

## Managing wolf–human conflict in the northwestern United States

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### INTRODUCTION

The grey wolf (*Canis lupus*) is the most widely distributed large carnivore in the northern hemisphere (Nowak 1995) and has a reputation for killing livestock and competing with human hunters for wild ungulates (Young 1944; Fritts *et al.* 2003). Wolves rarely threaten human safety, but many people still fear them. In the western USA, widespread extirpation of ungulates by colonizing settlers, wolf depredation on livestock and negative public attitudes towards wolves resulted in extirpation of wolf populations by 1930 (Mech 1970; McIntyre 1995). By 1970, mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), elk (*Cervus elaphus*), moose (*Alces alces*) and bighorn sheep (*Ovis canadensis*) populations had been restored throughout the western USA while bison (*Bison bison*) were recovered only in Yellowstone National Park. However, grey wolves were still persecuted. In 1974, grey wolves were protected and managed by the US Fish and Wildlife Service under the federal Endangered Species Act of 1973.

In 1986, the first recorded den in the western USA in over 50 years was established in Glacier National Park by wolves that naturally dispersed from Canada (Ream *et al.* 1989). Restoration of wolves in that region emphasized legal protection and building local public tolerance. Wolves from Canada were reintroduced to central Idaho and Yellowstone National Park in 1995 and 1996 to accelerate restoration (Bangs and Fritts 1996; Fritts *et al.* 1997). The Northern Rocky Mountains wolf population grew from 10 wolves in 1987 to 663 wolves by 2003 (US Fish and Wildlife Service *et al.* 2003) (Fig. 21.1, Table 21.1). Resolving conflicts, both perceived and real, between wolves and livestock remains the dominant social issue for the recovery programme, but perceived competition between hunters and wolves is becoming increasingly controversial (Bangs *et al.* 2001).

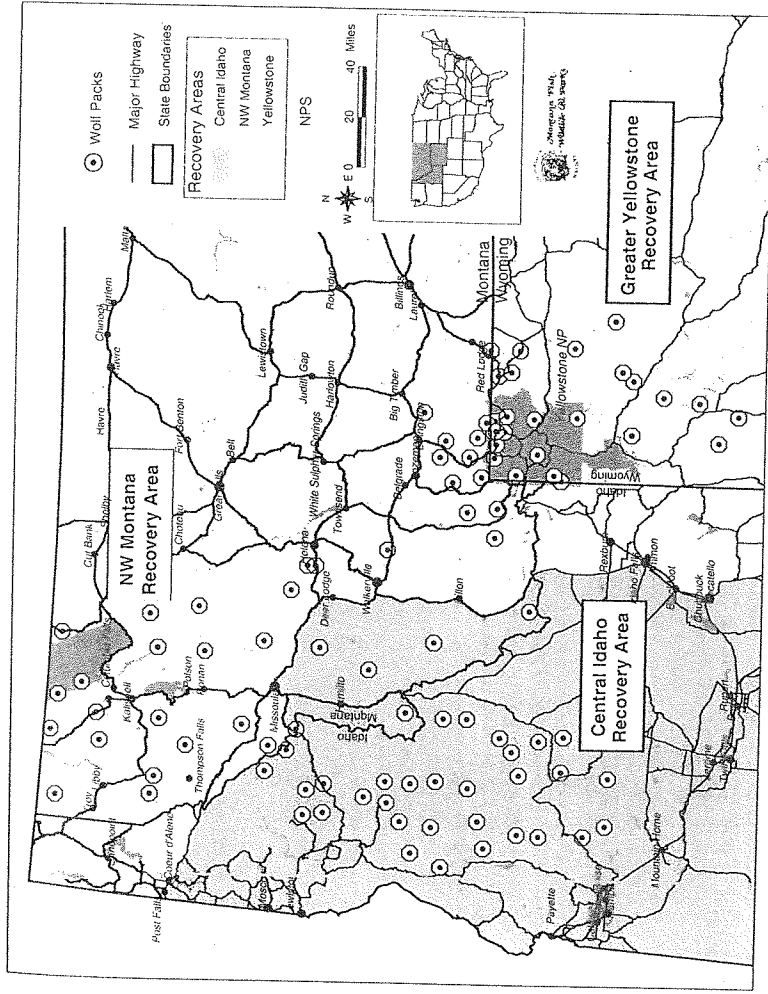


Figure 21.1. Wolf pack distribution in Montana, Idaho and Wyoming in 2002.





Table 21.1. (cont.)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
Wolves moved									6	8	14	0	0	6	8	0		42
Wolves killed									0	1	6	3	9	6	9	22		56
Central Idaho																		
Recovery Area																		
Wolf predation <sup>a</sup>																		
Cattle									0	4	1	10	16	15	10	10		66
Sheep									0	24	29	5	57	39	16	15		185
Dogs									0	1	3	1	5	0	1	4		15
Total wolves									14	42	71	114	141	192	261	285		1120
Wolves moved									0	5	0	3	15	10	5	0		38
Wolves killed									0	1	1	0	6	10	7	14		39
Total, three States, three Recovery Areas																		
Wolf predation <sup>a</sup>																		
Cattle	6	0	3	5	2	1	0	6	3	13	22	22	33	32	40	58		246
Sheep	10	0	0	0	2	0	0	0	0	37	126	12	89	80	138	102		596
Dogs	0	0	0	1	0	0	0	0	4	2	3	5	14	11	6	9		55
Total wolves	10	14	12	33	29	41	55	48	101	152	213	275	322	433	563	666		2967
Wolves moved	0	0	4	0	3	0	0	2	8	23	21	3	19	16	18	0		117
Wolves killed	4	0	1	1	0	0	0	0	0	6	21	7	24	20	19	45		148

<sup>a</sup> Numbers of animals confirmed killed by wolves in calendar year.<sup>b</sup> Includes 1 foal in 1999, 4 llamas in 2001, 5 llamas in 2002 and 10 goats in 2003.<sup>c</sup> Includes 13 wolves legally shot by ranchers. Others killed in government control efforts.

## WOLF HABITAT IN THE US NORTHERN ROCKY MOUNTAINS

The Wolf Recovery Plan for the Northern Rocky Mountains of Montana, Idaho and Wyoming identified preferred wolf habitat as large areas of public land with an adequate year-round supply of wild prey and few livestock (US Fish and Wildlife Service 1987). Based on those criteria northwestern Montana, central Idaho, and the Greater Yellowstone Area, which is mostly in northwestern Wyoming, were recommended for wolf restoration (Fig. 21.1). Each of these areas has a large refugium of National Park or US Forest Service Wilderness, where motorized access and livestock grazing are limited. Mountainous habitat is often undeveloped forested federal public land managed for multiple uses and is typically leased to the adjacent ranches for summer livestock grazing. Lower-elevation valleys are often in private ownership and used for livestock production. Ungulates often summer on higher elevation public lands but winter at lower elevations, so many wolves use private land. The proximity of the Northern Rocky Mountains recovery areas to one another and public land corridors between them, the genetic diversity of reintroduced wolves and the capability of wolves to disperse long distances indicated that genetic diversity is unlikely to be a threat to wolf conservation in the Northern Rocky Mountains (Forbes and Boyd 1997).

Oakleaf (2002) used geographic information system (GIS) modelling to predict preferred wolf habitat in the Northern Rocky Mountains. Higher degree of forest habitat, lower human population density, higher elk density, and lower domestic sheep density were the primary factors related to wolf occupancy. Central Idaho contained the greatest amount of preferred wolf habitat (77 596 km<sup>2</sup>), while the Greater Yellowstone Area (45 900 km<sup>2</sup>) and northwestern Montana (44 929 km<sup>2</sup>) had substantial amounts. However, few believe that any of the recovery areas could conserve an isolated wolf population by itself. Large carnivores are susceptible to extinction even in protected areas because of their large home ranges (Woodroffe and Ginsberg 1998). Wolves must live in and disperse through areas occupied by people and their livestock to ensure their long-term viability in the Northern Rocky Mountains.

## NEGATIVE HUMAN IMPACTS ON WOLVES

### Humans kill wolves

While wolf populations were severely reduced by human settlement and depletion of ungulates in the late nineteenth century, wolves were extirpated by extensive poisoning and federal and state government-led wolf

campaigns. Gipson *et al.* (1998) suggested stories of almost supernatural western wolves that supposedly killed thousands of livestock in the early twentieth century and were all but impossible to kill were largely the result of the political efforts of the Biological Survey (the agency that evolved into the US Fish and Wildlife Service) to create a purpose and funding for itself in Congress. This propaganda campaign capitalized on public hatred of wolves, agricultural development and wolf vulnerability to human-caused mortality, particularly poisoning. By 1930, the western remnants of a once vast southern continental wolf population vanished.

Biologically, wolves are easy to manage and control because of their distinct territories, pack structure, naturally low density and high recruitment potential. Wolves are habitat generalists and can live almost anywhere that has ungulate prey and moderate human-caused mortality. Wolf restoration depended on reducing annual human-caused mortality below 38% (Keith 1983). Unless wolves have been extirpated, restoration can be simply a matter of reducing human-caused mortality to a sustainable level.

Humans cause 85% of adult wolf mortality in the Northern Rocky Mountains (Pletscher *et al.* 1997; Bangs *et al.* 1998). Wolves have been killed illegally; accidentally by vehicles, trains, or traps; by other wolves; by their prey; in accidents (avalanches, drowning); and by other large predators. However, the most common documented cause of radio-collared wolf death is agency control in response to livestock depredation (Bangs *et al.* 1998). Despite the fact livestock depredations are rare, that competition for wild ungulates is minimal, and there have been virtually no restrictions of human recreational or commercial activities to enhance wolf survival and restoration, there remains widespread fear and resentment of wolf restoration. Some people equate wolf recovery with 'outsiders' who would use wolf restoration and federal authority to usurp state rights, control local land uses, confiscate guns, eliminate hunting and depopulate rural areas. Some people have publicly called for widespread wolf shooting and poisoning. Illegal killing is difficult to document but is probably the biggest single cause of adult wolf death. This sporadic illegal killing, including some poisonings with Compound 1080, strychnine and other prohibited chemicals, has not prevented wolf population growth, but it has affected wolf distribution. Wolves have not been able to persist in open prairie habitat in Montana or Wyoming (Fig. 21.1), where they are most vulnerable and least tolerated by people (Bangs *et al.* 1995).

#### Introduction of diseases and parasites and potential for canid hybridization

Wolves are vulnerable to dog (*Canis familiaris*) diseases and parasites (Brand *et al.* 1995) and can hybridize with dogs and coyotes (*Canis latrans*) (Wayne *et al.* 1995). Humans incidentally transmit dogs' and canid diseases and

parasites into wolf populations and habitat modification has greatly increased coyote distribution. However, these factors have not significantly affected wolf population viability in North America.

## POSITIVE HUMAN IMPACTS ON WOLVES

### Preservation of wolf habitat

In the late 1880s, large areas in the Northern Rocky Mountains were still undeveloped. Many of those lands remained in federal ownership after the western states were created, primarily because they were not productive for agriculture. These public lands were still set aside for commodities such as water, timber, forage and minerals. Most National Parks were originally established because of their unique geologic features or scenic beauty rather than wildlife. On public lands, wildlife and other uses were subservient to production of raw materials. Over the next century, the public's expectations of how these lands should be managed expanded to include outdoor recreation, wildlife conservation and other values associated with nature such as biodiversity, that reflected a national rather than primarily local public perspective (Keiter 1998).

### Restoration of wolf prey

The restoration of ungulate populations by state game agencies was one of the most remarkable achievements of wildlife management and without it wolf restoration would be impossible. Native ungulate populations that had been extirpated in the early twentieth century were restored throughout much of their historic range in North America by the 1970s. Ungulate research also provided insights into the ecological role of predators. This new information revealed a more positive image of wolves than the sinister one portrayed in folklore. The ultimate result of this fresh outlook by wildlife professionals, a more informed public and the increasing national concern for a host of environmental issues was that public attitudes about wolves changed dramatically.

### Wolf conservation programmes

The grey wolf was protected under the Endangered Species Act in 1974, after it had been deliberately eliminated from nearly 99% of its historic range in the contiguous USA. The Act prohibited all attempts to kill wolves, and mandated that all federal agencies use their authorities to help promote recovery. Changing societal values resulted in enforcement of strict laws with penalties up to one year in jail and a US \$100 000 fine for illegally killing wolves. The Endangered Species Act also funnelled federal funding



into wolf research projects and public information programmes, and initiated three successful wolf restoration efforts in the Midwest, the Northern Rocky Mountains and Southwest USA (Phillips *et al.* 2004).

## NEGATIVE WOLF IMPACTS ON HUMANS

### Wolf attacks on humans

Wolves in fairy tales and throughout most popular media, are portrayed as dangerous (Boitani 1995). This perception is a reason that people fear wolves and oppose wolf restoration (Bath 1992; Kellert *et al.* 1996). Wolves have attacked humans but incidents are remarkably rare (Quigley and Herrero, Chapter 3). Wolf attacks are often the result of rabies or some human-caused contributing factor such as dog-wolf conflict or food habituation (Linnell *et al.* 2002). In North America, healthy wild wolves have not been documented to kill anyone since European colonization (McNay 2002). There is no documentation of a wild wolf attacking a person in the Northern Rocky Mountains. Wild wolves kill prey much larger and better able to defend themselves than unarmed humans. Dogs kill a dozen and injure hundreds of thousands of people in North America each year, implying wild wolves choose not to attack people. Documented cases of rabid wolves attacking people in North America are rare; the last human fatality was in Alaska in 1945 (Ritter 1981). Despite some public apprehension, human safety was not a significant issue during wolf restoration efforts, because of accurate information and the fact that any wolf that threatened humans can be legally killed.

### Livestock depredations

Wolves can be effective predators and scavengers on livestock (Fritts 1982) and access to livestock and livestock carrion can increase wolf density (Hovens *et al.* 2000; Vos 2000). However, cultures that raise livestock strongly dislike wolves (Lopez 1978; Fritts *et al.* 2003). In today's society, livestock producers typically have the strongest dislike of wolves compared to other segments of society (Boitani 1995; McIntyre 1995; Kellert *et al.* 1996; Williams *et al.* 2002). In the late nineteenth century, as native prey populations diminished, wolf depredation on livestock was perceived as a major problem (McIntyre 1995). While the actual rate and importance of historic wolf depredation will never be known, it was probably exaggerated (Gipson *et al.* 1998). Wolf depredation on livestock is lower than expected given the wolf's effectiveness as a predator and its high exposure to livestock (Fritts *et al.* 1992; Bangs *et al.* 1995; Oakleaf *et al.* 2003). From 1987 to 2002 wolves in the Northern Rocky Mountains were confirmed to have killed 237

cattle (0 bulls, 8 steers, 17 cows, 26 yearlings, 165 calves, 21 unknown; 30% on public land; with an average of 1.3 cattle (range 1–7) killed in 173 depredations events that affected 74–112 cattle producers) and 593 sheep (33 rams, 85 ewes, 66 lambs, 409 unknown; 52% on public land; with an average of 7.0 sheep (range 1–41) killed in 80 depredation events that affected 31–49 sheep producers). Cattle (67%) and sheep (75%) were killed most often from April to September when grazing is most dispersed and young livestock are most common. Small body size makes livestock more generally vulnerable to a wider variety of predators (Fritts 1982), and allowed wolves to kill any sheep. Calves were more susceptible to wolf depredation than adult cattle (Fritts *et al.* 1992; Oakleaf *et al.* 2003). Wolf depredations were dispersed and sporadic and only a few livestock producers incurred multiple losses. While unimportant to the regional livestock industry, wolf depredations could affect the economic viability of a few small ranches, primarily those dependent on remote public land grazing allotments.

We reviewed statistics on livestock numbers, losses, and predation in 2000 to assess the relative importance of wolf depredation to the livestock industry in Northern Rocky Mountains (National Agriculture Statistics Service 2001a, b). There were 2 210 000 sheep, 9 300 000 cattle and 437 wolves in Montana, Idaho and Wyoming in 2000. Livestock producers there reported that they lost 235 000 cattle and 195 000 sheep from all causes in 2000. Of those losses 82 200 (42%) sheep and 10 300 (4.4%) cattle were reportedly killed by predators. Coyotes were responsible for over 70% of those losses. In 2000, wolves killed 80 sheep and 32 cattle in the Northern Rocky Mountains or 0.04% and 0.01% of all losses, and 0.01% and 0.31% of all predator-caused losses, respectively. Statistics from Montana from 1986–91 (Bangs *et al.* 1995) and Minnesota (Fritts *et al.* 1992) also indicted a very low percentage of wolf-caused loss.

Before wolves were reintroduced livestock producers estimated they annually lost 8340 cattle and 12 993 sheep in the Greater Yellowstone Area and 12 314 cattle and 9 366 sheep in central Idaho (US Fish and Wildlife Service 1994a). The service predicted 100 wolves would kill about 10 to 20 cattle and 50 to 70 sheep per area per year, a small fraction of the livestock losses that were already occurring from all causes before wolves were present (US Fish and Wildlife Service 1994a). Wolf damage was estimated at US \$2000–30 000 annually. Despite there being an average of 178 wolves in the Greater Yellowstone Area and 202 wolves in central Idaho from 1998 to 2002, confirmed livestock losses have been fewer than predicted averaging 14 and 12 cattle and 47 and 24 sheep, respectively (US Fish and Wildlife Service *et al.* 2003).

Wolves rarely attack other types of livestock in the Northern Rocky Mountains, with only one horse, ten goats and nine llamas confirmed killed. However, the US Fish and Wildlife Service considers any wolf attack on livestock serious. We relocated problem wolves 117 times and killed 207 to reduce conflicts (Table 21.1). Agency-initiated research with radio-collared livestock indicated that wolf depredation was rare but confirmed losses may be a fraction of actual wolf-caused losses near active dens in densely forested and remote public land grazing allotments. Seven calves might be killed and not documented for every confirmed wolf depredation in the worst-case scenarios (Oakleaf *et al.* 2003). If that ratio is typical, livestock depredations by wolves could still only be significant to a few public land grazing permittees.

Wolf depredation is a rare cause of livestock mortality, but it is inordinately controversial. Nearly every wolf depredation on livestock in the Northern Rocky Mountains becomes a major local and state-wide media story. This high level of publicity exaggerates the actual impacts of wolf depredation. Wolves are routinely discussed at the local, state and federal political level. Several county and state governments have passed 'resolutions' declaring the wolf an 'unacceptable species' and calling for its extirpation, and there has been litigation from livestock interests. Conversely, control by the US Fish and Wildlife Service of depredating wolves generates angry correspondence and litigation from animal rights, anti-public land grazing and pro-wolf advocates.

#### **Wolf attacks on dogs**

Wolves infrequently kill dogs and usually do not eat them (Fritts and Paul 1989; Kojola and Kuittinen 2002; Treves *et al.* 2002). To date 57 dogs (10 pet, 11 guard, 19 hunting hounds, and 16 herding, 1 undocumented, average 1.2 dog per depredation, range 1–4 per attack) have been confirmed killed by wolves in the Northern Rocky Mountains. Although Humane Society organizations in each state euthanize thousands more dogs than wolves kill, wolf depredation on dogs is a serious social issue. It is one of the most difficult conflicts that Northern Rocky Mountains biologists address because people form particularly strong emotional bonds with dogs. Depredations near homes also raise fears for human safety and anger over the perceived violation of personal space. Compensation is only provided for herding and guarding dog depredations, but trained hunting dogs can be worth thousands of dollars. Wolves that attack dogs on private land can be legally relocated or killed (US Fish and Wildlife Service *et al.* 2003), but to date none has been because most attacks were isolated incidents in remote areas.

#### Techniques to reduce wolf conflict with domestic animals

Wolf restoration in the Northern Rocky Mountains has little measurable direct impact on the lives of most people; however, the psychological impact of the programme has been enormous. It is surprising how many local livestock producers whose ancestors founded their ranch remarked that a relative had killed 'the last wolf' in this or that valley, county or state, and how that lone act became a source of pride and remembrance. One hundred years ago, elimination of wolves was seen as a righteous duty and was the symbol that civilization had 'won'. Wolf restoration became the symbol of change from an agricultural heritage and lifestyle to something else that was unfamiliar and undefined.

To moderate the real and psychological effects of wolf restoration, the US Fish and Wildlife Service and its cooperators implemented a wide variety of programmes to minimize the potential for and extent of wolf-human conflict. The Service took a highly publicized position that there was already adequate habitat for wolf recovery and traditional uses of private and public land would not be modified. The Service also stated that depredating wolves would not be the foundation for wolf restoration and chronic depredating wolves would be killed (US Fish and Wildlife Service 1988).

Before wolves were reintroduced, the US Fish and Wildlife Service established regulations that empowered local landowners and livestock producers (US Fish and Wildlife Service 1994b). In 2003 the Service liberalized and expanded that flexibility for problem wolf management to the entire northwestern USA (US Fish and Wildlife Service 2003). Livestock producers are routinely provided radio telemetry receivers so they can locate radio-collared wolves on their property. Landowners can harass wolves in a non-injurious manner at any time. Any wolf seen attacking livestock on private land can be legally shot, and five wolves have been killed. Over a dozen livestock owners obtained US Fish and Wildlife Service permits to shoot wolves seen attacking their livestock on public grazing allotments, but no wolves have been killed. In areas with chronic livestock depredations landowners received permits to shoot wolves on sight. Since the first permits were issued in 1999, eight wolves have been killed, three in 2002 and five in 2003. After a brief training course, over 100 landowners were issued permits and less-than-lethal munitions (12-gauge shotgun cracker shells and rubber bullets), to harass wolves near their livestock or dwellings. Several wolves have been hit but none was seriously injured, and those residents report that wolves are more wary. Biologists have temporarily provided road-killed ungulates to denning wolves when the potential for conflict appeared highest such as after young livestock were turned out on

rangeland before ungulates calved. In intensively grazed areas on private land biologists disturbed soon-to-be-active den sites or harassed wolves from rendezvous sites causing them to relocate their pups away from livestock.

Even though the vast majority of livestock producers would never experience wolf depredation, wolf advocates recognized that some losses would occur. Defenders of Wildlife started a private livestock compensation fund in 1987 that has paid ranchers nearly US \$275 000 for confirmed and probable damage to livestock and livestock herding and guarding animals caused by wolves (Fischer 1989; Nyhus *et al.*, Chapter 7). Compensation is based on professional field investigations of livestock death routinely conducted by US Department of Agriculture Wildlife Services (Paul and Gipson 1994). The US Fish and Wildlife Service contracts Wildlife Services to investigate reports of wolf damage and uses their findings to determine whether wolf control is warranted (Bangs *et al.* 1995). Defenders of Wildlife also helps livestock producers avoid wolf depredation by cost-sharing guard animals, fencing, fladry, extra livestock surveillance, disposal of livestock carcasses, alternative grazing pastures in lower-risk areas, attempting to purchase and retire public land grazing allotments in areas of chronic conflict, and funding research on non-lethal methods to reduce conflicts (Bangs and Shivik 2001). While these non-lethal efforts reduced conflicts, many were expensive to implement and none has been proven widely effective. Lethal control of chronic depredating wolves is still required.

#### Competition with human hunters for ungulates

The average adult wolf eats about 5 kg of prey per day. The US Fish and Wildlife Service (1994a) predicted that 100 wolves in central Idaho would kill the equivalent of about 1600 ungulates annually (primarily mule deer and elk) out of a population of nearly 241 000. That level of wolf predation would have little effect on any ungulate population or on the annual hunter harvest of 33 358 ungulates, except for the harvest of female elk that might be reduced by 10% to 15%. The reduced hunter opportunity would result in yearly theoretical economic losses of US \$757 000–1 135 000 in hunter benefits (i.e. what hunters thought the loss of that female elk hunting was worth to them) and US \$572 000–857 000 in potential reduced hunter expenditures (i.e. what hunters would have spent hunting female elk).

In the Greater Yellowstone Area the Environmental Impact Statement (US Fish and Wildlife Service 1994a) predicted that 100 wolves would kill the equivalent of 1200 ungulates annually, primarily elk, out of nearly 100 000. Few moose, bighorn sheep, mountain goats, bison and antelope would be killed by wolves. A recovered wolf population might reduce elk 5–30% (the

higher level only in some small herds), deer 3–19%, moose 7–13% and bison up to 15%. The Environmental Impact Statement predicted that wolf predation would not affect hunter harvest of males but could reduce harvest of female elk, deer and moose for some herds. Wolf predation would cause annual economic losses estimated at US \$187 000–465 000 in hunter benefits and US\$207 000–414 000 in reduced hunter expenditures.

The issue of how much wolf predation and 'harassment' affects ungulate populations and hunter harvest remains a major public concern. Wolf predation may or may not affect ungulate populations and hunter harvest depending on a wide number of variables (Boyce 1995; Vales and Peek 1995; Kunkel 1997). In anticipation of potential conflict, the regulations for wolf reintroduction allowed for the relocation of wolves if ungulate populations were being significantly impacted. To date, no wolves have been moved because there has been no documented need.

Despite data, including ungulate surveys, several groups with reportedly thousands of members have recently formed around the rumour that ungulate populations have been decimated by wolf predation. This is a powerful psychological issue and thousands of frustrated and angry hunters have the potential to cause significant illegal wolf mortality. State wildlife agencies report that hunters at game check stations routinely ask about 'wolf damage' to ungulate populations even when there are few wolves in that area or ungulate populations and harvests are at historically high levels. It is a foregone conclusion that any declines in ungulate populations or hunter harvest will be attributed solely to wolf predation by wolf opponents and adamantly denied as being wolf-caused by wolf advocates.

To address these public concerns, cooperative research on wolf-ungulate relationships has been continuously initiated and funded by the US Fish and Wildlife Service and other agencies since the 1980s. These often university-led multi-year studies predicted that wildlife managers should anticipate some ungulate population declines and reduced hunter harvest and recommended more intensive monitoring of ungulate population declines to detect changes early (Kunkel 1997). These data continue to be gathered and publicized to better inform the public about the effect of wolf predation on ungulate populations and hunter harvest. However, the effect of wolf predation on ungulate populations and subsequent hunter harvest appears minor and very difficult to detect despite the intensive research conducted to date.

#### THE SYMBOLISM OF WOLVES TO HUMANS

Perhaps the most interesting aspect and significant effect of wolves is their unusually strong symbolism to humans (Fritts *et al.* 2003). Humans have

used wolves as very powerful symbols in many cultures for thousands of years (Lopez 1978; Boitani 1995). Today, wolves have little material effect on people but wolves make many people's lives more interesting. Wolves can positively impact people by their strong symbolism and entertainment value. People can enjoy the opportunity to interact (i.e. hunting, trapping, viewing, photography) with wolves, and wolves can enhance the natural ecological integrity and wildlife diversity of wildlands, enhancing their value to some people.

Economic analysis predicted that wolf restoration, primarily associated with tourism in Yellowstone National Park, would generate up to US\$23 000 000 in economic activity in the Northern Rocky Mountains annually (US Fish and Wildlife Service 1994a). In addition, wolf restoration had a potential existence value (i.e., what people thought having wolves in Yellowstone was worth) of US\$8 300 000 annually. While specific follow-up studies have not been completed, the trends predicted in the Environmental Impact Statement seem to be occurring (J. Duffield pers. comm.). Most wolves are still fairly wary of people, but high prey density, open habitat and a highway in the northern portion of Yellowstone National Park provides outstanding wolf-viewing opportunities. On 26 June 2002, a Yellowstone National Park naturalist calculated that over 100 000 park visitors had seen wolves since 1995 (R. McIntyre pers. comm.). Several commercial wildlife-viewing tour operators have started since 1995, and wolf-viewing is a cornerstone of their business. Traffic actually became so congested that wildlife-watchers prevented wolves from crossing the highway. Beginning in 2000, National Park 'guards' were hired to direct traffic to protect visitor safety and allow wolves to pass. The powerful symbolism of wolves is still evident and is particularly deeply ingrained in Western culture. Wolves are one of the most popular species in North American wildlife art today. Northern Rocky Mountains wolves, especially those in Yellowstone National Park, have been featured in literally thousands of stories. Wolves have appeared in every form of international, national and local media. The entertainment value of wolves has never been calculated but we suspect it could be worth millions of dollars annually. It appears that whether people love wolves or hate wolves, everyone likes information and gossip about wolves and to share their perspective. Since 1987, we have presented nearly 1000 wolf information programmes to a wide variety of groups. Nearly 60% of the federal Northern Rocky Mountains wolf programme activities involved providing public information (Fritts *et al.* 1995).

Wolf-related legislation or resolutions, universally critical towards wolves and the federal government, are common in Montana, Idaho and Wyoming state legislatures and county governments. Northern Rocky

Mountains wolf recovery staff routinely respond to correspondence generated by members of the US Congress and state Governors. The level of local, national and international interest in wolf restoration was evident when 160 000 public comments from 40 countries were received on the Environmental Impact Statement to reintroduce wolves to central Idaho and Yellowstone National Park (US Fish and Wildlife Service 1994a). That response was one of the largest volumes of public comment received on a planned federal action up to that time. Although the government's legal position has prevailed, since 1994 both wolf opponents and proponents have initiated various wolf-related litigation, some of it going to the US Court of Appeals and Supreme Court level.

### CONCLUSIONS

Wolf extermination took place because of negative human values about wildlife in deference to other social values. As a result of those values, government programmes encouraged wildlands to be modified for direct human use; wildlife and indigenous people to be replaced by settlers, crops and livestock; and predators to be exterminated. Society ensured those values and opinions were perpetuated by mythology, popular media, schools and social events. Without large blocks of livestock-free habitat or abundant prey to minimize conflicts, and facing extreme human prejudice and persecution, wolves had no future in the early-twentieth-century American West. Societal values changed, probably fuelled most by urbanization. Society set aside public lands and eventually gave some of them purposes other than commodity production. Hunters established state game agencies to restore ungulate populations but ultimately other species were also valued and conserved. Some predator-control practices such as widespread poisoning became socially unacceptable and were banned. Human values about nature changed and these perspectives were reinforced by scientific research and popular media. 'Charismatic megafauna' benefited from new media technology like television and film, especially wolves because of their large size, familiar dog-like beauty and behaviour, easily anthropomorphized social structure, and inherent interest to people. Wolves also benefited from that fact that few modern people actually had first-hand experience of the real problems associated with living with them (Williams *et al.* 2002).

The Endangered Species Act numerical and distributional population recovery goals established for the grey wolf in the Northern Rocky Mountains were achieved in late 2002 (US Fish and Wildlife Service 1994a; US Fish and Wildlife Service *et al.* 2003). Currently, wolf packs successfully occupy areas where only 20 years ago biologists believed wolves



could not exist because the level of conflict would be intolerable (US Fish and Wildlife Service 1988). Successful wolf restoration was inevitable once human values changed, because the biological requirements for a viable wolf population – space and prey – had already been restored. There was enough remote habitat and wild prey so that, with agency management, conflicts between wolves and people were rare. The majority of the public perceived conflicts were rare enough and the presence of wolves valuable enough that local people should tolerate wolves.

Active management of wolf-caused conflicts will be required to maintain public tolerance. (Fritts and Carbyn 1995; Mech 1995; Fritts *et al.* 2003). A viable wolf population can persist in the Northern Rocky Mountains because large areas of suitable habitat are secure in public ownership. Conflict with livestock will remain low because sheep or other highly vulnerable types of livestock are unlikely to return to their former abundance because of global market competition and changing social values about acceptable uses of public land. Ungulate populations will continue to thrive on public and private land and state wildlife management agencies will continue to manage for high population levels for hunting, ensuring an adequate prey base for wolves. Professional wildlife managers should minimize wolf-caused problems to reduce the likelihood of a backlash of public opinion against wolves. Such a backlash could result in widespread vigilantism or public calls for government extermination programmes (Mech 1995). Given some minimal level of secure habitat, wild prey and human tolerance, wolf populations will persist. Wolves will eventually spread to adjacent areas as the changing social values that allowed recovery in the Northern Rocky Mountains, continue to manifest themselves elsewhere.