



National
Wildlife
Federation

A Review of

Lessons Learned to Inform Colorado Wolf Reintroduction & Management

by Diane Boyd

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Wolf recovery has been ongoing in a number of states for four decades, and Colorado can benefit from the lessons learned.

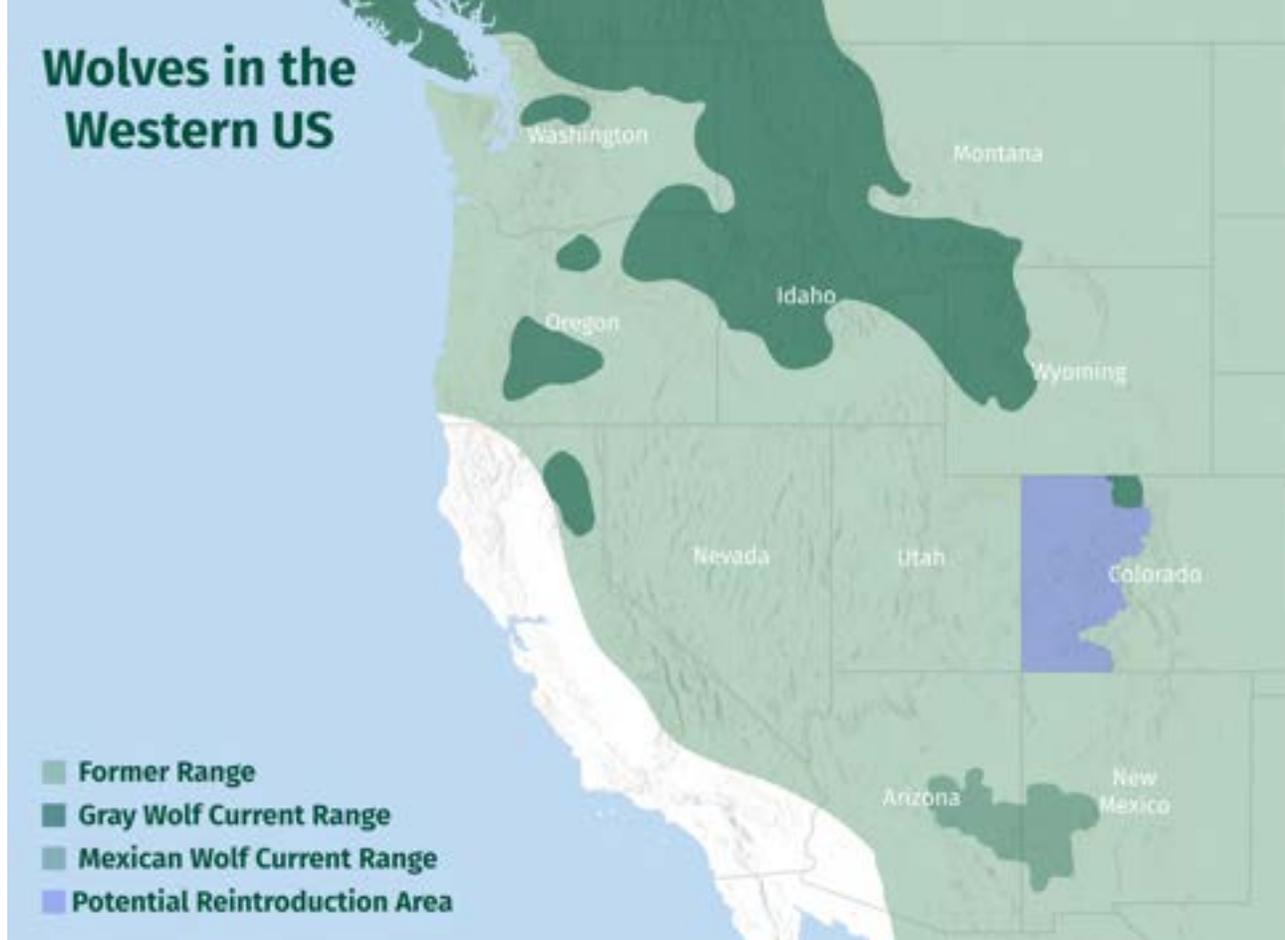
Introduction

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This review will provide science-based information to the Colorado Parks and Wildlife Commission (PWC), stakeholders, agencies and the general public on gray wolf reintroduction, management and the human-driven processes necessary to help wolf recovery succeed. Based on the best biological and social information available, this review provides a thorough analysis of the processes involved and lessons learned in other states: what worked, what didn't, and why. The goal is to encapsulate experience from gray wolf restoration processes across the U.S. to enrich present and future wolf recovery efforts in Colorado.

After nearly being exterminated in the lower 48 states, gray wolves (*Canis lupus*) have returned to some western and midwestern landscapes through both natural dispersals and human-designed reintroductions. While humans have been wrestling with the who, how, where, what and why of wolf recovery, wolves have grabbed a solid toe hold and recolonized portions of their former habitat. Their return has been controversial, but their resilience has helped them meet or exceed recovery goals in MT, ID, WY, MN, WI and MI, with populations expanding in WA, OR, CA and CO (Figure 1 and 2). However, as Colorado experiences both natural dispersal (Figure 2, p.16) and active reintroduction of wolves before the end of 2023 as mandated by a recent voter initiative, Colorado wildlife managers and stakeholders face a critical question: what are the information needs and social considerations to enhance wolf management and the long-term viability of wolves in Colorado? The good news is that wolf recovery and associated management has been ongoing in a number of states for four decades, and Colorado Parks and Wildlife (CPW) can benefit from the lessons learned and the experience gained in other states where wolves are recovering. While credible scientific data and sound biological research are critical to wolf management, sustainable wolf recovery is, and always will be, more about social issues related to wolves than it is about wolf biology.

Wolves in the Western US



Historical Perspective

Wolves have existed in North America for hundreds of thousands of years. Native American Tribes, as the original inhabitants of North America, coexisted with wolves for millennia before European settlement. As Europeans settled in the United States, they brought centuries of human-wolf intolerance and actively persecuted wolves. As Europeans moved into the western U.S., settlers and market hunters also hunted

For any of the successful wolf recovery efforts, many different perspectives were considered and compromises made on all sides of the issues.

bison, pronghorn, deer and elk extensively and ungulate (hooved wildlife) populations were decimated to the point of near extinction in some areas¹. As bison and other ungulate populations were depleted across the western U.S., millions of cattle and sheep were populating the landscape. Wolves increasingly turned to livestock as prey, catalyzing government wolf hunters and trappers

to pursue extirpation campaigns against wolves that succeeded in removing every wolf in the lower 48 states west of the Mississippi River in just a few decades. By the 1940s, wild wolves were completely removed from Colorado² until wolves were observed naturally entering the state between 2004 and 2020³.

Social Values

Human perceptions about wolves can be more polarized than almost any other wildlife issue on the planet. And yet, wolves have begun to recover in many areas across the U.S. For any of the successful wolf recovery efforts, many different perspectives were considered and compromises made on all sides of the issues. Given the social considerations of living and working with wolves, in most landscapes the number of wolves is influenced more by the capacity of humans allowing them to exist than by available habitat.

Building social tolerance may be the best path forward to ensuring sustainable wolf populations. But who should be tolerant of what? Proponents of wolf recovery ask the ranching and hunting communities to become more

tolerant of the presence of wolves as a natural predator while viewing wolves as a critical ecological, aesthetic and sometimes spiritual component of the western landscape. Ranchers want the public to recognize the direct impacts of wolves to their livelihood and to tolerate legitimate tools to address wolf-livestock conflicts, including occasional removal (e.g., lethal control) and compensation for economic losses. The majority of voters supporting wolf reintroduction in Colorado are not ranchers, and will not likely suffer economic impacts from wolves returning, while ranchers will likely bear the direct costs and indirect impacts of living and working with wolves.

Some in the hunting community feel that the return of wolves will negatively impact elk, deer and moose herds, along with the hunting opportunities, family traditions and rural businesses that depend on them. An extensive body of wolf-prey research⁴⁻⁸ shows that, while wolves can have negative impacts on prey populations over short periods, large-scale and long-term impacts to native prey populations do not occur in most states. However, these facts may be of little consolation for a hunting outfitter who depends on a particular elk herd that may be affected.

In Montana and Idaho, pressure coming from the hunting community, ranchers, livestock industry and some legislators led to the passing of laws expanding lethal control, hunting and trapping of wolves in those states in 2021.^{9,10} These bills were based mostly on social concerns, aiming to bring wolf populations down to minimum levels. Subsequently, the respective state wildlife agency biologists submitted counter-proposals based on science in an attempt to moderate these new anti-wolf laws. Ultimately, the laws were passed, reflecting eroded social tolerance for wolves in these states.

The perspectives of Tribal governments, Tribal members and Indigenous communities are also of critical importance given Tribes' ancestral connection to the land, government sovereignty, management of reservation lands and treaty rights⁶. There are numerous Tribes and Indigenous communities in the West that are sovereign nations with distinctive governments, cultures and viewpoints. Wolves have had cultural significance in many Native American tribes¹¹⁻¹² and have been considered a medicine or spiritual being with hunting prowess, courage, strength and loyalty.¹³ Some Tribes, including the Southern Ute Tribe in southwestern Colorado, have expressed hesitancy in the return of wolves due to potential impacts to their ranching and hunting traditions.¹⁴

Given the polarized situation, wolves must live somewhere in the middle ground amongst a wide range of social values including economic security, ecological balance, family tradition, spirituality and wildlife aesthetics. It is a challenging balance that all states with recovering wolf populations have wrestled with and for which there is no easy answer.¹⁵

North American Wildlife Management And Wolf Recovery Efforts

Wildlife in the United States suffered a heavy toll from over-hunting and habitat degradation in the late 1800s and early 1900s. As a result, several key laws were passed to reverse the damage and restore wildlife populations, including the Migratory Bird Treaty Act of 1918 and the Federal Aid in Wildlife Restoration Act of 1937. These acts inspired the creation of the North American Model of Wildlife Conservation¹ that recognized wildlife as a public trust resource, independent of where the wildlife live, managed by government entities based on sound science for the good of all residents to ensure the long-term sustainability of wildlife populations.

A general increase in support for wildlife conservation in the first half of the 20th century resulted in the passage of the federal Endangered Species Preservation Act of 1966, which later became the Endangered Species Act (ESA) in 1973. The ESA granted full protection to gray wolves as an endangered species in 1974 throughout the contiguous 48 states giving the federal government the jurisdiction over the recovery of wolves. Since then, Mexican wolves (*Canis lupus baileyi*) have been listed as a unique subspecies,





Photo Credit: Kira Cassidy

mandating that the U.S. Fish and Wildlife Service (FWS) conserve the unique genetic subspecies whose historical range is in Arizona, New Mexico and Mexico.¹⁶ Gray wolves throughout the rest of the lower 48 states have been federally delisted and relisted repeatedly, most recently being federally relisted throughout much of the lower 48 states based on a federal court ruling on February 10, 2022.¹⁷ Wolves in Colorado are listed on the [Colorado Endangered Species List](#) [Article 2, Title 33, 33-1-102(12)], meaning that “take” (e.g., harassment, harm, pursuit, hunting, shooting, wounding, killing, trapping, capturing, or collecting) of wolves in Colorado is prohibited except for scientific purposes, to protect human health or alleviate property damage and only if authorized by the Colorado Parks and Wildlife Commission. However, as of the publication of this report, the Commission has approved a regulatory change that would permit various non-lethal methods that could be employed by livestock ranchers or agency personnel to haze wolves away from livestock, contingent upon federal approval.

When the Endangered Species Preservation Act was passed in 1966, Minnesota and Michigan, were the only states outside of Alaska that had a resident wolf population. The first human-aided reintroduction of wolves in the world occurred in Michigan in 1974, proving that wolves could be reintroduced and establishing the standards for later reintroductions.

Further west, wolves began dispersing south from Canada in the late 1970s and 1980s and began to reproduce in northwest Montana.¹⁸ As Montana’s wolves were expanding across western Montana and Idaho, federal agencies developed plans to reintroduce wolves in the northern Rockies. To allow for more proactive management of reintroduced wolves, Senators from Idaho (Sen. James McClure, R) and Wyoming (Sen. Alan Simpson, R) advocated successfully for wolves to be reintroduced as “nonessential experimental” populations, separate from the wolves dispersing into the US from Canada, under the ESA’s 10(j) rule. The senators wanted to ensure that there would be flexible management options to address



wolves that killed livestock and potentially impacted ungulates, while still affording some protections to the reintroduced populations.

A total of 66 wolves from Canada were reintroduced by the FWS and the National Park Service into Yellowstone National Park (YNP), and by the FWS into central Idaho in 1995-96.¹⁹ Over the next two decades, these wolves dispersed into adjacent states and beyond, rapidly connecting wolf populations across a large area of the West (Figure 1) more quickly than predicted by the original federal planning documents.²⁰ Currently, there are approximately 3,000 gray wolves living in the western U.S. (Tables, 1 and 2). Mexican wolves were first reintroduced into Arizona and New Mexico in 1998.^{21, 22} Twenty-three years after reintroductions began, a minimum of 186 Mexican wolves exist in Arizona and New Mexico combined ²², with more in Mexico.

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Proposition 114 required the CPW Commission to:

- **Restore and manage gray wolves in Colorado**
- **Hold statewide hearings**
- **Periodically obtain public input**
- **Use state funds to fairly compensate livestock owners and assist in preventing conflicts with gray wolves.**

Colorado's Unique Opportunity

Wolves from Wyoming and Montana are confirmed to have entered Colorado multiple times since 2004 (Figure 2), including a pair that produced at least six pups in north-central Colorado in 2021. These naturally dispersing wolves coincidentally entered Colorado shortly before Colorado voters narrowly passed Proposition 114 (Prop 114) requiring the reintroduction of wolves to the state, which passed by less than a 2% margin in 2020 (~70,000 votes). Prop 114, now codified as Colorado Revised Statute 33-2-105.8, requires the CPW Commission to: 1) restore and manage gray wolves in Colorado no later than December 31, 2023, on designated lands west of the Continental Divide, 2) hold statewide hearings about scientific, economic and social considerations, 3) periodically obtain public input to update the plan and 4) use state funds to assist livestock owners in preventing conflicts with gray wolves and pay fair compensation for livestock losses.

Colorado has existing guidance for managing naturally dispersing wolves that comes from the "Findings and recommendations for managing wolves that migrate into Colorado" developed by a 14-member working group of livestock producers, wildlife advocates, wildlife biologists, hunters and local government officials in 2004.²³ This management plan was adopted by the Colorado Parks and Wildlife Commission in 2005 and reaffirmed in 2016. However, this plan did not discuss reintroduction and will be replaced by the Wolf Restoration and Management Plan that will result from the planning process required by Prop 114. The process to develop this plan is being managed by CPW, is being advised by a 17-member Stakeholder Advisory Group (SAG) and an 18-member Technical Working Group (TWG) and will be considered for adoption by the Parks and Wildlife Commission. Initial scoping for this plan included extensive public outreach through more than 40 public meetings, focus groups and online engagement opportunities.²⁴

Colorado is similar to several western and midwestern states that have had stakeholder processes prior to wolf arrival (OR, WA, CA, MN, WI) or soon thereafter (MI). Idaho's and Montana's stakeholder involvement processes occurred many years after wolves had been reintroduced, and Wyoming has not yet held a formal stakeholder process. Colorado is unique in that Prop 114 puts the burden of planning, resources, decision-making and potential public backlash squarely on the state rather than on federal agencies (although extensive consultation and perhaps approvals from federal agencies may be required for Colorado gray wolf reintroduction given the February 2022 relisting decision). In all other western states, wolf reintroductions were primarily managed by the federal government with varying degrees of consultation with the states and/or Tribes.

Social And Geographic Landscapes In Colorado

Colorado's Western Slope, where wolves are required to be reintroduced, hosts more rural communities with a higher percentage of ranchers and hunters than the more urban Front Range region. Voters in 18 out of the 22 counties that opposed Prop 114 were on the Western Slope, with multiple western counties passing resolutions against wolf reintroduction within their boundaries. In contrast, Colorado's Front Range and population center to the east of the continental divide is more urban and overwhelmingly voted to support wolf reintroduction. Colorado's urban and rural variation in perspectives is important but not necessarily unique among the western states. Washington, Oregon and Montana face similar social differences. In all of these states, reintroduction of predators may be viewed by some as an urban attempt to change rural areas, land uses and culture.²⁵

**Table 1:
Wolf status by state, as provided by various state agency annual reports 2019-2020***

State	Managed	1st wolf	Wolves in 2020	Packs in 2020	Lethal Control	Harvest	Status	Annual Cost**
Montana	FWP	1979	1,136	190	Y	Y	Species in need of special mgmt.	\$1.1M
Idaho	IDFG	1995	1,156	80-100	Y	Y	Big game, predator	\$1.3M
Wyoming	WGF	1995	311	43	Y	Y	Trophy, predator	\$1.9M
Washington	WDFW/ ODFW	2008	132/46	24/5	Y	N	Endangered Species	\$1.6M
Oregon	ODFW	2009	173	22	Y	N	Special status game animal	\$0.9M
California	CDFW	2011	9	2	N	N	Endangered Species	\$0.4M
Colorado	CPW	2004	<10	1	N	N	Endangered Species	N/A

* <https://wildlife.ca.gov/Conservation/Mammals/Gray-Wolf>

* Idaho Department of Fish and Game Wolf Report. 2020. 17 pages

* MTFWP Annual Gray Wolf Report. 2020. Inman, B., K. Podruzny, A. Nelson, D. Boyd, T. Parks, T. Smucker, M. Ross, N. Lance, W. Cole, M. Parks, and S. Wells. 2019. Montana Gray Wolf Conservation and Management 2019 Annual Report. Montana Fish, Wildlife & Parks. Helena, Montana. 106 pages. <http://fwp.mt.gov/fishAndWildlife/management/wolf/>

* Oregon Wolf Conservation and Management Plan. ODFW June 2019. 157 pages.

* Washington gray wolf conservation and management 2019 annual report. Washington Department of Fish and Wildlife. April 20, 2020. 51 pages.

* Wyoming gray wolf monitoring and management; 2020 Annual Report. <https://wgfd.wyo.gov/WGFD/media/content/PDF/Wildlife/Large%20Carnivore/WYWOLF-ANNUALREPORT-2020.pdf>

**Cost factors differ from state to state, some include livestock depredation actions and compensation, outreach, etc.

Colorado has extreme elevation and is one of only two U.S. states that lies entirely above 3,000', with the country's highest mean elevation at 6,800', and substantial territory above 10,000 feet. While stunningly spectacular, alpine tundra does not provide winter habitat to wolves' prey species such as elk and mule deer. Thus, in the fall, big game herds must migrate down from what is largely public land to lower elevation for accessible forage and shallower snow depths. When present, wolves will necessarily follow the herds out of the mountains and onto lower elevation lands that are have a higher density of private land with livestock overwintering and calving in early spring.

Wolf recovery through reintroductions and natural dispersals have been previously well-documented and analyzed.

Another feature unique to Colorado is its proximity to the Mexican wolf population in Arizona and New Mexico. Mexican wolves have limited genetic diversity²⁶, and some managers are worried about northern gray wolves interbreeding with Mexican wolves and swamping the unique Mexican wolf genes³ that have been carefully managed to maximize genetic diversity. Given the great dispersal capabilities of wolves (e.g., the 2014 dispersal of a radio-collared wolf from Cody, Wyoming to the Grand Canyon³), it is likely only a matter of time before northern gray wolves and Mexican wolves will mix and interbreed through dispersals, regardless of reintroduction plans. When Mexican wolf populations are robust enough, some amount of genetic interchange

may be beneficial to increasing diversity, but doing so prematurely could negatively influence the ambitious efforts and requirements that FWS and partner agencies are undertaking to recover this subspecies.

Learning From Previous Experience

While the return of the wolf is new to the residents of Colorado, wolf recovery through reintroductions and natural dispersals have been previously well-documented and analyzed in various state annual reports in MT, WY, ID, AZ and NM (see End Notes). Managers and biologists in these states have been monitoring their reintroduced wolf populations for more than 25 years (Table 1). Studies have documented wolf-prey interactions, wolf-predator interactions, wolf-livestock interactions, wolf-human interactions, various methods of compensation for livestock losses, most effective means to reduce livestock depredations (lethal and non-lethal), wolf-dog interactions, impacts on tourism, wolf-habitat interactions and more.²⁷ A vast reservoir of relevant research on nearly any topic imaginable is available to Colorado, including extensive lessons learned about the biological, social and procedural elements of wolf reintroduction and recovery. This report highlights top trends, themes and lessons learned through extensive expert interviews, review of gray and scientific literature, analysis of wolf management plans and other outreach. The goal is to synthesize and summarize relevant and scientifically-supported data and perspectives to provide Colorado with the best information to benefit its reintroduction efforts, with focus on western states and including notable midwestern exceptions.





Summary Information & Lessons Learned



Wolf Biology

W

olves are habitat generalists that historically lived in every habitat in North America where they had adequate year-round prey populations as evidenced by wolves having the broadest worldwide distribution of any mammal, with the exception of humans.^{28,29} Along with adequate prey, their most critical habitat requirement

is to have secure places to den and protect young pups in April and May, and to leave the pups at safe rendezvous sites in June through September (usually meadows bordered by forests) while the adults hunt. Dens and rendezvous sites are critical places for the wolf pack, and their location may determine the success of pup survival and recruitment into the pack.

Wolves live in a hierarchical society composed of a family group called a pack that is generally comprised of a breeding pair, their offspring from current and previous years, and possibly one or two unrelated adults. Packs rigorously defend their territories and will chase and kill wolf intruders, serving as a natural population control.³⁰ For example, in Yellowstone National Park, wolves killing other wolves is the leading cause of mortality. Outside of national parks, the majority of wolf mortalities are human-caused.³¹

Wolves have a fairly high reproductive rate with the ability to increase pup production in response to favorable environmental conditions. Wolves breed once per year, generally in February in the lower 48 states, producing an average of 4-7 pups³² in mid-April. However, in some ecosystems (e.g., Yellowstone) a wolf pack may have two or three breeding females producing pups simultaneously. All pack members help bring food to provision the growing pups, whose survival is primarily food dependent but may be significantly affected by diseases. The annual population growth rate is determined by a combination of many factors including the number of pups surviving past their first winter, movement of animals into or out of packs, adult survival, available prey, disease prevalence, removal by humans, etc. Throughout their range, recovering wolf populations grow until they reach the population level permitted by humans – this can be termed ‘social carrying capacity.’ In the absence of the removal of wolves by humans, the



**Figure 2:
Confirmed Colorado Wolf Sightings**

- 2004, F wolf, found dead on side of I-70, Idaho Springs
- 2007, CPW video of suspected wolf, Walden
- 2009, collared MT wolf F341, poisoned, Rifle
- 2015, black wolf on camera M935
- 2015, gray wolf shot, Kremmling
- 2019, collared WY wolf F1084, Walden
- 2019, October, pack seen, Mofatt Co, confirmed reproduction DNA tests
- 2020, January, 6 wolves confirmed by CPW, Mofatt Co.
- 2021, early February, M2101 collared, Jackson Co, traveling w/ collared F1084. Produced 6 pups in spring 2021

wolf population will grow until it reaches the ecological carrying capacity of that landscape and will remain relatively stable. The dynamics of wolf populations are driven largely by prey availability, population density of wolves and level of legal or illegal human removal.³²⁻³⁴

Beginning at the age of 2 years, approximately 10% of wolves in northern Rocky Mountain populations may disperse from their pack annually³⁵⁻³⁶ in an attempt to find other wolves and start their own packs or, infrequently, to integrate into an established pack. The average wolf dispersal distance in the Rocky Mountains is approximately 60 miles³⁵ but wolves are able to disperse 500 miles in a few weeks or months. Numerous examples have been documented of long-distance dispersals including a Great Lakes wolf that dispersed to Nebraska, Idaho wolves colonizing Washington, Oregon, and California and Wyoming wolves dispersing to Colorado (Figure 2), Utah and Arizona.

There are many questions about potential impacts of wolves on big game populations. The issue of whether predation by wolves on ungulate populations results in higher cumulative death rates remains both contentious and complicated in research efforts.³⁷ The effects of predation by wolves on ungulate population dynamics may vary widely, depending on the extent of human influence on wolves, the scale of observation, the prey species present, habitat conditions and presence/relative densities of other predators such as black bears, grizzly bears, mountain lions.³⁷⁻³⁹ Hebblewhite⁴⁰ compared wolf-prey dynamics across three well-studied ecosystems (Yellowstone, Banff, Isle Royale) and concluded that predicting the effects of wolf predation on their prey is at the edge of the limits of ecological knowledge.

Wolves tend to coexist with their prey in predator-prey dynamics that cycle up and down as nutritional availability changes for both predator and prey. Wolves and their prey species have coexisted for hundreds

of thousands of years, and thus prey species have uniquely adapted to survive wolf predation.^{28,37} Most hunting attempts by wolves results in the prey escaping to live another day, with wolves generally killing the more vulnerable, less fit individuals.^{28,37,41} If deer and elk populations decline significantly over an extended period of time, whether caused by wolves or other factors, the wolf population would likely decline before their prey could be eliminated on a large scale.³⁷⁻³⁹ However, there may be exceptions in some localized prey populations where wolves could potentially reduce ungulate numbers, and wolf presence may influence ungulate behaviors⁴² to lead to perceived ungulate population declines due to changes in where ungulates gather or travel.

In Montana, Wyoming and Idaho, wolves coexist with several other predator species including mountain lions, black bears and grizzly bears that also prey on deer and elk. Big game declines are often caused by a multitude of factors including declining habitat quality or quantity, severe winters, multiple predator species, human disturbance, diseases, etc., for which wolves may be blamed without direct evidence. Montana has had a viable population of wolves longer than all other

Social, not biological, challenges are by far the greatest for wildlife managers to address.

western states, and presently most Montana elk hunting units are at or above management population objective ([Montana Fish Wildlife and Parks, 2021](#)). There have been extensive research projects in ID⁴⁻⁵ and MT that have identified if and how wolves may have affected ungulate populations.⁶⁻⁸ These studies were conducted by the state wildlife management agencies in states with liberal wolf harvest regulations, and all of these long-term, multi-regional studies concluded that wolves were not the main cause of death on moose, elk or mule deer. For mule deer and elk, the number one cause of death was mountain lions^{4,7,8}, and for moose it was “health-related and non-predation”.⁶ Mule deer have been in decline throughout much of the western U.S. in areas with and without wolves, and the cause for this decline is multi-factored and debated at present.⁴³

The effects of wolf recovery on other aspects of an area’s ecology have also been documented. The return of wolves has often resulted in a decrease in the number of coyotes

as wolves kill and outcompete coyotes.⁴⁴ While there is speculation that wolf presence may reduce ungulate disease such as Chronic Wasting Disease (CWD), there is currently not conclusive evidence strongly supporting or refuting this hypothesis.^{2,45} The concept of wolf restoration causing compounding ecological benefits, often called trophic cascades, has been studied and debated extensively in Yellowstone and elsewhere.⁴⁶⁻⁵¹ In some areas of Yellowstone, the return of wolves has been associated with significant shrub or tree regeneration, and the return of beavers and their benefits; however, these benefits are not necessarily observed in all areas where wolves have returned. Care should be used when extrapolating results from studies inside a national park to predict what may occur on a much larger landscape subject to multiple uses such as western Colorado.

Lessons Learned

Wolves are highly adaptable, habitat and prey generalists who need three main things to survive and thrive: 1) adequate wild prey, 2) refuge for reproduction and pup rearing and 3) freedom to survive on the landscape. The social, not biological, challenges are by far the greatest challenge for wildlife managers to address. Wolves are excellent long-distance dispersers and will travel extensive distances and rapidly recolonize a landscape. Managers should expect them to expand their range relatively rapidly and prepare for them to be in areas outside reintroduction areas. All of these traits combine to make wolves a resilient species and very successful colonizers that, biologically, would be expected to have a relatively swift recovery with human social tolerance as the main limiting factor. Where wolves have recovered, there are still sustainable, huntable big game populations, but predicting the effects of wolf predation on their prey is very challenging. Wolves may impact some ungulate herds at a local scale, so close monitoring of ungulate populations is needed to discern whether wolves are a primary factor and help managers evaluate if management actions are appropriate. Presence of wolves may reduce some predator populations (e.g., coyotes) and have far-reaching ecological benefits such as trophic cascades in some locations. However, these ecological affects are not consistent across the landscape and should not be expected to occur wherever wolves are present. Additionally, there is currently no conclusive research regarding the effects of wolf presence on ungulate diseases such as Chronic Wasting Disease (CWD).

Wolf Reintroduction Logistics

Many gray wolf source populations exist for managers to select donor wolves for reintroduction, with CPW managers most likely to choose wolves from WY, ID or MT based on areas that have habitat and prey species most similar to Colorado's. Wherever wolves come from and are released, it is a certainty that many will not stay in the release area but will disperse and explore new areas as they try to find mates, return to the capture site, or find food resources.

Research does suggest that the method of reintroduction may affect the likelihood of immediate dispersal.⁵² Two methods of reintroduction releases have been used: soft release and hard release.^{19,51} Soft release entails capturing wolves and putting them into acclimation pens for approximately two months with a goal of creating a pack of wolves that would stay together, acclimate and localize in the larger landscape around the pen when they were released. This was first attempted in Michigan in 1974 and also used for the Yellowstone reintroductions, but is substantially more intensive and expensive for wolf managers. In Yellowstone, most wolves bred in the pens during captivity, and, after being released just before denning season, the pregnant females localized and dug dens immediately. For the most part, the immediate birth of pups initially kept some packs together as they quickly established a territory. However, eventual dispersal of wolves from the pack did occur and was to be expected.



Hard release occurred where individual wolves were captured, put in crates, moved to the desired release area, and immediately released without being held in a pen. This method was used in central Idaho where individuals of dispersal age (1-3 years) were selected in Canada during capture efforts. The goal was to quickly release these wolves at the edge of the Idaho wilderness to immediately disperse, eventually find other released wolves for mates, establish a territory, breed and start new packs. This approach was also successful based on reintroduction goals, with individuals dispersing quickly, establishing packs and successfully reproducing with substantially less financial and staffing investment from the managing agencies.

Adequate biological requirements for reintroduction sites primarily include proximity to denning and rendezvous sites with adequate nearby prey populations, which can be found in many locations across western Colorado. Given the abundance of biologically-suitable release sites, other factors, such as land jurisdiction which may impose additional permitting requirements or social considerations that address community concerns, are of primary importance when determining reintroduction sites.

Lessons Learned

It is important to select source wolves for reintroduction that have similar habitat and prey requirements that they will encounter in Colorado. Both soft and hard releases for reintroductions were successful in establishing wolf populations in Wyoming and Idaho, so CPW should determine which method to use based on desired biological and social outcomes, while also considering financial investments that would be necessary. Wolves that are reintroduced by soft release are somewhat more likely to remain in the area they are released. If avoiding immediate dispersal of wolves is a concern, soft release may have benefits, though requiring a substantially greater investment in financial and staff resources. With either release method, managers must expect reintroduced wolves to disperse outside the reintroduction area over time. Biologically-suitable wolf reintroduction sites are found throughout western Colorado, and social concerns are paramount in determining the success of wolf recovery. Therefore, wolf reintroduction site considerations should prioritize the social and logistical considerations such as what permits would be required on various land jurisdictions and efforts to address local community concerns, avoid creating deeper resentment and foster long-term social tolerance.



Photo Credit: Dan Stahler



Addressing and managing conflicts between wolves and livestock is a critical step in any effort to address human concerns about wolves in areas where they have the most economic impact.

Addressing Livestock Depredation

Where wolves and livestock overlap, it is almost inevitable that wolves will sometimes maim or kill (depredate) some livestock. Generally, wolves depredate on a very small percentage of overall livestock numbers and affect very few farms/ranches, but losses can be significant to affected producers.⁵³ Addressing and managing conflicts between wolves and livestock is a critical step in any effort to address human concerns about wolves in areas where they have the most economic impact. While the specific factors that affect people's tolerance of wolves are not well understood⁵⁴, proactive measures to reduce conflict and seek economic fairness for livestock producers is essential to foster conditions for wolf sustainability. Thankfully, much knowledge has been gained in many states on how to reduce depredations or to actively address a problem. There are many ways to mitigate or reduce livestock depredation including compensation paid to ranchers for their losses, implementation of conflict reduction tools and wolf removal.⁵⁵

Conflict Reduction Strategies

There are many non-lethal methods to try to proactively reduce or minimize conflict between wolves and livestock that have been utilized in every state where wolves are present, including range riders, fladry, radio activated guard boxes, propane cannons, livestock guard dogs or donkeys, electric fencing, livestock carcass removal and harassment (rubber bullets, cracker shells, beanbag shells).^{53,56} Another strategy that may be appealing to a subset of ranchers is adapting grazing systems in a way that can create a more resilient operation with lower depredation rates. These existing conflict reduction methods have been tried with various degrees of success over several years^{55,57}. Success depends on the quality, timeliness and effectiveness of the execution of each method, while matching the right method to each specific ranching operation. However, it is difficult, if not impossible, to use many of the techniques for conditioning wolves



Photo Credit: Alex Hughes

against approaching livestock (e.g., propane cannons, guard boxes) over large or forested landscapes. Also, wolves will habituate to various techniques fairly quickly, so they tend to be effective in localized areas for a short time.⁵⁷ An emerging theme is that human presence such as range-riders, in some landscapes can have a better and longer-lasting outcome than many of the other non-lethal strategies.

Positive outcomes have resulted when agencies, ranchers and nonprofit organizations partner to fund and implement conflict reduction approaches. This collaborative and community-based management builds relationships that open the doors of communication that are critical to conflict resolution, while also sharing costs and expertise. Regional or community-based approaches led by stakeholders in collaboration with agencies may be effective in helping livestock producers live and work with wolves at a local scale. These programs, such as the [Blackfoot Challenge](#) in Montana, help fund and deploy proactive tools, develop livestock grazing practices that discourage predation, monitor pastures with remote cameras, pay for livestock guard dogs, or develop incentive programs for ranchers to continue to accept some level of activity of wildlife on and around their private lands.

It is also important to note that, either due to the nature of the wolves or the effectiveness of conflict reduction strategies, not all wolves target or prefer preying on livestock. Therefore, in some cases, ranchers may defend their resident wolf packs if they're not having depredation issues because they don't want them replaced by new wolves that may kill livestock.

Depredation Compensation

Livestock depredation compensation programs exist in all of the lower 48 states where gray wolves are present, with varying approaches. All states require some level of proof that livestock were killed by wolves before considering compensation for “confirmed” or “probable” depredations, which requires finding a carcass intact enough to determine cause of death. In some states, federal Wildlife Services agents, who are part of the U.S. Department of Agriculture, are the primary investigators of livestock carcasses that were potentially killed by wolves (e.g., in AZ, ID, MT, MN, WI), while in others (e.g., MI, OR, WA, WY), the state wildlife agency takes the lead in examining carcasses and assessing cause of death. However, a wolf pack can fully consume some livestock in a matter of hours, leaving no evidence behind. Additionally, accessing more remote carcasses in a timely fashion may be a major challenge. For these and other reasons, for every livestock animal killed by wolves there may be other animals that won't be found.

Compensation policies for livestock killed by wolves varies greatly among states. Compensation money does not address all concerns from ranchers, but it can reduce economic hardship for those most affected by the presence of wolves and foster a sense of economic fairness. In some situations, compensation may build tolerance for wolves⁵⁴, although more research is needed to better determine the efficacy of such approaches in actually increasing social tolerance.

Most states set compensation rates for individual livestock losses based on ‘fair market value’ and industry market reports, while a more in-depth analysis of cost is done by some states (e.g., WI) or by third-party validators (e.g., AZ, OR). Some states pay only for confirmed kills, while others compensate ranchers for probable kills, missing animals, or production losses resulting from wolf presence (sometimes called ‘indirect’ losses). Production losses potentially caused by wolves may include slower livestock growth rates, loss of future genetic potential in a breeding lineage, and reduced reproductive success due to stress. Several states, including WA and WY, use a compensation ratio (a.k.a., multiplier) of the value of more easily-depredated animals (e.g., calves or sheep) to compensate for missing livestock and/or some production losses that are not compensated for in most state programs.^{58,59} Some states require ranchers to demonstrate proactive conflict reduction strategies to be eligible for compensation, such as the requirement in WA to enter into a damage prevention cooperative agreement with the state.

A “pay for presence” approach⁶⁰, which is being used in Arizona, proactively pays ranchers for the presence of wolves on or near their ranches and incorporates a “pay for performance”⁶¹ component that bases compensation for livestock producers on factors that reward wolf and livestock survival. Often implemented with some level of direct compensation for depredated livestock, “pay for presence” or “pay for performance” programs rely on adequate financial incentives (and funds available) for ranchers to participate. Most states with wolves don’t have “pay for presence” or “pay for performance” programs at this time, so their efficacy in the U.S. has not yet been objectively evaluated.

A consistent theme that emerges from a review of state livestock compensation programs is the need for a positive relationship between the agency that manages the program and the state’s ranching community to foster trust from ranchers that are most affected. Some states’ livestock compensation programs are administered by the state wildlife agency while others are run by a state agricultural or livestock agency. For example, the Montana Livestock Loss Board, found within the Montana Department of Livestock, manages all compensation for livestock losses, while Wyoming splits the management of livestock compensation programs between its wildlife and agricultural agencies based on two distinct wolf management zones. Partnerships with nonprofit

organizations may also provide support for livestock compensation (e.g., funding from Defenders of Wildlife that initiated the Montana compensation program), but the role of nonprofits in funding livestock compensation should be vetted with the ranching community to assure the funding source doesn’t diminish ranchers’ trust in the program.

Wolf Removal

When conflict reduction strategies fail or become less effective over time, and wolves depredate growing numbers of livestock in certain areas, removal of wolves is a strategy to directly address impacts to ranchers. Wolf removal involves either the translocation or lethal control of wolves, and both have been used in other states.^{55,62-64} Early in the Northern Rockies wolf recovery process,



**Proactive
measures to
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and seek economic
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sustainability.**

federal agencies used translocations and a conservative approach to wolf removal so as to remove a minimal number of wolves from the population⁶³. Bradley et al^{63,64} found that translocation of depredating wolves in MT and ID did not reduce depredation or advance wolf recovery objectives because translocated wolves had a strong homing behavior, poor survival and reproduction and high potential to depredate in their new translocated area. Most translocated wolves (67%) did not establish or join a pack or reproduce, and therefore did not contribute to recovery efforts⁶³. However, quality of the translocation release site, away from potential livestock conflicts, and soft release (where a family group is held in a pen on site for a period of weeks) tended to enhance survival of translocated wolves and reduce chances of dispersal.⁶³

Numerous studies have been conducted studying the effectiveness of translocations and various strategies of lethal control for wolves in the West and Midwest.^{62,64} Overall, the incremental removal of wolves (through translocation or lethal control of individual wolves) help reduce livestock predation in the short term at the original conflict site⁶³, but had limited success in reducing livestock depredations in the long-term. Remaining wolves or recolonizing packs usually resume depredating livestock within a year. Effectiveness of control methods were studied in 967 wolf depredations and control actions over 19 years in MT, ID and WY, comparing 1) no removal, 2) partial removal and 3) full pack removal.⁶⁴ Full pack removal

reduced the occurrence of subsequent depredations by 79% over a five-year period, whereas partial pack removal reduced the occurrence of subsequent depredations by 29% over a five-year period and was most effective if performed within 7 days of a depredation. Pack size was the best predictor of a recurring depredations, with the probability of more depredations increasing by 7% for each animal left in the pack after the lethal control action.

Guidelines for when agencies can implement lethal wolf removal vary widely, and are established collaboratively by federal Wildlife Services and state wildlife agencies in most states. Almost all states require some form of conflict reduction measures to be taken to deter depredation before the state agency will consider lethal control of a depredating wolf. For example, in Washington, the [Wolf-Livestock Interaction Protocol](#) allows for lethal control after four depredations if more than two measures were taken to ward off wolf attacks pre-emptively. The Mexican wolf program has a “three strikes and you’re out” wolf removal policy. However, there were so many depredations and resulting wolf removals that wolf control limited the growth of the Mexican wolf population from 2003-2007. Because of this, more non-lethal methods have been used since 2009 but depredations have continued to increase, suggesting that some combination of non-lethal methods and lethal control may be beneficial.

Outside of agency-sanctioned wolf removal, there are cases where ranchers or other non-agency individuals may directly remove wolves in other states. This ‘take’ of wolves ranges from the designation of geographic regions where wolves may be killed for any reason in WY to strict prohibitions on any killing of wolves except for direct defense of human life as in CA. These variations are dependent on wolf classifications and zoning in different states (see Wolf Management Section). In Colorado, the listing of wolves under state endangered species laws prohibits any killing of wolves except to defend human life or for scientific purposes approved by the Commission. Any lethal removal by government staff or by ranchers in defense of their livestock would require state regulatory changes to allow for targeted ‘take’ of wolves, and also be sanctioned through federal agencies if wolves remain federally-listed in Colorado.



Photo Credit: David Hiser

Lessons Learned

Colorado would benefit from a comprehensive approach to managing wolf-livestock conflict that includes various strategies for conflict reduction, compensation for loss and, when warranted, wolf removal, as has been demonstrated in other western and midwestern states. Compensating ranchers for confirmed and probable livestock losses, validated by highly-trained professionals, is a critical strategy. Compensation programs should be developed with ranchers and wolf advocates to find an acceptable compensation plan that addresses the actual economic impacts of wolf depredations on Colorado ranchers while building as much goodwill with the ranching and rural communities as possible, which may include some compensation for missing livestock and production losses. Ranchers must have trust in the agency tasked with implementing the compensation program and that agency must have adequate capacity and funding available to implement a compensation program in a timely manner. A compensation process that moves

Colorado would benefit from a comprehensive approach to managing wolf-livestock conflict...

quickly from validation to payment is a critical element of those compensation programs that are more well-received by the ranching community. Success may be dependent on having adequate funding, a clearly defined and relatively straightforward compensation plan, a trusted agency to implement the program and regular monitoring and auditing of the program to ensure confidence.

A robust and proactive conflict reduction program is critical as a companion to livestock compensation to address wolf-livestock conflict. Supporting ranchers with adequate resources and technical assistance to identify

and employ methods tailored to their ranching situation may result in greater adoption and success of conflict reduction tools. A collaborative approach between agencies, local ranching communities and nonprofit organizations to build an alliance to fund and implement conflict reduction techniques will be important to build lasting relationships, which also may increase social tolerance. Several notable examples where this model has been effective include the [Blackfoot Challenge](#) and [Tom Miner Basin Association](#) in Montana, and the [Wood River Wolf Project](#) in Idaho. Most non-lethal conflict reduction techniques are locally effective for short periods in pasture settings, while human presence (e.g., range riders) are particularly valuable in open range grazing operations.

Based on experience in other lower 48 states where wolves are present, it is key for Colorado to consider lethal control guidelines and methods early in the planning process to prepare for the time when wolves present chronic depredation challenges, even if affected ranchers and agencies have made consistent and credible efforts to proactively deter livestock depredation. Colorado would benefit from the development of a detailed decision framework that identifies any necessary conflict reduction measures by affected ranchers and agencies, as well as agreed-upon thresholds for lethal wolf removal and expectations for carrying out any lethal removal. While not socially palatable to some, wolf removal may address some acute impacts of wolves to Coloradans most negatively affected by growing wolf populations. These decisions will be scrutinized, so a clear decision framework that first considers non-lethal options, then potential wolf removal, will be critical to aid in decision-making, public relations and any efforts to increase the potential for rural communities to live and work with wolves. It is also critical to invest in social science research that will examine the causal impact of various management strategies on the reduction of wolf-livestock conflict and the level of social tolerance for the presence of wolves and wolf removal.



Wolf Management

All species reintroductions in the U.S have been guided by the North American Model of Wildlife Conservation¹. Based on this model, wolves in Colorado would eventually be treated like all other wildlife species that the state manages, as an integral part of the state’s wildlife legacy, managed as a public trust resource based on sound science and best management practices to ensure their long-term sustainability. This includes management of wolves by government agencies using policies based on the best science available, only killing wildlife for legitimate purpose and considering the opportunity for sustainable, ethical harvest of wolves if or when wolf populations are recovered.

While credible scientific data and sound biological research is critical to wolf management, sustainable wolf recovery is, and always will be, more about people and social dimensions than it is about wolf biology. Across each of the states where wolves have recovered, one commonality in wolf management is that wolves have had to be actively managed through conflict reduction efforts and/or lethal means to address conflicts that affect ranchers, outfitters or hunters. Whether professional removal of wolves due to conflicts with livestock, some allowance for individual ranchers to remove depredating wolves, or allowing for hunting and trapping when wolf populations are recovered, some level of wolf removal has been a consistent strategy in efforts to improve the social conditions for wolf recovery.^{29,55}

With a controversial species like the wolf, passionate viewpoints expressed by wolf proponents and opponents often reflect personal values more than the prevailing science. Wolf managers have the challenging job of managing based on the best science while simultaneously trying to address value-based concerns of the public.

Table 2:
Gray Wolf Statistics for the Western US States, 2009-2019

Year	Idaho					Montana						Wyoming					Oregon ¹				Washington					
	# Control	# Harvest	# Total Mortality ²	% Total Mortality ³	Yr. End Min. Count	# Control	# Harvest	# Total Mortality ²	% Total Mortality ³ (Min. Count)	Yr. End Min. Count	% Total Mortality ³ (POM ⁴)	POM ⁴ Estimate	# Control	# Harvest ⁵	# Total Mortality ²	% Total Mortality ³	Yr. End Min. Count	# Control	# Total Mortality ²	% Total Mortality ³	Yr. End Min. Count	# Control	# Harvest	# Total Mortality ²	% Total Mortality ³	Yr. End Min. Count
2009	93	135	272	24%	870	145	72	258	33%	524	23%	847	32	0	57	15%	320	2	2	13%	14	0	0	0	0%	14
2010	78	46	144	16%	777	141	0	179	24%	566	17%	862	40	0	69	17%	343	0	1	5%	21	0	0	0	0%	19
2011	63	200	296	28%	768	64	121	216	25%	653	18%	971	37	0	64	16%	328	2	3	9%	29	0	0	0	0%	35
2012	73	329	425	37%	722	108	175	324	34%	625	26%	915	43	67	136	33%	277	0	0	0%	48	7	0	9	15%	51
2013	94	356	473	42%	659	75	231	335	35%	627	24%	1,088	33	63	109	26%	306	0	3	4%	64	0	1	5	9%	52
2014	67	256	360	32%	770	57	213	306	36%	554	25%	898	37	12	78	19%	333	0	0	0%	81	1	0	10	13%	68
2015	75	256	357	31%	786	39	205	276	34%	536	22%	981	54	0	84	18%	382	0	7	6%	110	0	3	7	7%	90
2016	70	267	N/A	N/A	N/A	52	255	334	41%	477	29%	814	113	0	132	26%	377	5	7	6%	112	7	3	14	11%	115
2017	N/A	281	N/A	N/A	N/A	57	233	305	33%	633	26%	854	62	77	168	33%	347	5	13	9%	124	5	3	14	10%	122
2018	N/A	329	N/A	N/A	N/A	60	259	341	N/A	N/A	29%	819	66	85	177	38%	286	3	7	5%	137	4	6	12	9%	126
2019	N/A	N/A	N/A	N/A	1,000 ⁶	N/A	N/A	N/A	N/A	N/A	N/A	N/A	30	49	96	24%	311	1	7	4%	158	11	6	21	13%	145

* From the Federal Register, 85 FR 69778, 50 CFR 17, 11/03/2021. Page 69810

1 Legal harvest not authorized by the State.

2 Total represents all known mortality during the associated calendar year.

3 Annual percent total mortality based on known number of wolves and known total number of wolves that died that year of any cause. Derived by adding #Total Mortality to YearEnd Minimum Count (i.e. the minimum number of wolves known to be alive at some point during the year), and then dividing by the # Total Mortality the number known to be alive during that year.

4 Patch occupancy modeling

5 Includes harvest in trophy game (i.e. WTGMA) and predatory animal areas.

6 Estimate not derived using minimum population count method; thus, not directly comparable to prior year counts.

Wolf Management Status And Recovery Objectives

As mentioned previously, federal listing status for gray wolves is volatile and may change over time based on a variety of factors. Even if wolves are federally listed, the federal ESA does provide options to accommodate more flexibility for state management of wolves, especially for reintroductions. For example, wolf reintroductions in the Northern Rockies occurred with wolves designated as “nonessential experimental” populations under the ESA’s 10(j) rule.

To assure adequate management of wolves regardless of federal listing status, all states have determined their own status of wolves for management purposes (Table 1). These state classifications for gray wolves include State Endangered Species (CO, CA, WA), Species in Need of Special Management (MT), Game Animal (ID), Special Status Game Mammal (OR), Trophy Game Animal (WY) and Predatory Animal/Wildlife (WY, ID). Each state status is associated with particular state management prescriptions, including the potential to ‘take’ wolves, or ability to hunt, and states may adjust this status based on recovery objectives or potential social pressures.

Every state with wolves has designated criteria for down-listing or delisting to inform state-level changes in wolf status and management should wolves be federally delisted. In some cases, these criteria are heavily dependent on original federal recovery criteria (e.g., MT, ID, WY), and others are driven more by state-level wolf population objectives. The metrics and criteria used to define when wolves move from one management status (a.k.a., phase) to another vary widely, with some common

Federal listing status for gray wolves is volatile and may change over time based on a variety of factors.

metrics including: total wolf population numbers (e.g., WY, MT, ID), number of breeding pairs (e.g., OR, WA) and trends in population metrics (e.g., MN), with some states also identifying geographic requirements for changes in status (e.g., MN, OR, WA). Every state that uses total wolf population numbers as a recovery metric clearly states that these numbers represent *minimum* population thresholds to trigger changes in status. However, in 2021, wolf population recovery thresholds were characterized as

population goals or maximums in MT, ID and WI to support state policies that allowed for substantial reduction in wolf populations.^{9,10,65} Therefore, identifying a suite of conservation biology metrics⁶⁶ besides or in addition to total wolf population is garnering attention as a way to assure recovery and reduce potential politicization.

Wolf Zone Management

Some states, such as WY, MN, WI, WA and OR, manage wolves with varying management prescriptions, level of wolf protection or potential for wolf removal depending on geographically-defined spatial zones. In states without management zones, such as MT, wolves are given the same classification throughout the state. Under nearly all management strategies, whether zoned or not, flexibility is built into state wolf management plans to allow for actively addressing conflicts from wolves to help calm inflammatory situations and resolve a problem before it becomes chronic. Proper oversight of a zoned system requires dedicated and well-funded monitoring and enforcement.

Wolf Harvest

In several states (MT, ID, WY, WI) where wolves have met recovery goals and been federally delisted, a public hunting season, and in some states also a trapping season, have been implemented (Tables 1 and 2).⁶⁷⁻⁷⁰ Michigan and Minnesota are considering a hunting season for 2022 but not in 2021. In MT, ID and WY, liberal harvest seasons have been the standard for many years and wolf populations have remained stable or declined slightly, as evidenced in the states’ annual wolf reports.^{67-69,71} Given the role of sustainable, ethical harvest in the traditional North American Model of Wildlife Conservation, along with a belief that hunting may foster greater social tolerance of wolves for hunters and ranchers, wolf hunting is an often-considered, yet controversial, wolf management approach. However, it is important to note that the causal relationship between public hunting and trapping and greater social tolerance of wolves is not proven; at least in the case of the first public wolf hunt in Wisconsin, wolf hunting did not lead to an increase in tolerance of wolves.^{72,73}

As of this writing, wolf harvest policies developed by state legislators or politically-appointed bodies in WI, MT and ID, as opposed to professional wildlife managers, have led to a federal review of wolf status to consider whether these state management changes have compromised the long-term recovery of gray wolves. Wolves may have some ability to increase reproduction as harvest pressure increases and disintegrates established pack social structure so more females may breed.⁷⁴ However, other research reported that harvest of breeding animals lowered reproduction and recruitment.⁷⁵ But as MT, ID and WI significantly increased harvest levels in 2021 and potentially beyond, it remains to be seen what impact this will have on overall wolf numbers and distribution. In contrast, California has just two packs of wolves as of 2021, and no plans to harvest or lethally control wolves for any reason.⁷⁶



Photo Credit: Karin Vardamen

Lessons Learned

The North American Model for Wildlife Conservation can provide guidance on wolf management goals and critical considerations. This model is based on using science-based policies to manage wildlife, which, with wolves, can be challenging based on strong public opinions and resulting politicization of wolf management. Colorado should make every effort to produce a plan that lays out management strategies that proactively address inevitable conflicts to reduce the impacts of wolves on rural communities while prioritizing the collection of extensive data to inform science-based decision-making and reduce the politicization of wolf management.

The status of wolves and associated management in Colorado should adapt as populations grow to assure adequate management flexibility that can address conflict situations that arise while supporting wolf recovery. Colorado's criteria used for down-listing, delisting or deciding on other changes in wolf management should be wary of relying solely on single population objectives, as these may be viewed as population targets. Recovery based primarily on single population numbers sets the stage for political struggles, frustrated stakeholders on all sides of the issue, and wolf managers being asked to manage outside of the best science in an effort to manage toward one specific number of wolves. Colorado may

consider setting recovery and management objectives based on a variety of viable population metrics or benchmarks (as CPW did to gauge the success of Canada lynx reintroduction) based on a growing set of conservation biology species recovery recommendations.

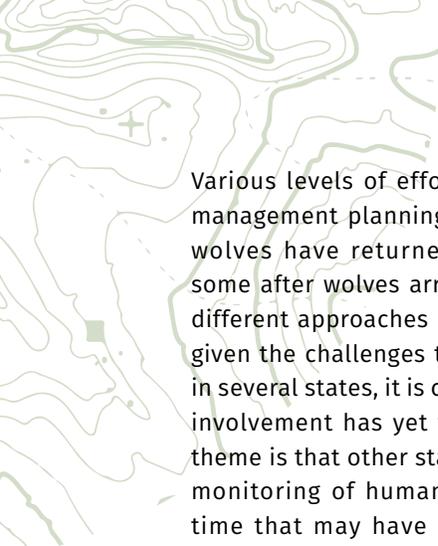
Whether wolf status is blanketed across the state or divided into management zones will depend on whether certain geographical zones warrant distinct management prescriptions or whether there is an advantage to maintaining consistent status across Colorado. A decision on zoning should be made early in the planning process given that adjusting these in the future would create substantial challenges for public expectations and enforcement.

Essentially all professional wolf biologists and managers interviewed for this report stated that some form of wolf harvest will be a critical future management tool in Colorado, only after wolf populations meet specific recovery criteria. It is recommended that the Commission, agency and stakeholders discuss potential for post-recovery wolf harvest early on in the planning process, even though any potential harvest may be a long time in the future and ultimately may remove very few wolves.



Social Factors, Outreach & Public Engagement

Consistently, human concerns with wolves due to conflicts with livestock and perceived effects on ungulates and human safety has resulted in the greatest obstacle to acceptance of wolves as a part of the western landscape. These social factors have resulted in the adoption of extreme wolf management approaches to reduce wolf populations in some states (e.g., ID, MT, WY, WI). In these states, potential issues that led to these measures may have included a lack of clarity or misinterpretation of management plan details; the inability to adapt management plans based on monitoring; unmet public expectations of wolf management; perceptions that managers are powerless to adequately manage wolves; inability to adequately address wolf-livestock losses and associated economic impacts to limit concerns of ranchers; hunters or outfitters perceiving negative impacts from wolves on ungulates without adequate attention on monitoring and control to address the problem; a lack of relationship-building with affected communities; or politicized wildlife management subsuming scientific evidence. These issues highlight the critical role of two major aspects of wolf management: planning and implementation (see next section) and public outreach and engagement.



Various levels of effort to involve the public in wolf management planning have occurred in states where wolves have returned, some occurring before and some after wolves arrived. The effectiveness of these different approaches has yet to be fully analyzed, but given the challenges that continue to be encountered in several states, it is clear that the ideal level of public involvement has yet to be developed. One recurring theme is that other states consistently lacked detailed monitoring of human attitudes toward wolves over time that may have identified social issues before they became critical. Since wolf recovery is primarily about people, it will be important to gather data on people's shifting attitudes toward wolves to influence both wolf management and outreach as part of an adaptive plan.⁷⁷

As mentioned previously, CPW is already soliciting extensive public input in the planning process before the actual wolf reintroduction will occur in an effort to build public trust in the agency to manage and monitor the controversial wolf reintroduction, inform reintroduction efforts and increase social acceptance of wolves and wolf management. Colorado State University and CPW have partnered to investigate how these public involvement efforts may impact social outcomes and development of management plans over time. These social data and outreach efforts may support the development of an adaptive management process for CPW's wolf reintroduction and management.

Lessons Learned

People's beliefs about wolves are often value-laden, passed down for generations, and/or not easily swayed by scientific data. However, it is still critical for the ongoing Colorado public engagement effort to creatively and consistently convey scientifically accurate data and to proactively counter common myths, combined with active resolution of conflicts, extensive outreach to all stakeholders and clear and transparent planning and adaptive management that builds trust and relationships. Listening is critical to authentic engagement, so CPW field staff must have the capacity to hear people out as part of a process that can then lead to the business of resolving conflicts. Wherever possible, it is important that local field staff that have local trust are the face of this work with the public. CPW must make substantial and consistent efforts to truly hear people who are being impacted the most by the return of the wolf (e.g., ranchers, hunters) and involve them in the planning process early on, as well as in the adaptive management process that should be driven in part by robust social data. In addition, it is important that annual wolf reports and regular website updates are written in a manner that is accessible and understandable to the general public with active efforts to hear public feedback.





Each state has created and implemented wolf recovery plans and policies following a wide variety of processes.

A topographic map with green contour lines is in the background. The title 'Planning & Implementation Engagement' is written in a large, bold, black sans-serif font.

Planning & Implementation Engagement

Each state has created and implemented wolf recovery plans and policies following a wide variety of processes. Some have worked well and others have faced greater challenges. Below is a synopsis of themes and takeaways from other states' planning processes that may help Colorado attain successful wolf reintroduction and recovery.

Lessons Learned

Critical wolf management planning components involve: setting measurable, agreed-upon goals; proactively identifying core activities needed to improve social tolerance; making detailed plans to address conflicts adequately over time with extensive monitoring and adaptive management; assuring adequate long-term funding; and building trust between agencies and stakeholders that could achieve long-term wolf sustainability.

It is important that CPW incorporate adaptive management into wolf management plans to adjust as the wolf population grows. Based on recent history, once wolves become established, it requires approximately 15 years before there is a substantial increase in wolf conflicts and the associated social and political struggles that can marginalize science and best management practices. It is critical that CPW draft a durable plan based on the best science available, and incorporate regular milestones to revisit the plan with stakeholders. CPW should commit to stick to the plan, and be prepared to adapt implementation of the plan based on monitoring results, no matter what political pressures appear. This plan will offer the public very clear expectations of the measures CPW will undertake as wolf numbers increase or decrease. It is critical that CPW not let the outreach process fade after adoption of the plan. The plan needs to maintain its momentum coupled with regular public outreach so that people maintain or build trust in the agency that the plan is working, using the best data and adapting to address important issues.

For plan implementation, it will be critical to hire good people and let them do their job, preferably from within local communities, be available to answer all calls, have excellent listening skills, go on site to address concerns/problems and build trust with local groups.



Monitoring and Research Considerations

Monitoring is essential to inform adaptive management and to assure that decisions are made on the best information available, rather than perceptions or generalized data. These efforts need to include biological monitoring of wolves, prey populations, other predator populations and habitat changes, as well as shifts in human attitudes. Only through adequate monitoring and research at the correct geographic scale can changes be detected and addressed through evolving management decisions that can maintain public trust and limit future pitfalls.

Wolves

The monitoring of wolf populations has been a critical component of all wolf reintroduction efforts, both to inform recovery efforts and to contribute data to management actions. Radio collars have been used for many decades as a primary method for monitoring wolves and population changes, with two types of radio collars commonly used: GPS (global positioning system) and VHF (very high frequency). Noninvasive methods (primarily remote cameras and DNA from scats, hair and tissue) have been developed to monitor individuals and populations as well. Each monitoring method has undergone years of testing and refinement in other states





Photo Credit: Kira Cassidy

where wolf monitoring has been underway for decades. Colorado is in an enviable position to learn from the proven benefits and drawbacks of each monitoring approach and can apply best scientific monitoring practices based on the type of biological data that CPW wants to track to inform wolf status, management and research.

Ungulates

Fine-scale monitoring of deer, elk and moose populations can be challenging, but will be important to help wildlife managers to understand whether wolves have impacts on ungulate populations, and if so, what kind. Colorado can learn from the extensive research projects in ID^{4,5} and MT that have identified if and how wolves may have affected ungulate populations.⁶⁻⁸ Such projects could be proactively funded and implemented before, during and after wolf reintroduction in Colorado. However, detailed long-term research projects are not the only way for wildlife managers to track ungulate response to wolves. State agencies regularly collect more detailed data at the ungulate herd level (a.k.a., Data Analysis Unit or DAU) that can help to identify if ungulate populations are declining and whether wolves might be a contributing factor. Robust annual data may be collected for ungulate herds that are most likely to overlap in range with wolves through hunter harvest data, survey flights, radio collars and telemetry. This data would provide more immediate information, highlight places where ungulates might be in decline, and provide insights into causes of decline that may warrant more active wolf management to address valid concerns from hunters.

Livestock

Many states' livestock compensation programs have in place a system of audits and monitoring to regularly evaluate the effectiveness of the program. Additionally, multiple states have evaluated the effectiveness of conflict reduction and lethal wolf control measures, which can provide valuable information to inform CPW's management strategies.



It is critical that funds are dedicated to targeted social surveys and other means of learning... the social attitudes toward wolves.

Social Data

As recognized earlier in this report, social, not biological issues present the greatest challenges to sustainable wolf populations. However, because state wildlife agencies are mandated to manage wildlife populations within their states, biological monitoring, not social monitoring, receives a vast majority of investment in all states where wolves have been reintroduced. Expanding the capacity to investigate the social aspects of wolf management, such as geographically-specific attitudes toward wolves and wolf management over time, may be just as critical an investment for agencies to identify issues and address social challenges before they become insurmountable.

Lessons Learned

Wolf monitoring will be essential, and can be accomplished using a suite of heavily-tested methods that can be tailored to fit budgets and the specific biological or social questions asked about wolf populations and behavior. The selection of wolf monitoring methods should follow best scientific practice learned from decades of testing in other states, and may evolve with Colorado's wolf

population as methods continue to improve. Being clear with the public about what data will, and will not, be available on wolf individuals and populations is critical to avoid unrealistic expectations.

While wolf monitoring captures public attention, it is critical that biological monitoring of other species is also supported over time, particularly the population monitoring of deer, elk, or moose that are most likely to overlap with wolf packs. Assuring the robust gathering of ungulate data at the Game Management Unit or Data Analysis Unit level, not just statewide, will be essential to help CPW proactively address concerns of hunters, outfitters and others interested in big game populations and associated economies. Long-term monitoring of ecological conditions in areas where wolves are and are not present may also shed light on whether and how the presence of wolves might be affecting biodiversity and other ecological systems.

By auditing and monitoring the effectiveness of any livestock compensation programs, conflict reduction techniques and wolf removal activities, CPW can also ensure that they are adjusting wolf management and livestock programs appropriately to address livestock conflicts.

It is critical to assure that funds are dedicated to regular, geographically-targeted social surveys and other means of learning the trajectory of social attitudes toward wolves. Such efforts should have the ability to identify trends in attitudes toward wolves by ranching, hunting and rural communities, along with general perceptions on wolf management, to identify potential social issues before they become critical and to inform outreach priorities and adaptive management needs.

CPW is presented with a unique opportunity that may serve as a living laboratory for multiple research projects such as the interaction of wolves and ungulates, livestock, other wildlife, etc., coupled with social attitudes and effectiveness of public involvement. If agencies, universities and nonprofits proactively seek funding for research projects, this can ensure that CPW has adequate information to support the long-term success of Colorado's wolf population and reduce societal conflicts around wolves.

Funding

Investments made in state managed wolf programs have generally been ~\$1-2 million annually to pay for salaries, vehicles, field equipment, research, technology, outreach programs, livestock loss programs and compensation (Table 1). Other states fund their wolf management and monitoring programs through a variety of methods in collaboration with many partners, including, but not limited to: lottery ticket proceeds, wolf stamp, sale of wolf hunting licenses, state general fund/wolf program specific appropriation, federal funds (e.g., Pittman-Robertson, USFWS grants, USDA Wildlife Services), bed tax on lodging accommodations, State Dept Ag/Livestock, nongame tax checkoff and personalized license plates. With Colorado's unique situation of managing their own wolf reintroduction program, CPW has a unique opportunity to identify the most critical investments that are needed, while also co-developing adequate funding strategies with stakeholders and state leaders.

Lessons Learned

Based on the various lessons learned highlighted in this report, the potential costs for Colorado to set the standard for wolf recovery over time may be \$1-2 million annually as has been invested in other states. Table 3 provides a non-exhaustive list of expenses that would require adequate and consistent funding to implement the lessons learned for a robust wolf program in Colorado. Not all of the costs would necessarily need to be managed by or funneled through CPW, but could be collaboratively raised and utilized with federal, state, university or nonprofit partners. Colorado has already identified some dedicated sources of funding for wolves, including appropriations from the general fund budget (\$1.1M in FY22). The bipartisan bill, [HB 21-1243](#), prohibits using funds raised through hunting and fishing license fees to support wolf reintroduction, but also identifies four other potential sources of funding. With the public support of Prop 114, and strong relationships among CPW, universities and various nonprofit organizations, Colorado has an opportunity to raise adequate funds to assure long-term investment and success of its wolf recovery efforts. Federal investments in state non-game wildlife, such as the Recovering America's Wildlife Act, and other federal grants may also play a critical role in Colorado's efforts.



Photo Credit Jeremy Sunder

**Table 3:
Potential funding needs for successful Colorado wolf reintroduction**

Wolf planning process	Consultants, meetings, public outreach, federal process for 10(j) exemption, etc.
Wolf reintroduction costs	Wolf capture, transport, vaccinations, release, etc.
CPW dedicated staff	Including dedicated wolf biologists and game damage/conflict reduction experts; portions of public outreach specialists, human dimensions specialists, law enforcement, terrestrial biologists, etc.
Implementation of livestock conflict reduction program	Including dedicated staff costs, equipment/supplies, technical assistance/training, tailored consultation for ranchers, etc.
Implementation of livestock compensation program	Including dedicated staff costs, direct compensation for depredated livestock at full market value and any funds for missing, production losses, or pay for performance programs, as decided by the Commission
Outreach and stakeholder engagement	Ongoing, during and after reintroduction
Monitoring of wolves, social attitudes, program success, etc.	Funds for wolf monitoring, increased ungulate monitoring to attribute potential causes of population declines, social attitude tracking with geographically-specific details to identify potential impacts, and evaluation of program success.
Research support	To address long-term ecological, predator-prey, livestock conflict program, and social science questions
Information and education	Targeted and general campaigns to center science-based information, counteract unsupported information, and seek common ground across Colorado

Conclusions

A topographic map with contour lines, showing terrain elevation. The map is partially visible in the upper right corner of the page, with a green crosshair symbol.

Wolves, similar to other wildlife, should be held in trust for all people, and managed based on sound science by agencies for long-term sustainability.

Wolves are staging a successful comeback in several western and midwestern states. Successful recovery of wolves is attributable in part to their adaptable and resilient nature, and in part to agency management efforts and steps taken to proactively address conflicts that erode social acceptance. Colorado has the benefit of lessons learned from states that have already contended with wolf recovery and subsequent management challenges for several decades. One major takeaway from 40 years of learning is the need for a robust and adaptable plan that addresses livestock depredation and hunter concerns, assures that adequate and consistent funding is available to implement the plan, invests in monitoring, and includes efforts to build and maintain social tolerance for long-term wolf recovery.

Inclusion of the public in stakeholder processes and outreach efforts is a critical step toward creating social tolerance and ultimately the success of wolf reintroduction. Future funding for research and monitoring of wolves, ungulate population, social attitudes, all aspects of depredation reduction and mitigation, and hunter conflict resolution will be needed. It is essential that these data are used to develop and implement adaptive management strategies so that wolf recovery is not hindered by what may have been foreseeable and manageable social issues. The costs associated with this level of research and monitoring may be significant, but critical to the long-term sustainability of the wolf program in Colorado. CPW is well on its way to building a collaborative stakeholder process that should help navigate the biological, social and political pitfalls on the path to wolf recovery. Wolves, similar to other wildlife, should be held in trust for all people, and managed based on sound science by agencies for long-term sustainability. If done correctly, this missing piece of Colorado's wild landscape will soon be restored and remain viable for future generations. While credible scientific data and sound biological research is critical to wolf management, sustainable wolf recovery is, and always will be, more about people and social dimensions than it is about wolf biology.



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