The Wolf in Colorado

Destruction to Restoration

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The future cannot be denied, and so it is with consideration of restoring the gray wolf (*Canis lupus*) to western Colorado. After completing decades of wolf recovery work elsewhere in the United States, conservationists can now focus on the last great remaining expanse of wolfless wildlands in the lower forty-eight states—the public lands of the Southern Rockies Ecoregion of western Colorado. It is altogether fitting that such a focus should begin by looking back, by reviewing the history of the last wolves in Colorado and their purposeful, hateful, and needless destruction. As described in vivid detail by Arthur H. Carhart in his important book *The Last Stand of the Pack*, wolf extermination in Colorado involved brutish means applied by zealots. While the species was rendered all but ecologically extinct by the 1930s, the last wolf hung on until 1945, when it was killed near the Colorado-New Mexico border. With that death, the clarion call of Colorado's wildlands was silenced.

HISTORY OF EXTERMINATION

As recently as 150 years ago, the gray wolf was distributed throughout the contiguous United States, except from central Texas to the Atlantic coast, where the red wolf (*Canis rufus*) roamed. Historically, the gray wolf was the most widely distributed large mammal in North America. Tolerant of

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environmental extremes, wolves inhabited areas from central Mexico to the North Pole. This expansive distribution was greatly reduced as a result of long-term extermination efforts that began as Europeans settled in North America. Conflict with agricultural interests resulted in government-supported eradication campaigns, beginning in colonial Massachusetts in 1630. Eventually wolf extermination became the policy of the federal government and was applied relentlessly, including in the western United States.

For millions of years the western United States had been wolf and bison (*Bison bison*) country. As the cardinal features of the region, these two species greatly shaped its ecology. Of the two, the wolf had an overseer role, with authority provided by predation. Through that authority wolves were the shepherds of the buffalo and other big game.

The settling of the region to make it suitable for ranching exotic cattle and sheep imported from Europe brought about profound reductions in the wolf's native prey. Even the mighty bison was slaughtered to the brink of extinction. In desperation, wolves turned to sheep and cattle. The response by livestock men was certain, swift, and furious.

As Barry Lopez wrote, "The wolf was not the cattlemen's only problem. There was weather to contend with, disease, rustling, fluctuating beef prices, the hazards of the trail drives, the cost of running such enormous operations. But more and more the cattlemen blamed any economic shortfall on the wolf . . . The wolf became an object of pathological hatred."[1]

At the behest of ranchers pursuing their anger-fueled sense of Manifest Destiny, bounty hunters and government field agents shot, roped, trapped, gassed, stomped, and strangled wolves.[2] By the 1930s the ranchers' hatred had rendered wolves uncommon. Some of the last to survive were given names and a permanent place in western folklore. Montana's last wolf was called Snowdrift. South Dakota's sole survivor was the Custer Wolf. Wolves named Rags, Whitey, and Lefty were among Colorado's last, and one final story from the state involves a female wolf named Three-Toes. Wandering alone, driven by an urge she could not control, she mated with a dog, which sealed her fate. Pinned down by motherhood, her habits were discovered by federal agents. They used that knowledge to kill her, the dog, and their puppies.

In the early 1950s government trappers turned to northern Mexico and the few wolves there that dispersed to the United States. This influx was eliminated by the end of that decade when wolf numbers reached an all-time low. At that time less than one thousand persisted in the remote Superior National Forest of northeastern Minnesota. Additionally, probably less than twenty wolves inhabited Isle Royale National Park, a small island located in Lake Superior about twenty miles from the northeast Minnesota mainland.

STATE PROTECTION

Given the extermination of the wolf in Colorado, it is altogether fitting that the species is listed as endangered under Colorado's Nongame, Endangered, or Threatened Species Conservation Act. The act states that "species or subspecies of wildlife indigenous to this state which may be found to be endangered or threatened . . . should be accorded protection in order to maintain and enhance their numbers to the extent possible . . . this state should assist in the protection of species or subspecies of wildlife which are deemed to be endangered or threatened."[3]

Despite the clear intent of Colorado law, it is unlikely that any proactive state-led recovery effort will surface. Why? The state's law is best suited for management actions that promote the persistence of imperiled but extant species. For extirpated species like the gray wolf, the law specifies that reintroductions must be authorized by the Colorado legislature. Given the influence of the livestock industry, and to a lesser extent the big game hunting industry, it seems unlikely that the legislature would ever willingly authorize wolf reintroductions. Some people continue to harbor a pathological hatred of wolves.

FEDERAL PROTECTION

The federal Endangered Species Act (ESA) passed in 1973, and by 1978 it provided protection to the gray wolf throughout the continental United States, including Colorado. Starting with about one thousand wolves in Minnesota in the early 1970s, by 2016 ESA-related recovery actions had led to the establishment of about six thousand wolves in Minnesota, Michigan, Wisconsin, Montana, Idaho, Wyoming, Oregon, and Washington spread across about 15 percent of the species' historical range. Recovery actions also led to a population of about one hundred Mexican gray wolves in southwestern New Mexico and southeastern Arizona.

Since the gray wolf is listed as endangered in Colorado under the ESA, recovery should be inevitable. After all, the ESA mandates the secretary of the interior to use all methods and procedures necessary to recover a listed species, including reintroductions, to restore viable populations to unoccupied habitat. For more than twenty years, however, the US Fish and Wildlife Service has shown no interest in restoring the wolf to western Colorado. In 2013 the agency made it clear that disinterest was its official policy, when it released a draft proposed rule for the species to be removed (delisted) from the federal list of endangered and threatened species for most of the country, including Colorado.[4] Delisting would absolve the Service from any future obligations to advance wolf recovery beyond the range currently occupied. This would, of course, eliminate the potential for a federally led restoration effort in Colorado. Curiously though, as of November 2017, the proposed rule had not been advanced beyond the draft stage.

Many believe that if finalized as drafted, the proposed rule would be flawed and probably unable to withstand judicial review, which is inevitable given the certainty of litigation. This belief is based on many things, including the fact that reintroducing wolves to western Colorado would ensure the establishment of a population, thereby advancing recovery of the species throughout a significant portion of its historical range, which is the cardinal mandate of the ESA.

While the ESA of 1973 was the third in a series of laws aimed at protecting imperiled species, it was the first to offer protection to species in danger of extinction throughout only a portion of its historic range. Previous federal laws—the Endangered Species Preservation Act of 1966 and the Endangered Species Conservation Act of 1969—only considered species facing total extinction. In contrast, the 1973 ESA defined an endangered species to be any species in danger of extinction throughout all or a significant portion of its range; a threatened species was any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. By including the phrase, "significant portion of its range," Congress elevated the threshold for recovery by establishing the expectation that a recovered species would be well distributed within its historical range.[5]

This expectation was buttressed when Congress included in the important but often overlooked "Findings, Purposes, and Policy" section of the ESA the recognition that imperiled species "are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."[6] It would be impossible for many of these values to be realized if a recovered species occupied only an insignificant portion of its historical range. There is, for example, no way for a species' ecological values to be manifest if it is absent from the vast majority of different ecological settings reasonably available to it.

The expectation that a recovered species would be reasonably well distributed within its historical range, at least where suitable habitat exists, was further buttressed when Congress defined the term *species* to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature."[7] Thus, ESA protections and recovery activities can be applied to a population segment of an otherwise common species as long as the population segment in question is discrete, significant, and threatened or endangered.

For all these reasons, it seems clear that Congress intended that the ESA's recovery mandate would have wide geographic application. Not surprisingly, previous delisting actions and case law upheld this intent. To emphasize this point, when considering recovery of the flat-tailed horned lizard (*Phrynosoma mcallii*), the Ninth Circuit Court of Appeals concluded that the text of the ESA and its subsequent application have been guided by Aldo Leopold's maxim: "There seems to be a tacit assumption that if grizzlies survive in Canada and Alaska, that is good enough. It is not good enough for me . . . Relegating grizzlies to Alaska is about like relegating happiness to heaven; one may never get there."[8]

Relegating the gray wolf to about 15 percent of its historical range and at population levels that are but a shadow of historical abundance fails to honor the spirit and intent of the ESA.[9] As long as the gray wolf remains extirpated in Colorado, the western half of the state will represent a significant gap in the species' range. That is exactly the problem that the ESA aims to correct.

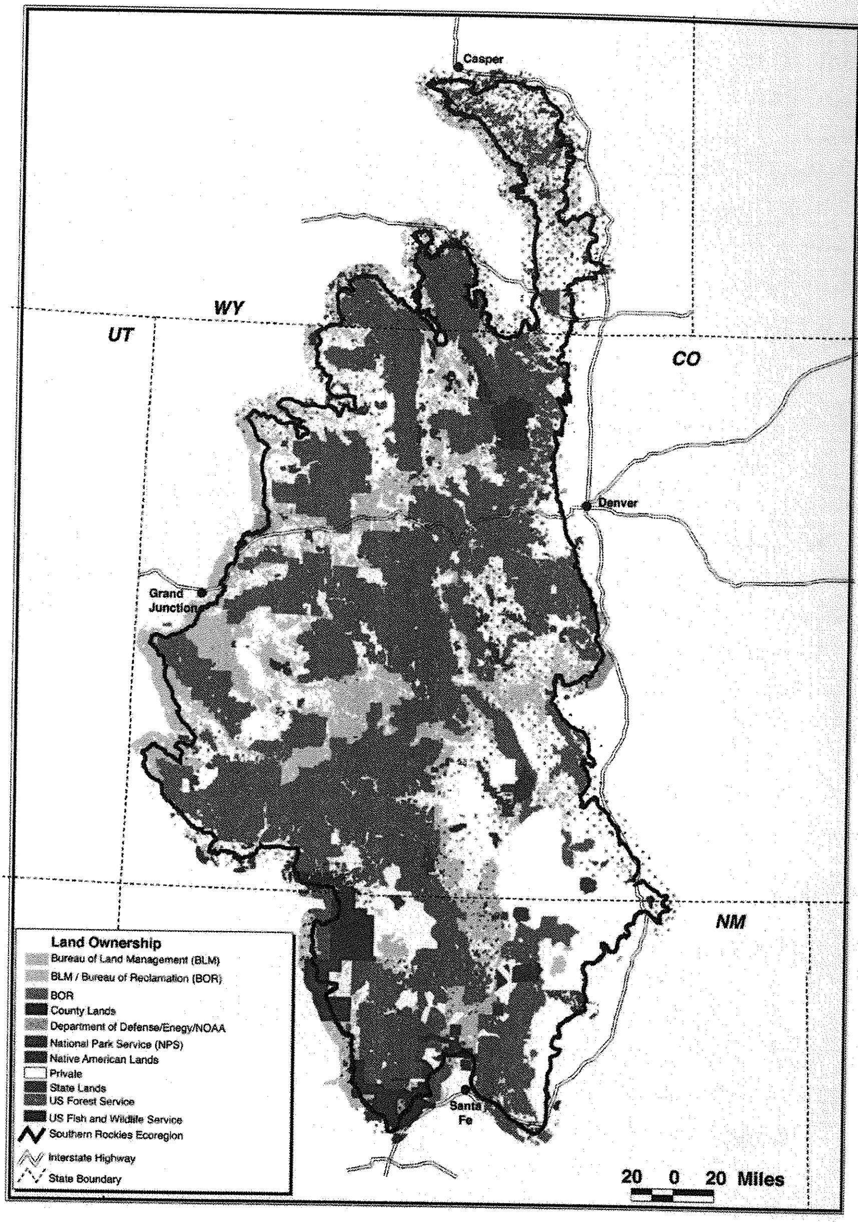
HABITAT SUITABILITY—BIOLOGICAL AND SOCIAL ASPECTS

In addition to state and federal endangered species laws, wolf restoration to Colorado is strongly indicated by the presence of extensive and highly suitable habitat. In short, western Colorado contains more public land and prey for wolves than anywhere else in the United States.

As the heart of the Southern Rockies Ecoregion, western Colorado is a mother lode of biological opportunity for the gray wolf. The ecoregion stretches from north-central Wyoming, through western Colorado, into north-central New Mexico and includes nearly 25 million acres of public land (figure 6.1).

The vast majority of the ecoregion lies in western Colorado in the form of public land that stretches across about 18 million acres that are managed for conservation purposes and support robust populations of native ungulates (hoofed mammals like elk [*Cervus elaphus*] and deer [*Odocoileus* spp.]), the gray wolf's preferred prey.

Although wolves sometimes occur outside core protected areas of public land, it is clear that the beachheads of security offered by public land are essential for their long-term persistence. It is not coincidental that by the late



The Southern Rockies Ecoregion is centered on western Colorado and includes millions of acres of public land that is highly suitable for the gray wolf (from Shinneman, McClellan, and Smith, *The State of the Southern Rockies Ecoregion*).

1950s, when wolves had been exterminated throughout most of the continental United States, only several hundred survived in the Superior National Forest in northeastern Minnesota. And it is not coincidental that all wolf recovery projects have been centered on public lands.

Across the vast assemblage of public land in western Colorado, prey populations are more than sufficient for wolves. From 2004 through 2015, Colorado's combined post-hunt population (i.e., after recreational hunters killed a combined number of elk and deer that averaged 85,279 animals annually) of elk and deer averaged 758,314 animals.[10] This probably represents the largest and densest population of ungulates for wolves anywhere in the world.

The persistent commonness of elk and deer in western Colorado is noteworthy since prey abundance is the best predictor of habitat quality for wolves in areas where human-caused mortality of wolves is low.[11] Not surprisingly, a 1994 congressionally mandated study conducted by the US Fish and Wildlife Service concluded that Colorado could support over one thousand wolves.[12] Three additional studies, using increasingly reliable techniques, concluded that Colorado could easily support a self-sustaining population of wolves.[13]

In addition to extensive suitable habitat, as defined by large tracts of public land and robust prey populations, there is significant public support for the wolf's return to Colorado. Regional public opinion surveys conducted across a span of twenty years reveal strong and durable support for restoring the wolf to Colorado. In a public opinion survey conducted in 1996, 66 percent of the respondents said they would vote yes on a referendum to restore wolves.[14] This level of support persisted through the early 2000s, and a February 2014 survey affirmed that the vast majority (64 percent) of Coloradans want to see the wolf restored.[15]

RESTORATION: NATURAL RECOLONIZATION VERSUS REINTRODUCTIONS

Even though western Colorado is ideally suited for the gray wolf, the area is a considerable distance from wolf populations elsewhere. It is highly unlikely that a viable population will inhabit the area through natural recolonization.[16] Conventional wisdom, based on decades of reliable research and wolf recovery actions, indicates that reintroductions provide the best guarantee for reestablishing a wolf population in western Colorado. It is simply too far, and there are too many mortality hazards along the way, for a sufficient number of wolves from the Northern Rockies or the Great Lakes states to wander to Colorado, find one another, and survive long enough to give birth to the countless litters of pups required to give rise to a viable population.

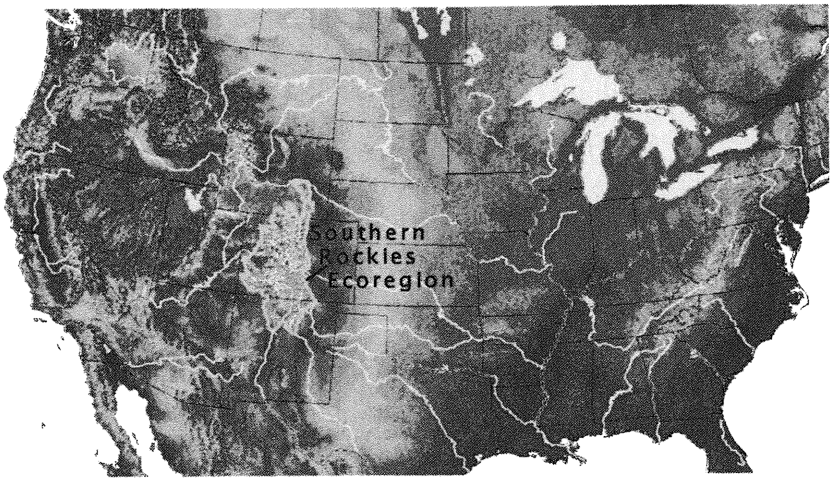
The limits of natural recolonization are apparent elsewhere. A viable population of wolves does not exist in western Minnesota and the Dakotas, despite over two thousand wolves in the northeastern quarter of Minnesota. It is quite likely that without reintroductions a viable population of wolves would not exist in Yellowstone National Park and the surrounding national forests despite about one thousand wolves nearby in Idaho and Montana.

When considering natural recolonization versus reintroductions as the mode of restoration, it is important to note that naturally recolonizing wolves (and any offspring) in Colorado would be fully protected as endangered under the federal ESA. Such protection significantly restricts management options. In contrast, reintroduced wolves (and any offspring) could be managed in a much more accommodating manner to address the needs and concerns of Coloradans.

The tremendous success of wolf reintroductions in Yellowstone National Park has relevance to western Colorado. While the park and surrounding national forests were certainly suitable for wolves, western Colorado's vast tracts of public land and unusually large populations of deer and elk make it even more so. What was done safely and cost-effectively in Yellowstone Park can more easily be done in the Rocky Mountains of western Colorado.

Given that the wolf was purposefully, but needlessly, exterminated from the area during the first half of the 1900s, reintroductions represent a responsible and practical way of restoring Colorado's natural balance. Claiming that it is likely that wolves will naturally recolonize the state is a red herring and detracts from a central fact: carefully planned and implemented reintroductions are the most certain way of restoring the gray wolf to the snow-capped peaks, rimrock canyons, and primeval forests of the Rocky Mountains of western Colorado. In contrast, counting on wolves to naturally recolonize Colorado is nothing more than an exercise in futility and one that has scant chance of restoring the wolf's howl, the cardinal voice of Colorado's wildlands.

The importance of restoring the wolf to western Colorado is especially significant when considered against a continental perspective. Because western Colorado is nearly equidistant from wolf populations in the Northern Rockies and southwestern New Mexico/southeastern Arizona)—a population that includes several hundred animals, through the movement of many wolves dispersing both north and south—would serve as the arch stone for a metapopulation of wolves (a population of populations) extending from the High Arctic to Mexico.



Reestablishing the gray wolf in western Colorado represents the last step for restoring the species from the High Arctic to the Mexican border. Credit R. P. Reading, B. Miller, A. L. Masching, R. Edward, and M. K. Phillips (eds), *Awakening Spirits: Wolves in the Southern Rockies* (Golden, CO: Fulcrum Publishing, 2010).

Why does this matter? There is no other region in the world where one can imagine the restoration of a large carnivore species across such a sweeping continental landscape (figure 6.2). On this, the dean of wolf biologists, Dr. L. D. Mech, observed, "Ultimately then restoration to western Colorado could connect the entire North American wolf population from Minnesota, Wisconsin, and Michigan through Canada and Alaska, down the Rocky Mountains and into Mexico. It would be difficult to overestimate the biological and conservation value of this achievement."[17]

CONSEQUENCES OF RESTORATION

If wolves were restored to western Colorado, some people would be anxious about the consequences. Why? There is the persistent notion, based nearly exclusively on myths, that wolves are a threat to human safety, livestock, and big game hunting. Indeed, if we have learned anything from the last fifty years of wolf conservation it is that the species affirms the power of myths. But the real wolf is a mere shadow of what people conjure it to be. The following summary aims to set the record straight on the basics of the interactions between wolves and humans, big game, and livestock. For those interested, M. K. Phillips et al. (2010) offer a more detailed assessment.[18]

Wolves and Human Safety

Despite overwhelming evidence that wolves do not pose an acknowledgeable threat to humans, many find this fact hard to accept. Perhaps this is because wolves are large predators and in superficial respects are doglike; probably nearly everyone has had at least one, if not several, negative, nerve-rattling encounters with dogs. In reality, though, wolves represent an infinitesimal threat to human safety.

The Alaska Department of Fish and Game considered this issue extensively and documented only twenty-eight cases of humans being injured by wolf attacks since 1890, even though more than sixty thousand wolves exist in Alaska and Canada. In North America, from 1900 to 2000, no healthy wolf killed a human being.[19] However, it is worth noting that wolves may have killed a Canadian man in northern Saskatchewan in 2005, although some experts concluded that the actual culprit was a black bear. More clearly, in 2010 wolves killed a woman jogging alone in a very remote part of Alaska. The final report from the investigation of that tragedy concluded, "Jogging alone and other solo activities in remote parts of Alaska entail inherent risk, but an attack by wolves is not considered to be a risk commensurate with bear attacks, inclement weather or personal injury."[20] These two cases notwithstanding, M. E. McNay concluded that wolves represent very little threat to human safety.[21]

It is useful to note the absence of dangerous interactions between humans and wolves in Minnesota, Michigan, and Wisconsin even though approximately 22 million people live in those states alongside about four thousand wolves. It is useful to note that about 19 million visitor days have been recorded in the Superior National Forest—always a stronghold for wolves—without any wolf attacks. Additionally, millions of visitor days have been recorded without incident at national parks and wilderness areas in Canada, Alaska, and the northern Rocky Mountains. Consider camping in Yellowstone Park. From 1995 to 2014, there were nearly 2.6 million tent-camper overnight stays in the park's developed campgrounds and backcountry sites. During this period, no camper was injured by a wolf despite the fact that an average of 115 wolves were distributed in eleven packs throughout the park.

Nearly all wolves are shy and avoid humans. Encounters between the two are rare, and those that do occur typically have been a result of mistaken identities, defensive reactions, habituation, or a person getting between wolves and a dog they were attacking.

Lightning strikes, bee stings, car collisions with deer, inclement weather, or random shootings all represent a much greater threat to human safety than wolves. Nonetheless, wolves—like bears, cougars, and coyotes—are wild animals and should be respected as such. If wolves were ever restored to western Colorado, a big part of such respect would involve following simple guidelines (e.g., see www.wolf.org/wolf-info/basic-wolf-info/wolves-and-humans) for reducing the potential for conflicts between humans and wolves.[22]

Wolves and Big Game

When considering the wolf as a predator of big game, it is important to acknowledge that it is not a wanton killer able to exercise its will on a whim. Indeed, life for a wolf is a nearly constant struggle to survive.

On average, a wolf needs to consume seven to ten pounds of sustenance (meat, fat, minerals, vitamins) on a daily basis to maintain itself in good condition. Typically this is hard to do. Wolves often go for days with no food. Feast or famine is the wolf's modus operandi. Starvation is a common cause of death.

Not surprisingly, reliable studies have revealed that hunting by wolves is an endeavor overwhelmingly characterized by failure. Typically 80 percent or more of hunting attempts end unsuccessfully.[23] In the constant battle between predator and prey, wolves typically lose. They survive, despite long odds, because they refuse to give up. They are doggedly determined.

It is fair to conclude that a wolf is kept fed by its feet. They are willing and able and often must travel considerable distances to find prey that is somehow predisposed to predation. (Wolf pack territories commonly extend across hundreds of square miles or more.) Yet they do find such prey and by doing so, remove the young and old; the weak, sick, and infirm; and the unlucky. Wolves relentlessly shepherd their prey.

Hunting is a dangerous endeavor, and injuries are common. In a study of 225 skulls from wolves shot by the Alaska Department of Fish and Game and examined by Phillips, 25 percent revealed injuries (e.g., broken jaw, nose, skull) from blunt force trauma caused by escaping prey animals. Rolf Peterson has studied wolves on Isle Royale National Park since the early 1970s; nearly every wolf he has examined has shown similar traumatic injuries, many of which were caused by a moose in defense of its life.

It is important to acknowledge the wolf's difficulty in using just its teeth to kill a prey animal that is typically much larger than itself. It may be surprising given wolves' reliance on predation, but they are not particularly well designed physically for the task. D. R. MacNulty, D. R. Stahler, and D. W. Smith considered this lack of specialization and wrote, "In general, wolves lack a specialized skeleton for killing."[24] Its front-most teeth—the incisors and canines—are their only tools for grabbing and subduing prey, and these wear out with age.[25] Also, its skull is not mechanically configured to deliver a killing bite like other mammalian carnivores such as cats and hyenas. Specifically, a relatively long snout reduces the force of jaw-closing muscles that is extended at the canine tips during the bite.[26] In addition, the joint where the jaw connects to the skull does not allow the jaw to be locked or heavily stabilized when biting prey.[27] Wolves also lack retractile claws and supinating, muscular forelimbs, which precludes them from grabbing prey as other large carnivores (e.g., cougars and grizzly bears) do.

Despite the difficulties and dangers of hunting and the lack of specialized physical traits to overcome them, wolf predation still has the potential to sharply influence the population dynamics of prey species. Often this potential, even with no reliable evidence that it has been realized, prompts cries to reduce wolf numbers to allow game populations to increase in size. In this regard, Alaska has a long history of killing wolves specifically to address concern over ungulate populations, with mixed success.[28] Notably, few such conflicts have arisen in wolf range in the continental United States. In the western Great Lake states, for example, where white-tailed deer (*Odocoileus viginianus*) are the primary prey, wolf predation does not usually negatively affect hunter harvest.

In the Northern Rockies, where elk and deer are also important prey and wolf recovery has occurred in areas that support cougars (*Puma concolor*), bears (*Ursus* spp.), and coyotes (*Canis latrans*), wolf predation, as one of many mortality factors affecting elk and deer survival, may negatively affect hunter harvests.[29] On this possibility for western Montana, which is a reasonable analog for western Colorado, S. Hazen wrote, "Using the current data available wolves are not having a significant effect on elk harvest in Montana. On the other hand, they are shifting demand in the southwest region from areas in close proximity to the border of Yellowstone National Park to areas farther away."[30]

There remain outstanding opportunities to hunt elk and deer in Montana, Wyoming, and Idaho even though the region supports about 1,500 wolves. In Montana, for example, a state that supports about five hundred wolves, the majority of the elk management units are at or over the population objective established by the state game department; many of these units support wolves. In 2016 Montana took the unprecedented step of adding shoulder seasons to the regulations for nearly a third of the state's hunting districts (many of which support wolves) because of an overabundance of elk.

Despite claims to the contrary, wolves have not brought about a reduction in or an end to big game hunting in the northern Rocky Mountains.

What could Colorado big game hunters expect if several hundred wolves occupied the western half of the state? While it is notoriously difficult to reliably predict the specific effects of wolf predation on any localized elk or deer herd, it would be reasonable to expect some reduction in their numbers in specific areas where many native carnivores (e.g., wolves, bears, cougars, and coyotes) and humans vied for the same prey, winter weather was severe, or the herd was small and isolated. It is important to note that in a setting that supports many native carnivores, adding one more does not necessarily mean a direct increase in predation pressure on local ungulates. Recent meta-analyses of more than two thousand elk calves across the northwestern United States reveal compensatory mortality between predator species in calf survival.[31]

For all these factors, and as is the case in the Northern Rockies, it is most reasonable to expect that the persistently large numbers of deer and elk in Colorado could support gray wolves and recreational hunters.

Despite being a concern to some hunters, wolf predation has the potential to generate ecological benefits. By tending to kill prey that are somehow predisposed to predation, wolves help to cleanse big game herds of the maladies that inevitably affect them.[32] Take old age, for example. By differentially selecting older prey, many of which are past their reproductive prime, wolf predation can help minimize competition within members of a game herd for nutritious forage. Chronic wasting disease (CWD), a fatal neurological disorder that has no cure, can kill large numbers of deer and elk and curb enthusiasm among hunters. For obvious reasons, chronic wasting disease is a great concern to big game managers and hunters. That the disease is becoming more widespread geographically—and now includes Colorado—and its prevalence is increasing among ungulate populations adds to everyone's angst.

The presence of the disease has precipitated draconian control efforts. For example, after finding chronic wasting disease in white-tailed deer in 2002, the Wisconsin Department of Natural Resources killed thousands of deer through 2006 and spent $27 million to control the disease. The report from a chronic wasting disease workshop identified predators (wolves and coyotes) as one additional element that could limit the disease. The absence of predators may allow sick animals a longer period in which to spread chronic wasting disease. M. A.

Wild et al. concluded "that as CWD distribution and wolf range overlap in the future, wolf predation may suppress disease emergence or limit prevalence."[33] Notably, it is live infected elk, deer, and moose (*Alces alces*) that replicate and spread the malformed protein responsible for the disease; dead animals do not.

Because wolves are coursing predators that typically chase prey over some distance, they would be especially adept at detecting and killing animals in poor health from chronic wasting disease. M. A. Wild et al. concluded "that as CWD distribution and wolf range overlap in the future, wolf predation may suppress disease emergence or limit prevalence."[34] Studies suggest that wolf predation of overcrowded elk in Rocky Mountain National Park, where an estimated 10 to 13 percent of the elk are infected with chronic wasting disease, could eliminate or greatly reduce the incidence of the disease.[35]

It has been said that wolves are ecological engineers because of predatory habits that can cause a ripple of effects—a trophic cascade—that give shape and functionality to an ecosystem that would not exist otherwise. How? The classic view of a trophic cascade is one in which predators reduce the density of their herbivore prey with repercussions on plant production and important consequences for many species. How does it work? Simply put, more wolves can mean fewer prey with altered behavior, which can lead to more plant biomass and, in turn, greater biological diversity. It has been known for decades that a reduction in prey numbers due to wolves can facilitate a release of vegetation that the prey feed on.[36] This was the essence of Leopold's seminal essay "Thinking Like a Mountain":

> *Since then I have lived to see state after state extirpate its wolves. I have watched the face of many a newly wolfless mountain, and seen the south-facing slopes wrinkle with a maze of many new deer trails. I have seen every edible bush and seedling browsed, first to anemic desuetude, and then to death. I have seen every edible tree defoliated to the height of a saddle-horn. Such a mountain looks as if someone had given God new pruning shears, and forbidden Him all other activities. In the end the starved bones of the hoped-for deer herd, dead of its own too-much, bleach with the bones of the dead sage, or molder under the high-lined junipers. I suspect just as a deer herd lives in mortal fear of its wolves, so does a mountain live in fear of its deer.*[37]

While the existence of trophic cascades is well documented,[38] identifying the presence and architecture of any specific one can be exceedingly difficult and typically requires assessing the importance of predation and herbivory on the population dynamics of many interacting species. As R. O. Peterson et al.

pointed out, "This, in turn, requires data that are difficult to collect and inferences about cause-and-effect that are difficult to make and easy to get wrong."[39]

In the well-studied wolf-elk system in the northern portion of Yellowstone, it has been postulated that the reduction in elk numbers and changes in their behavior due to wolf predation have led to renewed growth in willow and aspen, which has led to an increase in beavers, songbirds, and other species, as well as changes in waterways. In a summary of twenty-four studies in Yellowstone involving wolves, elk, and plant species such as aspen, cottonwoods, and willows, Beschta and Ripple wrote:

> *The multi-decadal absence of wolves allowed native ungulates, principally elk, to assume a dominant role in altering the composition, structure, and function of riparian plant communities . . . in which native species biodiversity and ecosystem services decline. . . . [R]esearch results following wolf reintroduction are generally supportive of the concept that the contemporary large carnivore guild is increasingly, via a trophic cascade, mediating the effects of elk herbivory on riparian plant communities. The reduction in elk herbivory has thus been helping to recover and sustain riparian plant communities in northern Yellowstone, thereby improving important food-web* [sic] *and habitat support for numerous terrestrial and aquatic organisms.*[40]

The potential for wolf predation to cause or contribute to a trophic cascade is a function of wolf density, distribution, and persistence. To serve as ecological engineers, wolves must be common enough for a long enough period of time to sufficiently change the demographics and behavior of prey to cause the changes in patterns of herbivory necessary for a trophic cascade. As L. D. Mech observed, this probably is why the trophic cascades attributed to wolves come from studies conducted in national parks, areas where wolf densities can achieve levels necessary for inducing trophic cascades. In a cautionary warning about overextending understanding of wolf ecology, Mech concluded, "Thus to whatever extent the findings [of wolf-induced trophic cascades] are valid, they apply to National Parks and not necessarily elsewhere . . . To the extent that wolves in National Parks do influence lower trophic levels, for them to do so outside of parks, their population would have to reach natural densities for long periods. Because wolf populations will almost always be managed outside of National Parks . . . their densities will probably never consistently reach the densities of wolves in National Parks."[41]

Because of insufficient density of wolves across much of their occupied range and myriad other factors, trophic cascades do not follow wolves wherever they go. It is nonetheless important to note that the conclusions reached by researchers in Yellowstone and Isle Royale National Parks are consistent with those reached by researchers working in northern Wisconsin as well as Banff and Olympic National Parks.[42] It is not unreasonable to expect that wolves could have a similar effect on the ecology of Rocky Mountain National Park, an area the supports an elk population in need of chronic and aggressive management to minimize the continued degradation of aspen and willow communities and consequent biodiversity.

When considering the ecological consequences of wolf restoration, a few words about wolf-coyote interactions are in order. Wolves regularly kill coyotes, and this sometimes can precipitate a population reduction. This is not part of a trophic cascade per se, since coyotes are not an important prey item even though wolves will sometimes consume them. (The word *trophic* specifically relates to feeding and nutrition.) Nonetheless, killing coyotes is another way that wolves can engineer ecosystem changes. With fewer coyotes, predation pressure on the medium- and small-sized mammals on which they subsist is reduced. This has the potential to alter the trophic system by bringing about increases in the distribution and abundance of small herbivores like rodents and rabbits with concomitant benefits to predators, from red foxes and badgers to raptors. But as with trophic cascades, the magnitude of the consequence of wolves killing coyotes depends on wolf population density and persistence. The resilience and resourcefulness of coyotes is also worth mentioning; their populations are notoriously difficult to control. Even in Yellowstone National Park, where shortly after the wolf's return the species had caused a noticeable reduction in the number of coyote packs, that number has returned to pre-wolf levels.[43]

Wolf predation can be a powerful ecological force capable of affecting the interactions of numerous animals and plants and the consequent structure and function of ecosystems. Thus, the preservation or restoration of gray wolves can be important actions for helping to maintain the diversity and resiliency of wildland ecosystems. From a purely biological diversity perspective, which is increasingly important as the sixth great extinction crisis to confront the planet tightens its hold, a laudable goal of conservation could be to establish ecologically effective populations of wolves wherever possible.[44] On this, Beschta and Ripple wrote, "Results from Yellowstone, other areas in western North America, and around the world increasingly point to a need for recovering ecologically effective populations of large predators to help recover or maintain biodiversity in ungulate populated landscapes."[45] Other important scientific investigations favorably view large carnivores, like wolves, as essential to the integrity of ecosystems.[46]

While the potential for wolves to promote the ecological health of landscapes favors their return to Colorado, any ecosystem response to the wolf's return would take decades to unfold and be greatly influenced by the number of wolves involved and their persistence in specific areas.

Wolves and Livestock

Conflicts between wolves and livestock and their resolution are typically controversial. Even though wolf depredations are relatively uncommon—it is the atypical wolf that kills livestock—the public expects immediate and certain action to resolve problems when they do arise, especially those that occur on private land. For example, as the wolf population in the Northern Rockies increased over the last twenty-nine years, the number of wolves killed to resolve conflicts with livestock increased from 4 animals in 1987 to 168 animals in 2015.[47]

Such frequent control, however, belies the actual magnitude of the wolf-livestock problem. Over the last twenty-nine years in the Northern Rockies, the average annual number of confirmed livestock losses to wolves included 78 cattle and 156 sheep.[48] In response, eighty-four wolves on average were killed. To put the magnitude of these livestock losses in perspective, using 2010 as a typical year, cattle producers in Montana, Wyoming, and Idaho reported losses of 198,800 cattle to non-predator causes like digestive problems, respiratory problems, metabolic problems, mastitis, lameness or injury, and diseases.[49] In other words, average wolf-caused cattle losses amounted to 0.03 percent of the cattle lost to other causes in 2010.

Or take 2014, another typical year for wolf-livestock interactions in the Northern Rockies.[50] During that year, Montana, Idaho, and Wyoming collectively supported nearly 6.9 million cattle and sheep and 1,657 wolves. Confirmed wolf depredations for the year included 136 cattle and 114 sheep, or a minuscule fraction of the total populations (cattle [0.0023 percent] and sheep [0.0208 percent]) (table 6.1). In response, 161 wolves were killed, or about 10 percent of the population. Additionally, ranchers were paid nearly $275,000 in compensation for their losses.

It is important to acknowledge that more livestock are lost to wolves than are verified.[51] To promote fairness, livestock-compensation programs should include an upward adjustment if payments are solely based on confirmed wolf-killed cattle.

Table 6.1. Cattle and sheep in Montana, Wyoming, and Idaho in 2014 and confirmed depredations by wolves.

Year 2014	*Cattle*	*Sheep*
Montana	2,550,000	220,000
Idaho	2,240,000	260,000
Wyoming	1,270,000	335,000
Total population	6,060,000	815,000
Total confirmed wolf depredations	136	114

A proper assessment of the interaction between wolves and livestock goes beyond a simple accounting of livestock deaths. For example, a persistent concern exists in the Northern Rockies that wolves can affect the weight gain of domestic calves because wolves can routinely encounter and stress, but not kill, domestic livestock.[52] However, a reliable study of this issue for eighteen ranches in Montana found no evidence that wolf packs with territories that overlapped them had any detrimental effects on calf weight.[53] But just as importantly, they found that for ranches that experienced a confirmed depredation by wolves, the average calf weight declined by 3.5 percent (about twenty-two pounds) across the herd, possibly due to inefficient foraging behavior or stress to mother cows. (They also concluded that ranch-specific husbandry and climatological factors were much more important for determining calf weight than wolves.) J. P. Ramler et al. concluded, "Although this may not seem like a large loss, it is not economically insignificant. Given that the average compensation for a wolf depredation is $900 per cow, the uncompensated estimated indirect loss for the average ranch was approximately 7.5 times the compensated loss."[54] As with unconfirmed livestock losses by wolves, compensation payments should be adjusted upward to account for a reduction in weight gain of calves when depredations are confirmed.

It has always been a challenge for ranchers to reduce the death of livestock (from a variety of causes) and ensure sufficient weight gain before animals are slaughtered for profit. But for the vast majority, wolves do not influence that challenge.

Because of the infrequent nature of wolf depredations, the impact from those that do occur is too small to be of consequence to the economics of the livestock industry. Nonetheless, if not addressed quickly, wolf depredations and related problems can cause significant problems for individual producers and create great animosity toward wolf recovery.

Many livestock producers have cooperated with recovery because they believe that wolf-induced problems will be resolved quickly and equitably.

Monetary compensation for livestock losses has proven useful in this regard and for minimizing animosity toward wolves. Lethal control of wolves has also proven useful in attenuating opposition to wolf recovery, even though legalized killing of carnivores to prevent livestock loss does not have a strong record of effectiveness and in some cases can have a counterproductive effect.[55]

Besides compensation and killing wolves, other tools and approaches can be useful for preventing and minimizing encounters between wolves and livestock, including releasing older and larger calves to pasture (small calves are most vulnerable to wolves), keeping vulnerable calves in lighted yards or close to human buildings, altering grazing regimes, and deploying ranger riders, guard dogs, sound devices, and fladry (flagging). A number of conservation organizations are willing to provide assistance to promote coexistence between livestock and wolves.

THE FUTURE

Gray wolf restoration remains a controversial and divisive issue. Consequently, the species continues to be restricted to about 15 percent of its historical range despite an abundance of suitable but unoccupied habitat, most notably in western Colorado. The best conservation science instructs that the widespread absence of this important species creates a problem of simplification for nature. The big, bold idea of restoring the wolf remains a viable solution to this problem. In one fell swoop, wolf restoration could help to revitalize biologically compromised landscapes and move the world forward by reminding humanity of the wondrous diversity of life on earth and our undeniable capacity to restore it.

The legal backdrop that strongly favors restoration and the knowledge gained from previous reintroduction projects affirm that western Colorado is an ideal area to restore the species to its rightful place as an essential and fascinating part of our nation's ecological past and future.

To advance this future, the Rocky Mountain Wolf Project (RMWP) (figure 6.3) was launched in March 2016 to improve public understanding of gray wolf behavior, ecology, and restoration options of relevance to western Colorado.

The RMWP intends to

- Disseminate science-based information about wolves and dispel existing myths.
- Engage Coloradans about the reality of coexisting with wolves, including ways to mitigate the effects on hunters, ranchers, and others concerned about wolves.
- Cultivate enthusiasm among Coloradans about returning wolves to the western half of the state.

ROCKY MOUNTAIN WOLF PROJECT

RESTORING COLORADO'S NATURAL BALANCE

The Rocky Mountain Wolf Project (www.rockymountainwolfproject.org) is an outreach effort based on the belief that education advances the restoration of the gray wolf to western Colorado.

The RMWP recognizes that wolf restoration is framed by several key elements:

- Wolves were native to Colorado, having once existed across the state, but were rendered extinct by the 1940s.
- Wolves were, and could be again, an integral part of the ecology of western Colorado, helping to restore the state's natural balance.
- Successful wolf projects in places like Yellowstone National Park demonstrate that a gradual reintroduction of wolves can be done safely, effectively, and humanely and with great certainty lead to the restoration of a viable population.
- Reliable science has shown that wolves do not represent a threat to humans or a burden to the vast majority of ranchers.
- Because natural recolonization is unlikely, reintroducing a small number of wolves to western Colorado is the only certain way to reestablish a viable population that can be managed in a manner respectful of the needs and concerns of Coloradans.

The RMWP is supported by a community of individuals and organizations—from wildlife biologists to landowners to conservationists—dedicated to returning the wolf to western Colorado. The organization is based on the belief that wolf restoration advanced through education encourages thoughtful public conversations with all stakeholders, including ranchers and sportsmen.

The work of the RMWP—especially if successful at reestablishing the wolf in western Colorado—could help fix a narrative that is vastly different from the one that has defined our activities since the first Homo sapiens huddled around fires and swapped stories hundreds of thousands of years ago. What would this new narrative be? A restorative and affirming relationship with nature rather than an exploitative and destructive one is possible.

From the Flat Tops Wilderness and surrounding parts of the White River and Routt National Forests in northwestern Colorado to Rocky Mountain National Park and adjacent Roosevelt National Forest on the east side, to the Weminuche Wilderness and surrounding parts of the San Juan National Forest in the southwestern part of the state, and everything in between—including the Grand Mesa, Uncompahgre, and Gunnison National Forests—the western half of Colorado is a mother lode of restoration opportunity for the wolf. If the US Fish and Wildlife Service or Colorado Parks and Wildlife ever set their mind to conducting reintroductions in western Colorado, restoration of a self-sustaining population of wolves would be as certain as water running off a duck's back.

Like few other species, the gray wolf elicits strong emotions and serves as an ideal lens for examining why humanity struggles with, dominates, and destroys wild places and wild things at an ever-increasing rate and at its own peril. Restoring wolves, the terrestrial carnivore most persecuted by humans, has a transcendent power to make clear that we can choose to have a beneficial and accommodating relationship with Mother Earth rather than a destructive and exploitative one.

With the sixth great extinction ripping creation apart at the seams, it is important to note that a Colorado wolf project would illustrate that restoration is an alternative to extinction. As this crisis tightens its grip on the planet, thus compromising all that is important, such an illustration is sorely needed and long overdue. Maybe, just maybe, a Colorado wolf restoration project would help to catalyze the foundational work to save creation.

If you are a person of faith, any work to save creation should be motivational. Loving the Creator should be synonymous with loving the creation. Or conversely, if you're a secular humanist who above all else believes in facts, logic, and empiricism, then the best science tells us that healthy, diverse landscapes that support more rather than less biological diversity are essential to humanity's well-being. Regardless of your moral compass, everyone should support efforts to arrest the extinction crisis. Wolf restoration is one such effort.

With sufficient time and engagement, a Colorado wolf project could help bring about a society that places a premium value on life. Such a society could give rise to a human nature that follows suit. Such a human nature is profoundly important since it would represent a bending of the sordid history of Homo sapiens with the rest of the natural world across the long sweep of time. Without such a bend, future prospects for most life remains bleak.

As reasoned by Durward Allen, an early pioneer in wildlife conservation and the founder of the seminal Isle Royale wolf-moose project: "Impartial sympathy toward all creatures, regardless of their diet, is an attitude of the cultivated mind. It is a measure of a man's civilization. If ever we are to achieve a reasonable concord with the earth on which we live, it will be by our willingness to recognize and tolerate . . . the biological forces and relationships . . . in the living things about us."[56]

The path for restoring the gray wolf to western Colorado is straightforward and quickly navigated. A wolf population there would serve as the last piece of a forty-year puzzle to reestablish the species from the High Arctic to Mexico. Nowhere else in the world does such an opportunity exist to restore an iconic, unfairly maligned animal across such an inspiring and continental landscape. For those who celebrate the importance of wild and self-willed nature, it is an opportunity that must be seized (figure 6.4). Once accomplished, a Colorado wolf restoration project would help to illuminate a new relationship with nature, one that is restorative and accommodating and advances peace, prosperity, and justice for all life.

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