Social and Ecological Benefits of Restored Wolf Populations

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Introduction

Our relationship with, treatment of and scientific understanding about the wolf (formally, the gray wolf, *Canis lupus*) have always been a reflection of humankind's beliefs about our own place in the universe. From at least the 18th century until the first part of the 20th century, western civilization, in particular the United States, based its perspective of the earth and of its natural resources, forests, wildlife, rivers and oceans on viewpoints developed in that period of human history known as the Enlightenment.

Humans were at the center of a mechanical, rational universe. Using rational powers of the mind, newly developed science and modern technologies, western civilization set out to conquer the rest of the world, to spread its enlightenment and to convert the natural resources of the world into wealth and power that would continue to fuel its progress. This was viewed as a social good that would benefit humankind.

The wolf was an unfortunate beneficiary of this enlightenment. When Europeans arrived in North America in the 1500s, perhaps 2 million wolves

roamed the continent (Leonard et al. 2005). By the end of the 1940s, viable wolf populations had been largely purged from the continental United States (Coleman 2004).

Over a three-century period, wolves were relentlessly persecuted by various methods beyond trapping, shooting or poisoning, including live burning or dismemberment or being captured and released with muzzles or genitals wired shut (McIntyre 1995, Coleman 2004, Smith and Ferguson 2005). When strychnine was introduced in 1860, the killing of wolves was achieved at a wholesale level previously impossible to achieve (Lopez 1978). Nearly 100 years later, German wolf biologist Erich Zimen remarked, "We killed the wolf in Europe and we hated the wolf, but it was not anything like what you have done in America" (Lopez 1978:169).

In the 1500s, European colonizers brought their old-world myths about, fears toward and hatred of wolves to the New World. Wolves were perceived as and referred to as cowards, as gluttons and as vicious killers who killed for the pure joy of killing (Lopez 1978, Coleman 2004). In a colonists' world view shaped by immediate survival, the land and animals were resources that were here solely for human use; if it wasn't useful, if it had no economic benefit, then it would simply be destroyed.

Elimination of the wolf in this country and elsewhere was based on certain expected cultural biases in addition to a philosophical view of the wild that anointed humans as conquerors. European-Americans viewed the very existence of what was once the most widely ranging land mammal on the planet as incompatible with their way of life. Yet, historical attacks on humans by rabid wolves were prevalent enough in Europe to perpetuate rational fears and, when contrasted with far fewer wolf attacks (due in part to lower wolf-to-human transmission of rabies) in North America, go a long way in explaining how and why this cultural inertia against wolves persisted on this continent (Linnel et al. 2002). In any event, most nonindigenous peoples certainly did not view the wolf as providing any benefits to the landscape, to other wildlife, to individual humans or to social welfare.

Thus, a comprehensive discussion of the social and ecological benefits of restored wolf populations necessitates, as precursor, an evaluation of what is meant by benefit and answers precisely the question of who or what, exactly, is benefiting. A new discussion is justified now, too, for other reasons. First, recent research indicates that our immense effort devoted to lethal control of wolves and

other canids has not resulted in mitigating livestock depredation and its associated costs to the extent desired, if at all (Musiani et al. 2005, Berger 2006). Second, reintroduced or restored wolf populations have not harmed the economic welfare of ranches and farms to the degree expected, if not feared (e.g., Chavez and Gese 2006).

Direct-, Indirect- and Passive-use Benefits

Benefits may be classified as direct-use, indirect-use or passive-use. Direct-use benefits refer to consumptive or nonconsumptive benefits, such as wildlife viewing, photography or hunting. Whereas, indirect-use benefits refer to ecological functions that lead to human benefits, such as ecosystem services (Manalo 2006). Ecosystem services may be thought of as those flows from a natural area that are of relatively immediate benefit to humans (Boyd and Banzhaf 2006, Brown et al. 2006). Passive-use benefits refer to the attachment of value we place on landscapes, ecosystems or species independent of actual use and include such things as existence value, stewardship or bequests (Manalo 2006).

Extrinsic versus Intrinsic Value

Benefits of a restored wolf population may also be classified according to whether they arise from the extrinsic or intrinsic value of wolves. Certain types of identifiable direct-, indirect- or passive-use benefits arise from the extrinsic, or the instrumental, value of wolves, that is, the value that wolves provide to human and nonhuman organisms and systems, not to wolves themselves (Lynn 2007). Seen through the lens of conservation, restored wolf populations provide ecological benefits to other entities or organisms. In this analysis, wolves play roles and provide services to the ecosystem by applying selective pressure that has ripple or cascade effects. Examples of this include selectively culling weak members of ungulate herds, providing food for other animals that feed on wolf-killed carcasses and initiating trophic cascades that result in increased growth of woody riparian plants, in nesting sites for songbirds, in materials for beaver dams and in cool, deep ponds needed by juvenile fish (e.g., Ripple et al. 2001, Wilmers and Getz 2005).

Economic analysis of the benefits of restored wolf populations presents wolf presence and visibility to nature-seeking tourists as a commodity that translates into tourism dollars that benefit local and regional economies. Or, it

presents wolves as a source of passive-use benefits to people who simply cherish knowing that wolves again roam free in their native habitat. Other social sciences also focus on human benefits of restored wolf populations; a key example is the fact that wolf recovery has encouraged the development of a dialogue and partnerships between stakeholder groups who may otherwise be adversaries on this issue.

These extrinsic values contrast other benefits of restored wolf populations that are based upon the intrinsic value of wolves, i.e., the concept that wolves have value in and of themselves. Intrinsic value (also known as inherent value) suggests that, "one has importance or worth in and of oneself, without reference to what one's value is to someone or something else" (Lynn 2007:813). Acknowledging the intrinsic value of wolves allows us to evaluate how restored wolf populations benefit the species' ability to flourish. Such benefits to wolves might include ability to pass the wolf's genetic code on to future generations, an increase in hunting prowess and feeding efficiency, enhancement of pup survivorship, and transmission of "cultural knowledge"—behavior taught by learning from other individuals within the pack—in this social species for such life-history requirements as profitable hunting sites, traversable linkage corridors for dispersal, and safe denning locations for pup rearing.

Benefits Derived from the Extrinsic Value of Wolves

Ecological Benefits and Ecosystems Services

Age structure, health and foraging competition by ungulate herds. As a keystone species, wolves have a dynamic relationship with and influence on their prey. A commonly held assumption among early wolf biologists was that wolves selectively hunt the weakest members of their prey species, and ongoing studies of restored wolf populations demonstrate this to be generally true. Selection of individual prey takes place through a sifting and sorting process that includes testing a herd, identifying weak individuals and pursuing the inferior animals (Halfpenney 2003). In Yellowstone National Park, necropsies of elk killed by wolves showed that animals killed were very old, with wolf-killed cow elk (*Cervus elaphus*) averaging 14 years of age (Mech et al. 2001). Necropsied remains also reveal that many of the animals killed by wolves have age-related infirmities, such as arthritis, disease, injuries or severely depleted fat reserves (Mech 1970, Stahler et al. 2006). Removing these unhealthy, aging,

postreproductive-age individuals from the population results in the availability of more forage for younger, healthier, more reproductively active members of the herd.

Recent research suggests that wolves could substantially reduce prevalence of chronic wasting disease (CWD) in deer and elk populations (Wild et al. 2005). The extent of such an impact, however, remains to be seen. So far, it is based exclusively on results of simulation modeling because of the current lack of overlap between CWD and occupied wolf habitat.

Predation by wolves on deer and elk also can also provide ecosystem services, as defined above. Such predation reduces forage competition between livestock and other ungulates, such as deer and elk, that constitute wolves' primary prey, with potentially positive impacts on livestock production (Unsworth et al. 2005). In some locations, reintroducing wolves is likely to generate net economic benefits by lowering densities of ungulates that have created financial burdens on stakeholders exposed to costs from ungulate over-abundance (Nilsen et al. 2007).

Scavengers. One of the most frequent and novel observations by wolf-watchers in Yellowstone National Park is the number of species besides wolves that show up to dine on wolf-kill leftovers. At least 12 scavenger species have been observed at wolf kills, including coyotes (*Canis latrans*), grizzly bears (*Ursus arctos horribilis*), black bears (*Ursus americanus*), eagles (*Haliaeetus leucocephalus and Aquila chrysaetos*), ravens (*Corvus corax*) and magpies (*Pica hudsonia*; Smith et al. 2003, Wilmers et al. 2003). Ravens, in particular, frequent wolf kills in large numbers, flying in close association with wolves even before the prey is down (Stahler et al. 2002). A Native American saying insightfully notes that the wolf acts as the raven's tooth and the raven as the wolf's eye (S. Strauss, personal communication 2004). Recent research also suggests that, because wolves make carrion available to other species during increasingly mild winters, these predators may buffer the effects of climate change and, thus, allow scavengers more time to adapt to (or seek alternatives for) otherwise negative impacts from altered climate (Wilmers and Getz 2005).

Impacts on populations of other predators and interspecific competition. The reintroduction of wolves to Yellowstone National Park and their subsequent aggression towards coyotes resulted in a 50-percent decline in coyote density on the northern range (up to 90 percent in core, occupied, wolf-pack territories) and reduced the size of coyote packs there. Interspecific competition between

wolves and coyotes is well documented (Crabtree and Sheldon 1999, Smith et al. 2003). From this, one may speculate that, in the more-than-70-year absence of wolves, coyotes had expanded in number and distribution to fill a gap created by the absence of the ecosystem's top dog; the wolf's return shifted this balance back toward its prior state.

Wolves also reduce predation by other livestock predators, such as coyotes, feral dogs (*Canis spp.*) and mountain lions (*Felis concolor*), through interspecific competition with those predators (Crabtree and Sheldon 1999, Smith et al. 2003). Potentially most important economically is the effect of competition between wolves and coyotes, especially that of predation by the former on the latter. This may reduce the number of livestock depredation episodes by coyotes that accounts for the overwhelming majority of all livestock kills by predators (National Agricultural Statistics Service 2001).

In Yellowstone National Park, most pronghorn (*Antilocapra americana*) fawn mortality is caused by coyotes. While the data are preliminary, it appears that fawn survival correlates positively with wolf density and inversely with coyote density (Smith et al. 2003). Pronghorn are rarely part of wolf diet, due to the sheer speed of adult pronghorns (D. Smith, personal communication 2004). Indeed, it now appears that wolf presence indirectly enhances survivorship of pronghorn offspring.

Mesocarnivores. In Yellowstone National Park, some midsize carnivores (weasels [*Mustela spp.*], marten [*Martes americana*] and badgers [*Taxidea taxus*]) exist at robust levels. Whereas, others (fishers [*Martes pennanti*], wolverines [*Gulo gulo*], red fox [*Vulpes vulpes*], lynx [*Lynx canadensis*], bobcat [*Lynx rufus*] and otter [*Lutra canadensis*]) persist in low numbers. Reduced coyote populations, due to wolf presence, could increase the numbers of some of these midsized carnivores, e.g., red fox, which compete more closely with coyotes. Other mesocarnivores that scavenge, such as wolverines, could also increase in number due to the presence of wolves and wolf-killed carcasses (Smith et al. 2003).

Restoration of wild behaviors. The restoration of wolves may, over time, reinitiate antipredator responses in ungulates that have grown soft, in the absence of wolves. In experiments with different moose populations, reactions to wolf-odor cues were compared among naive and predator-habituated moose (*Alces alces*) populations (Pyare and Berger 2003). Odor cues in the form of wolf-urine-scented snowballs were placed near moose in Wyoming that, for the last 70 years,

had lived without wolves until their reintroduction in the mid-1990s. The same odor cue was given to an Alaskan moose population from interior Alaska, whose exposure to wolves had been uninterrupted in evolutionary time, and to a second Alaskan moose population that lived on the Kenai National Wildlife Refuge within a 2500-acre (1,011.71-ha) research facility fenced off from all but the most occasional encounters with wolves. Very different reactions were elicited from the test populations. The reactions indicate antipredator types of behaviors, including vigilance, aggressive response and test-site abandonment. Interior Alaskan moose that had an unbroken relationship with and exposure to wolves were more vigilant and were more than three times as likely to respond aggressively to the odor cue as either the Kenai moose living in a fenced enclosure or the Wyoming moose that had only recently been re-exposed to wolf presence. More than half the trials of the interior Alaskan moose could not be completed because the subject animals departed the experimental area. We contend that these results demonstrate that recovery of an endangered species is not necessarily gauged solely upon reaching population and demographic goals but ought to include broader ecological and behavioral processes that have also been restored (for a broader discussion of this issue, see Berger 2002). Thus, an additional extrinsic value and indirect-use benefit of wolves is their potential to restore ecosystem processes involving predator-prey dynamics.

Vegetation effects and trophic cascades. Wolves have been documented to exert a biological control function through their impacts on the trophic structure of ecosystems (Ripple et al. 2001, White et al. 2003, Ripple and Beschta 2004, Hebblewhite et al. 2005). A trophic cascade is the "progression of indirect effects by predators across successively lower trophic levels" (Estes et al. 2001:859; Ripple and Beschta 2004). Studies of wolf-moose-balsam fir (*Abies balsamea*) relationships on Isle Royale and of wolf-elk-woody riparian plant (namely aspen [*Populus tremuloides*] and willow [*Salix spp.*]) relationships in Yellowstone National Park suggest that suppression by ungulate herbivory on the respective plants results in depressed plant growth rates. Reappearance of wolves in Yellowstone National Park and increased wolf populations on Isle Royale may release the plants from herbivory pressure as the ungulates change their foraging patterns due to fear of predation (McLaren and Peterson 1994, Ripple and Beschta 2004).

In Yellowstone National Park, following the reintroduction of wolves and apparent changed elk foraging behavior, the release and subsequent enhanced

growth of plants, such as willows and aspens, has fostered many beneficial changes in the ecosystem. This includes providing pivotal nesting and roosting sites for neotropical migrant birds, root strength for soil erosion protection along streambeds, and food and building sources for beavers (*Castor canadensis*), with resultant dams that create cool, deep ponds needed by juvenile fish (Ripple and Beschta 2004, Hebblewhite et al. 2005).

Social Benefits

Direct-use Economic Values

Northern Rocky Mountains. When wolves were reintroduced to Yellowstone National Park and central Idaho, economic projections were a part of the initial environmental impact statement prepared for Congress for the proposed reintroduction. A survey of a national, random sample of households, as well as a subsample of all listed phone numbers in the three-state recovery region (Wyoming, Montana and Idaho), questioned individuals regarding their understanding of and attitudes towards the area's wolf reintroduction. By a two to one ratio, nationally, wolf supporters outnumbered opponents. Whereas within the three-state region opinion, it was very closely divided with 49 percent in favor, 43 percent opposed and 8 percent not knowing. The survey also estimated willingness-to-pay to support or oppose the reintroduction. It was estimated that wolf recovery in the Yellowstone National Park area would lead to benefits between $6.7 and $9.9 million per year, with total costs (value of foregone benefits to hunters, lost value due to livestock depredation and wolf-management costs) of $0.7 to $0.9 million per year. The study also estimated that increased visitation due to wolf recovery would result in additional, annual, regional expenditures of $23 million (Duffield 1992, Duffield and Neher 1996).

Fourteen years later, the results of a follow-up study regarding the economic impacts of wolf recovery in the Yellowstone National Park area yielded figures that far surpassed the original estimates (Duffield et al. 2006, Stark 2006). Between December 2004 and February 2006, approximately 1,900 park visitors were asked why they came to the park, what they hoped to see, what their opinions were about wolves and other wildlife, and how much they spent on these visits. Based upon study participants who indicated whether they would have come to Yellowstone National Park if wolves were not present, it was determined that the presence of a restored wolf population has brought an

additional, average $35 million annually in tourism expenditures for the local economies of the three-state region. These expenditures, in turn, multiplied effects as they circled through the regional economy, resulting in an estimated total increase in output of about $70 million annually (Duffield et al. 2006).

As described above, wolves may affect browsing behavior by deer and elk, increasing riparian vegetation and decreasing stream temperature (Ripple et al. 2001, White et al. 2003, Ripple and Beschta 2004). This, in turn, is likely to improve habitat conditions for cold-water loving fish, like trout, that lie at the heart of a major sportfishing industry (U.S. Fish and Wildlife Service and U.S. Census Bureau 2002). The economic impact of sportfishing is substantial (American Sportfishing Association 2002). Hence, even a small increase in the quantity of trout fishing in an area could increase recreational expenditures and local incomes.

Minnesota. The single area where wolves were never fully eradicated in the contiguous United States was in far northeastern Minnesota, and some of the earliest (since as early as the 1930s), ongoing studies of wolves in the United States have taken place in this region. As a result, the International Wolf Center chose the remote northeastern Minnesota town of Ely as the location to build a world-class, public, wolf-education facility, first opening in a temporary building in 1989. Though members of the community initially were hostile to wolves and to the concept of the center (L. Schmidt, personal communication 2000), they have since embraced the center's presence. The center's draw of visitors to the region brings an estimated $3 million annually into the local economy, while stimulating the economic equivalent of 66 full-time jobs (Schaller 1996).

A recent survey conducted in Minnesota queried residents of two cities about their willingness to pay for two wolf-management options that would maintain a minimum wolf population of 1,600 animals in the state (Chambers and Whitehead 2003). Though overall the number of respondents willing to support each management option was smaller than the number opposing it, this may have to do with the fact that respondents were told the plans would be financed through tax increases, a financing mechanism that may negatively impact attitudes of respondents otherwise predisposed towards supporting such programs. Survey results indicated that people had seen or heard, or had planned to see or hear wolves—direct uses. Many respondents also believed that wolves have a right to exist—passive-use value for wolves. The benefits, rather than representing market output associated with wolves, indicated that Minnesotans would be

willing to pay more for the wolf-management plan (and thus to preserve wolves) or for the wolf-damage plan than it would cost the state to implement those plans, resulting in net benefits of wolves to the state's residents (Chambers and Whitehead 2003).

North Carolina. The economic benefits of red wolf (*Canis rufus*) reintroduction to northeastern North Carolina and the Great Smoky Mountains National Park were estimated via surveys in an eight-state area, including the recovery states of North Carolina and Tennessee, plus six neighboring states (Rosen 1997). The surveys were intended to measure the attitudes towards reintroduction, the general knowledge of red wolves, and the potential regional and local impacts of reintroduction. Results showed very strong public support for reintroduction in both areas, and they indicated that people were more likely to visit the area as a result of the red wolf presence, even more so if activities related to the red wolf's presence were offered as part of an ecotourism draw. Increases in tourism due to presence of red wolves and to red wolf-related activities were predicted to generate additional annual visitor spending of between $10.75 and $24.66 million in northeastern North Carolina and additional annual visitor spending of between $105.83 and $185.67 million in the greater Great Smoky Mountains National Park region. Applying regional multiplier estimates (e.g., how these added dollars prompt more jobs, more income to newly employed people, etc.) to these initial figures, the regional impact of red wolf visitor activities was estimated at $35.36 million in northeastern North Carolina and at $291.51 million annually in the Great Smoky Mountains National Park.

In 2005, the national nonprofit conservation organization, Defenders of Wildlife (Defenders), commissioned a study of the potential contribution of red wolf-based ecotourism to economic development in coastal North Carolina. The results showed that landowners and residents were interested in locally based tourism efforts that would benefit communities and would protect the natural beauty of their counties. Tourists also expressed interest in participating in red wolf-related activities (G. Y. B Lash and P. Black, personal communication 2005). These findings spurred Defenders and its partners, the Red Wolf Coalition and the U.S. Fish and Wildlife Service, to create and install six red wolf educational displays on the Outer Banks and in other important tourist areas near red wolf country. The kiosk-style displays present general information about red wolves and promote "howlings," or guided, nighttime tracking and listening tours of the Alligator River National Wildlife Refuge in the heart of the region's red wolf habitat.

Passive-use Economic Values

Wolves also generate benefits that are not related to any direct use of or ecological benefit to humans. Many people assign value to the existence and preservation in the wild of charismatic species, such as the wolf, even though they may never come into contact with the species. Many also see it as society's responsibility to practice good stewardship towards other species and to pass a complete and healthy ecosystem to future generations. These passive-use values in economics commonly are referred to as existence, stewardship and bequest values (Krutilla 1967). The importance of passive-use values in the case of wolves has been documented in a number of studies. For example, Manfredo et al. (1994) examined perceptions and attitudes of Colorado residents towards wolf reintroduction to the state and found that passive-use values are strong motivation in the residents' attitudes toward reintroduction. Their findings were confirmed for other states (e.g., Chambers and Whitehead 2003) as well as for the United States as a whole (Duffield 1992, U.S. Fish and Wildlife Service 1994).

Indirect-use Economic Values

Ecosystem service values. In addition to direct-use and passive-use values described in the preceding paragraphs, wolves also generate indirect-use benefits through their provision of ecosystem services in wolf habitat. As described in the section on ecological benefits and ecosystem services, these services include the biological control function of wolves through their impacts on the trophic structure of ecosystem, which has been documented to affect browsing behavior by deer and elk. This tends to increase riparian vegetation and to decrease stream temperature, potentially improving habitat conditions for cold-water loving fish, like trout, a highly important species in many states' sportfishing industries. Other ecosystem services wolves may provide is reduction of forage competition for livestock from wolves' primary prey, deer and elk; a reduction in depredation levels by other livestock predators, such as coyotes, feral dogs and mountain lions; and a reduction in the prevalence of CWD in deer (*Odocoileus spp.*) and elk populations (Wild et al. 2005).

Human Discourse

State wolf planning stakeholder committees. Presence of restored wolf populations has borne far-ranging and intense dialogues between stakeholders that could best be characterized as having conflicting interests for achieving

restored wolf populations. Several states have established stakeholder committees to develop wolf-management plans. This has been the case in the western Great Lakes region as well as in the northern Rocky Mountains. As the plans are adopted, either by a state wildlife commission or by a state legislature, public hearings have accompanied the planning process and, once again, have provided opportunity for individuals with diverse perspectives on wolves to exchange their views. Under these circumstances, stakeholders achieve enhanced understanding by exchanging views about wolves among livestock producers, hunters and trappers, conservationists, tribal representatives, biologists, economists, educators, agency personnel, elected officials and even schoolchildren.

Livestock compensation programs and proactive conflict-prevention partnerships. Several programs developed by nongovernmental organizations have also extended this discourse through development of compensation programs, designed to pay for wolf-caused losses, and through proactive partnership programs, designed to solve problems jointly and to implement methods to prevent wolf-livestock conflicts before they arise. Examples include the Bailey Wildlife Foundation Wolf Compensation Trust and The Bailey Wildlife Foundation Proactive Carnivore Conservation Fund, both operated by Defenders. Other examples include range-rider programs and marketing concepts being developed by the Montana-based, nonprofit organization, Predator Conservation Alliance, to protect livestock from wolves and to commercially market those products from ranches that use predator-friendly methods. Benefits derived from compensation and proactive programs include economic stability, enhanced survivorship for both wolves and livestock, and broadened communication and understanding among stakeholder groups.

Livestock producer advisory council and surveys. Expanded understanding and shared goals developed by participants in compensation and in proactive programs are broadened through forming advisory councils whose express purpose is to shape these programs so that the benefits will be the greatest for all involved and (through the development of surveys) to gauge livestock-producer response to the programs. In 2004, Defenders established a Livestock Producer Advisory Council that currently consists of five cattle producers and sheep growers from Idaho, Montana, Wyoming and Oregon. Defenders's staff involved in the organization's compensation and proactive programs meet several times each year with the Livestock Producer Advisory Council in order to seek guidance from ranchers regarding the implementation of these programs.

Recently, Defenders also conducted a survey of northern Rocky Mountain ranchers who had received compensation from the Defenders-operated fund over a 3-year period for wolf-caused losses. The survey gauged, through public opinion, how compensation might aid conservation of wolves. The survey of 138 individuals was sent to all northern Rocky Mountains ranchers who received compensation between 2002 and 2004. This represented more than 90 percent of the total, documented losses realized during the 3-year period, as well as the majority of livestock owners who experienced verified wolf-caused livestock losses since the compensation program's inception in 1987. The response rate was 44 percent (n = 61, where n represents the number of respondents); respondents answered standardized questions regarding their experience with and attitude towards wolves and the compensation program. Although other studies have suggested that an increase in tolerance for wolves does not necessarily accompany receipt of compensation (Linnell and Broseth 2003, Naughton-Treves et al. 2003, Nemtzov 2003), the Defenders study yielded slightly different results. When asked if receiving compensation increased their tolerance for wolves, more than 60 percent said it did not. However, when asked how their tolerance for wolves would be affected if the compensation program were halted, 59 percent said their tolerance would be lower or significantly lower if the program ended. None thought compensation should end. This study revealed that compensation functioned somewhat like a dam, at the very least preventing some erosion in acceptance of wolves from a stakeholder group most inclined to resist wolf presence (Stone, in press) The compensation fund also facilitated direct interactions between ranchers and conservation staff that furthered the interests of both parties. So, an additional benefit of restored wolf populations is development of human relationships, resulting in increased understanding and expanded opportunities to achieve goals through voluntary programs and direct action.

Institutions: Public Education, Polling, Politics and Media

Public education. Education about the natural world, including the role of carnivores in nature and the history of human-carnivore interactions in the United States, benefits the public by providing historical perspective for wildlife management and for large-carnivore conservation in this country. Since before reintroduction of wolves to Yellowstone National Park and central Idaho, concerted efforts have been undertaken by federal agencies, by

nongovernmental agencies and by others to provide public education about wolf biology, behavior, the history of wolf extirpation and the subsequent recovery efforts in this country. These endeavors have allowed for the broad dissemination of information not only about wolves but about the ecological role of carnivores in general. This dissemination has occurred through a surprisingly broad array of outlets, spawning countless books and videos on wolves; displays at museums, libraries, zoos and nature centers; school curricula; poster contests; the creation of an annual, national Wolf Awareness Week; plus an incredible marketing onslaught of wolf imagery on t-shirts, coffee cups, bumper stickers and the like, which can be more-or-less educational in imagery and messaging.

Polling. As a result of the federal mandate to restore threatened and endangered species, such as wolves, numerous public polls have been conducted throughout the United States to survey attitudes of the public regarding wolf restoration. Poll results benefit state and federal agencies by informing them of public attitudes regarding active, species-reintroduction programs versus recovery via natural dispersal. And, they assist other entities, such as nongovernmental advocacy organizations, in gauging public response by locale, thus helping to shape where and what type of public-education campaigns are most needed. Over the last several decades, many polls have been conducted nationally and regionally; two examples, one from Oregon and the other from Colorado, illustrate the type of information that can be obtained from the public and then put to use accordingly.

In 1994, a survey conducted in Colorado (Manfredo et al. 1994) showed that more than two-thirds of its public would vote for wolf reintroduction to Colorado. The survey showed that, for those in support of reintroduction, the most important drivers were a belief that reintroduction would result in preservation of the wolf, in balanced deer and elk populations, in an increased understanding of the importance of wilderness, in greater control of rodent populations, and in a return of the natural environment to the way it once was.

A 1999 poll of 600 registered Oregon voters focused on the possible return of wolves to Oregon (Davis and Hibbitts, Inc. 1999). Seventy percent of respondents favored recovery of wolves in Oregon, either through active reintroduction by wildlife agencies or by allowing wolves that entered Oregon from other states to remain in the state. Fifty-seven percent of respondents felt that wild wolves should be allowed to stay in Oregon when they returned on their own; 13 percent believed that wild wolves should be actively reintroduced into Oregon; 23 percent felt that wolves should not be allowed in Oregon at all. On

a region-by-region basis, there was little variance among those favoring active wolf reintroduction or among those agreeing that wolves who enter Oregon on their own should be allowed to remain in Oregon. Two-thirds (66 percent) of those surveyed felt that the best reason to support the return of wild wolves to Oregon was that they owe it to future generations to leave the most complete ecosystem possible, including predator species like wolves (Davis and Hibbitts, Inc. 1999).

Politics. The restoration of wolf populations to the lower 48 United States has set the stage for some of the most remarkable politics ever witnessed regarding wildlife. Restored wolf populations fuel arguments for and against the Endangered Species Act and for and against federal involvement in what some view as primarily a state issue. Wolf politics have resulted in the passage of a plethora of antiwolf resolutions at the county level, and they have been the basis for many bills introduced into state legislatures. Because of the political nature of wolf-restoration issues, a large number of people have been exposed to information about real and perceived impacts of wolves on livestock operations and on populations of wild ungulates preyed upon by wolves. Although the word "ethics" is rarely thrust into the spotlight on this issue, the emotionally charged nature of the arguments and discussions reveal what is essentially a values-laden foundation to the issues. As pointed out repeatedly here, one benefit of restored wolf populations is that it has increased involvement of citizens in the democratic process, simultaneously sparking widespread discussion of the scientific underpinnings to wolf management, the political forces attempting to exert influence over wolf management decisions and the ethical considerations throughout the process. Whether wolves have benefitted from this is yet to be answered, but it is clear that a normally apathetic U.S. public participates with great vigor in these debates.

Media. As a result of wolf restoration, the public has been treated to the opportunity to see how much or how little local and national journalists know about wolves and the associated issues. The public has also had the opportunity to note media biases in reporting sensationalized stories about wolves, as well as to appreciate the rare article that presents factual information in full context.

Benefits Derived from the Intrinsic Value of Wolves

Identifying benefits that wolves themselves can obtain from restoration requires acknowledgment that wolves, as a species and as individuals, have

intrinsic value. Intrinsic value of nonhuman organisms, according to a range of philosophical theorists, may be said to arise from the sentience, sociality and intelligence of the organism in question. Regardless of the existence of these characteristics or other human-conceived standards of measurement, the concept of intrinsic value states that an organism has value in and of itself, independent of the use anyone else may have for it (Lynn 2007).

Genetic Transmission

An enhanced ability to transmit genes into future generations could benefit individual wolves in and packs of restored populations. A greater number of animals allows for more breeding opportunity and for successful reproduction. In wolf packs, one pair tends to be the dominant breeders; though, other adults in the pack may breed as well (Mech 1970). Furthermore, subadult wolves frequently disperse from the pack, locating mates and colonizing territories of their own. A larger wolf population creates greater likelihood that dispersers will encounter other lone wolves with whom to mate and reproduce.

Increased Hunting Success and Feeding Efficiency

Wolf-pack size can vary due to a number of factors, including but not limited to food competition, dispersal and size of prey species hunted. Wolf-pack sizes tend to be larger in areas where wolves are preying upon the largest ungulates (Mech and Boitani 2003). Though lone wolves can and do successfully kill prey, restoring a dwindling wolf population could allow for increased pack sizes and, therefore, could enhance ability to kill larger prey species. This, in turn, would allow adult wolves to subsidize the food needs of their pups by sharing large prey (Mech 1970), improving the inclusivity of the family social unit (Rodman 1981).

Enhancement of Pup Survivorship

Wolf packs do not restrict care of pups to biological parents. Wolves are highly social animals that exhibit hierarchical behaviors within packs and that demonstrate a high degree of social cohesion and a distribution of labor among the extended family members to care for the pack's litter of pups (Mech 1997). Pup-care duty by nonparent pack members is observed frequently enough by biologists that these animals are often referred to in

observational reports as babysitter wolves. In one instance, a federal wolf biologist conducting observations in the Arctic National Wildlife Refuge reported an hours-long observation of one babysitter wolf transporting the pack's pups to a new location where the pups' mother lay waiting for their arrival. In the process, the babysitter wolf learned what types of activities pups initially were not willing to undertake, but the pups learned to overcome fear of obstacles and ground surfaces, which they would need to be familiar with to survive as adults (U.S. Fish and Wildlife Service 2001). A larger restored wolf population allows for larger packs, and for more members able to rotate pup-care duty, thereby providing valuable development lessons the pups need to survive as adults.

Transmission of Cultural Knowledge

All species benefit from knowing where to obtain sources of food, water, shelter and safety from predators. While some of these sources may be encountered through chance or through visual or olfactory sensory cues, indirect evidence suggests that the passing along of this critical, cultural knowledge from one animal to another, from one generation to the next, is a phenomenon exhibited by wolves. Wolf biologists have observed that wolves from multiple generations den in the same locations for hundreds of years (Mech 1997). Wolf dispersal takes place across trails and regions used by other wolves, with repeat travel even occurring on such human constructs as roads, railroad tracks and snowmobile trails; wolves living in close proximity to humans know where and when to travel safely (Mech and Boitani 2003) and may teach this to their offspring. Prey-seeking and hunting skills are taught by adult pack members to pups over territorial ranges well-marked and defended by the resident pack. Generations later, wolf packs continue to frequent and defend these same sites. Without written journals or illustrated maps to guide them, individual animals teach their young to follow in the footsteps of ancestors long gone.

Conclusion

Recognition that the wolf has both extrinsic and intrinsic value allows us to significantly expand our identification of the many benefits that result from restored wolf populations. The term benefits need not be limited or

limiting if we are willing to broaden the philosophical discourse beyond extrinsic values attached to wolf presence. Such an expansion is taking place against a backdrop of simultaneous evolution in the breadth of Western Civilization's cultural, philosophical and scientific foundations. "It has been said that wolf's eyes are mirrors; what different people see in them is simply a reflection of ourselves. Could they reflect even more, not just a person's attitudes towards wolves, but towards the environment, wild lands, nature itself?" (Theberge and Theberge 1998:10). Our treatment of the wolf measures the scope of our own place in the world, with respect to the landscape and with respect to the human and nonhuman inhabitants with whom we share that world.

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