states are managing wolves now that the species has been removed from federal Endangered Species Act protections. Idaho's current wolf management plan calls for a substantial reduction in its wolf population. Although the agency has not set a specific population objective, in 2010 an IDFG commissioner asserted that the recently recovered population was two to three times as large as it should be (Iverson-Long 2010), and Idaho's governor declared he would support a hunt to kill all but 100 wolves (Bruskotter et al. 2010). Meanwhile, Idaho's legislature has twice passed legislation calling for the complete removal of wolves by any means necessary and, in 2011, passed Idaho House Bill no. 343, which declared wolves to be a "disaster" arguing:

[the] state's citizens, businesses, hunting, tourism and agricultural industries, private property and wildlife are immediately and continuously threatened and harmed by the sustained presence and growing population of Canadian gray wolves. (Idaho Legislature 2011, n.p.; see also Bruskotter et al. 2010)

Idaho's view of wolves is perhaps most succinctly stated in House Joint Memorial no. 5 (2000), where the legislature justified complete removal of wolves by noting, "wolves are not a game animal; they are predators and should be managed as such." These words bear striking similarity to those of Wyoming's Senator Kendrick, who seventy years earlier had called for the

extermination of wolves, while at the same time touting his record as a conservationist.

Intensive management of large carnivores is not limited to Idaho. Montana has also called for heavy harvest of its wolf population, and Wyoming insisted on implementing policy that allows wolves to be shot on sight in over 80 percent of the state immediately following removal from ESA protections. The state of Alaska has codified “intensive management” of wolves and grizzly bears in a 1994 statute that was explicitly designed to reduce carnivore populations in order to provide for greater numbers of ungulates for human hunters (Miller et al. 2011), while Utah has declared its official policy is to prevent “the establishment of a viable pack of wolves within the areas of the state where the wolf is not listed as endangered or threatened” (Utah Legislature 1953, n.p.). Though Utah lacked any resident wolf packs, in February 2011 Utah’s director of natural resources told a legislative committee that the return of the wolf was comparable to “the resurrection of the *T. rex*” and argued that wolves were a “biological weapon” to end hunting and grazing (Maffly 2013, n.p.). More recently, legislators from Utah proposed to spend \$300,000 for the second consecutive year to lobby federal officials against any further reintroduction of wolves (Maffly 2013).

These examples illustrate the extent to which state legislatures and agency policy makers in the West view wolves as a threat to other, more-valued game species and domestic livestock, and have taken specific actions to reduce and even minimize wolf populations. Importantly, examples of using aggressive harvest of carnivores to boost ungulate populations are not exclusive to wolves in the Northern Rockies, but include cougar (Stoner, Wolfe, and Choate 2006), grizzly bear (Miller et al. 2011), and coyotes as well. In sum, because large carnivores prey upon game species that are perceived as more valuable by hunters and such predation potentially affects the sale of hunting licenses and agency funding, agencies have an incentive to minimize large carnivore populations.

Hunting for Value in Carnivores: An Ecological Perspective

The actions of states in the American West beg the question, what good are carnivores? Some research suggests that carnivores can regulate a variety of species either directly (e.g., killing, changing

behavior) or indirectly, by changing the composition of communities (e.g., trophic cascades, mesopredator release) (Ripple and Beschta 2004; Stolzenburg 2008). For example, recent research suggests that the extirpation of large carnivores fundamentally altered the structure, composition, and function of plant communities (Beschta and Ripple 2009). Large carnivores, and in particular wolves, appear to limit ungulate densities—at least in northern forests (Ripple and Beschta 2012), which, in turn, limits herbivory affecting the recruitment of a variety of plant species. Thus, the reintroduction of wolves in Yellowstone National Park has corresponded with a decrease in local elk populations, an increase in recruitment of aspen and cottonwoods, a general increase in woody browse (Ripple and Beschta 2011), and the recovery of riparian plant communities in the park (Beschta and Ripple 2010). However, both the extent to which these effects can be attributed to predators and the ability to attain such effects in managed system are the subject of vigorous scientific debate; scientists do not yet understand how widespread such effects are or under what conditions such effects can be anticipated (Mech 2012).

Perhaps more importantly, while the reduction of ungulate densities and the restoration of riparian communities, aspen, and other species associated with the presence of wolves is viewed as a valuable ecosystem service by some ecologists, it is likely to be viewed negatively by those human hunters who place greater value in the opportunity to hunt favored game. Likewise, fish and game agencies are likely to view these “benefits” as costs because of their potential to negatively impact hunting opportunity, recruitment, and associated revenue.

Researchers have long recognized the need to find value in species and ecosystems in order to incentivize their conservation. Ehrenfeld (1976) argued that the value of natural resources need not be construed in strict economic terms, but rather could be derived via a variety of characteristics (e.g., aesthetics) of these resources, as well as the (ecological) services they provide. Other researchers have proposed “existence value” as a mechanism deriving value from a resource when the free market fails to assign monetary value to it (Attfield 1998). Yet no licenses, tags, or excise taxes are assessed on aesthetic and existence values, and as yet there is no market of willing buyers for the ecosystem services that carnivores allegedly provide. Thus, although ecological

and existence values are often perceived by the general public (Kellert, 1985), they do not provide revenue to the agencies charged with the conservation of wildlife resources.

Conclusion: A Way Forward

Our analysis is meant to highlight a deficiency in the way wildlife conservation and management are funded in North America—specifically, the reliance on the sale of hunting licenses creates incentives to maximize harvestable surpluses of a few species of valued game, while minimizing factors that can negatively impact highly valued game animals (e.g., carnivores that prey upon game). The well-documented decrease in the proportion of people who engage in hunting (Pergams and Zaradic 2008) may actually amplify this effect; that is, with dwindling funding from license sales and few methods at their disposal for increasing funding for conservation, wildlife agencies are likely to become even more sensitive to the desires of human hunters in the future.

This deficiency may be a by-product of the early, single-species focus of wildlife management, where management activities were viewed as akin to agricultural production (Leopold 1933). The single-species focus that arose out of this view was not designed to consider complex interactions between valued game species and predators; indeed, carnivores were largely viewed as an impediment to producing sustained annual crops of valued species—as Leopold (1949, 130) noted, “I thought that because fewer wolves meant more deer, that no wolves would mean a hunters’ paradise.” The actions taken recently by western states—specifically, management intervention designed to reduce wolves and other carnivores to provide for greater harvestable surpluses of game—indicate that this mind-set is not a thing of the past.

Importantly, we recognize that public harvest is a useful tool for helping agencies meet carnivore population objectives and that the opportunity to engage in these activities is valued by the hunting community. We also recognize that harvest could be used to reduce real or perceived impacts of carnivores on other valued game species, which could ultimately help increase public tolerance for carnivore populations (Bruskotter and Fulton 2012; Treves 2009). However, implementing wolf hunting and trapping could also come at a cost (Way and Bruskotter, 2012); in particular, wildlife

management agencies risk alienating nontraditional stakeholders (e.g., nonconsumptive users of wildlife, urban residents) who tend to view hunting and trapping more skeptically (Duda and Jones 2009; Treves et al. 2009).

Probably the most relevant question for those interested in wildlife conservation and the restoration of ecosystems is: *How can we create incentives for carnivore conservation?* Development of other revenue streams could serve to reduce agencies’ reliance on license sales (Schmidt 1996), thereby lessening the incentive to minimize carnivores’ real and perceived effects on game species. Potential sources for such revenue include excise taxes on nonhunting, wildlife-related goods (e.g., bird feeders, field glasses, specialty camera lenses), state sales tax on wildlife-related goods, a mandatory “license” for the use of state lands, and redistribution of some of the sizable economic contributions that wildlife watching (including tourism) already bring (U.S. Department of the Interior et al. 2007), which could be directed toward wildlife management activities. Some states (e.g., Missouri) have already begun to diversify revenue streams.

Expanding public involvement and outreach could also help agencies reach a broader, more diverse group of citizens interested in wildlife. While such actions will not necessarily reduce the incentive for agencies to minimize the negative impacts of carnivores, they could increase agency trust among nonhunters, and ultimately, foster greater “buy-in” in management activities (Beierle and Konisky 2000). Over time, citizens’ trust in agencies and agencies’ abilities to engage a broad range of stakeholders will be crucial in retaining sources of funding for wildlife conservation, and in building broad-based support for the institution of wildlife management (Jacobson et al. 2010).

Another avenue to curb exploitation of carnivore populations would be to use the courts to force state governments to adopt policies designed to secure the conservation of these species under the Public Trust Doctrine. In *Geer v. Connecticut* (1896) the U.S. Supreme Court articulated states’ duties where wildlife is concerned. The Court held that states have a “duty . . . to enact such laws as will best preserve the subject of the trust and secure its beneficial use in the future to the people of the state” (*Geer v. Connecticut*, 161 U.S. 519, p. 534 [1896]). Jacobson et al. (2010, 206) argued that states, as trustees charged with the management of the public’s wildlife, “should adhere to principles

fundamental to care of the Trust's assets, not those associated with the preservation of interests of self or those elected authorities." They lamented the "politicization" of wildlife conservation by short-term political appointees, and argued that state-trustees should act "absent the demands of narrowly focused constituents" (Jacobson et al. 2010, 206). Bruskotter,ENZLER, and Treves (2011) took this notion a step further, arguing that states have an affirmative duty to preserve trust resources for all citizen-beneficiaries (see also, Musiker, France, and Hallenbeck 1995). Yet, while a variety of legal scholars have recognized the importance of the public trust doctrine as a tool for wildlife conservation (Blumm and Ritchie 2005; Hudson 2009; Musiker et al. 1995), its application in state courts remains rare and inconsistent.

Absent changes in state policy, federal legislation or agency rule-making could be used to help ensure that the broader public interest in wildlife is represented. For example, because wolf populations in the West occur primarily on federal public lands managed by the U.S. Forest Service, Bureau of Land Management, and National Park Service (Oakleaf et al. 2006), these agencies could adopt rules designed to limit hunting and trapping of large carnivores by limiting the length or timing of hunts, methods of take, or zoning areas to restrict harvest (Way & Bruskotter 2012). Federal legislation akin to those acts protecting bald and golden eagles and wild horses might also be used in a similar capacity. However, given the extent to which wolf reintroduction and recovery have been couched as an issue of "states' rights" (Nie 2003), opposition to federal intervention is likely to be acute.

In summary, large carnivores, and especially wolves, challenge traditional wildlife management in the United States because state wildlife agencies lack an incentive for conserving carnivores. The reliance of states upon hunters as the primary source of revenue generation creates a reason to reduce large carnivore populations, at least to the extent that they are perceived as not conflicting with valued game species. Until funding mechanisms can be expanded to generate revenue to state wildlife agencies from more diverse sources, state agencies will have an incentive to minimize carnivore populations to appease the desires of hunters and maximize hunting opportunities for more valued game. Such actions are likely to be viewed

skeptically by the largely nonhunting and urban public, which, in turn, could act to erode trust in state fish and wildlife agencies, and the wildlife profession.

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CENSORSHIP OF SCIENCE

Censorship—that is, changing or suppressing publications and communications for political, religious, military, or other purposes—has occurred throughout the history of science and still happens today. Censorship undermines the progress of science by interfering with the free and open exchange of ideas, which is essential for scholarly debate, collaboration, peer review, replication of results, and education. History demonstrates that science thrives in an environment where researchers can share ideas and information freely and openly, and that it stagnates when censorship is common. Although censorship is widely recognized as an anathema to science, there are legitimate reasons for restricting the flow of scientific information in some situations. Difficult ethical and political dilemmas arise when scientists conduct research that can be used to cause significant harm to society, because