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Wolves In The West: An Analysis of the Northern Rocky Mountain Wolf Recovery Plan and the Findings and Recommendations for Managing Wolves That Migrate Into Colorado

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Wolves In The West: An Analysis of the Northern Rocky Mountain Wolf Recovery Plan and
the Findings and Recommendations for Managing Wolves That Migrate Into Colorado

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Abstract

Wolf populations are undoubtedly increasing in the western United States as a result of wolf reintroduction efforts in Wyoming, Montana, and Idaho in 1987 on behalf of the U.S. Fish and Wildlife Service. However, as wolf populations continue to increase throughout the west, so does the number of people negatively impacted by wolves such as livestock producers, hunters, and homeowners that are in close proximity to wolf populations. Colorado is currently involved in the ongoing controversy over wolf reintroduction because of the fear wolf populations may have on communities, as well as the livestock and hunting industries, but the U.S. Fish and Wildlife Service is required to develop a plan by the end of 2017 to increase Mexican gray wolf populations in Arizona, New Mexico, and possibly Colorado. The Colorado Department of Wildlife (CDOW) published a wolf management program in 2004 that offered solutions to managing wolves that were migrating from surrounding states, but this program was published nearly 15 years ago and does not promote the repopulation of wolves, nor was it fully implemented because wolves are still federally listed as endangered in Colorado. This paper revisits the *Northern Rocky Mountain Wolf Recovery Plan* from 1987 to improve upon the *Findings and Recommendations for Wolves Migrating into Colorado* from 2004 to encourage wolf repopulation in Colorado while also limiting conflict between humans and wolves. Through this analysis, I found that the 2004 Colorado wolf management plan could improve upon the lack of measurable goals for restoring wolves in Colorado, the absence of buffer zones between wolf habitat and human development, insufficient sources of funding for management and depredation funds, and an incomplete education and outreach program. I recommend that the future Colorado wolf management plan implement specific goals to measure wolf repopulation, purchase multi-use land between wolf habitat and human development, acquire funding for wolf management and depredation from Colorado's lottery tax, marijuana tax, and tourism, and lastly develop individual outreach programs for the interest groups most impacted by wolves and provide them with non-lethal wolf protection alternatives. These effective solutions will limit the negative impacts of wolves as much as possible, while also giving wolves a second chance to thrive in a land that was once their own.

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List of Abbreviations

CDOW	Colorado Department of Wildlife
CO Wolf Plan	Findings and Recommendations for Wolves that Migrate Into Colorado (2004)
CWWC	The Colorado Wolf and Wildlife Center
ESA	Endangered Species Act
GOCO	Great Outdoors Colorado
NGO	Non-government organization
NRMt Plan	Northern Rocky Mountain Wolf Recovery Plan

Introduction

Although the Earth has already experienced at least five mass extinctions in the past half-billion years, we are currently experiencing the fastest rate of species loss since the extinction of the dinosaurs 65 million years ago. The main cause of the current loss of biodiversity around the globe is due to human activity that has resulted in human overpopulation, habitat loss or fragmentation, introduction of invasive species, pollution, climate change, and over-harvesting of species (Rinkesh, 2013). In response to this rapid decrease in flora and fauna, the U.S. Fish and Wildlife Service has attempted to reverse the extinction of many species by implementing reintroduction programs for species that are endangered or have gone extinct in certain areas of the United States. A reintroduction program is a methodical release of species into a certain area of the wild, from either captivity or other habitats and is used as a tool to stabilize, regenerate, or increase populations of animals that have experienced rapid population declines.

The Colorado Parks and Wildlife Commission has conducted many of their own reintroduction programs in Colorado including the moose, lynx, and black-footed ferret. However, the Colorado Parks and Wildlife Commission has recently opposed the reintroduction of wolves despite popular opinion of Colorado citizens and the benefits these programs have shown to ecological communities in different states (Pate et al, 1996)(Weiss et al., 2006). The Commission claims the reason for this is due to the lack of any measurable, beneficial impact that hasn't already been provided by animals like the mountain lion, bobcat, coyote, lynx, and humans; the Colorado government is also apprehensive because of the negative impact wolves may have on the elk-hunting and livestock industries (Explanation of Wolf Resolution, 2016)(Gilbert, 2016).

The reintroduction of wolves in Wyoming has become one of the most recognized reintroduction programs due to the ongoing controversy with livestock owners, but also the recent recognition of the keystone role that wolves play in ecosystems. This paper will analyze the implementation strategies and results of the successful Northern Rocky Mountain Wolf Recovery Plan (NRMt Plan) that reestablished wolf populations in Yellowstone National Park, Central Idaho, and Northwestern Montana and apply those findings to a revision of *Findings and Recommendations for Managing Wolves That Migrate Into Colorado* (CO Wolf Plan) published by the Colorado Wolf Management Working Group in 2004. I will discuss why the Western United States is ideal wolf habitat and the guidelines each program has put into place to protect the animals and other interest groups such as ranchers, hunters, wolf conservationists, nearby homeowners, and related policy makers. I will also discuss the goals each program set and their successes and failures in obtaining these goals. I will then use this information to act as a change agent and identify primary flaws of the CO Wolf Plan to generate a revision of the 2004 document that will take into account the needs of wolves, ranchers, hunters, the general public, and the government in Colorado to promote a more beneficial outcome for all parties involved.

Background

Prior to the 1900s, gray wolves (*Canis lupus*) were once abundantly scattered throughout North America with a population of 250,000 to 500,000 individuals (White, 2014). These large populations of wolves remained rich until the early 1900s when non-indigenous human populations began to expand and settle in the western United States. Ranching was the primary occupation in the western region during this time and a highly

influential sector of the growing U.S. economy. As a result, ranchers lobbied for more land to expand their grazing ranges but found the land was lavish with wolves. Elk and deer populations were also declining as a result of western expansion, therefore these large populations of wolves began to pose a risk to ranchers' livestock as they searched for other prey. Public attitudes in the U.S. often compared wolves to vermin in order to showcase their disdain for this fierce top predator that threatened their families and livelihoods (Jacobs, 1994). This resulted in extensive efforts to eradicate wolves from the United States including a nationwide wolf control policy enacted by the U.S. government that had government sanctioned hunters kill off large populations of wolves in order to protect livestock (White, 2014). The implementation of these predator control programs resulted in the elimination of wolves from the wild by the early 1970s.

Although wolf populations were no longer thriving in the U.S. by the 1970s, the environmental movement in the 1960s-70s provided a chance for this species to re-inhabit its native territories. Americans began to shift their opinions of wolves from vermin-like creatures to a key ecological component that deserves consideration, protection, and preservation. The passage of the Endangered Species Act (ESA) in 1973 prompted the gray wolf to be listed as an endangered species and protected under its sanctions in 1974. The ESA requires that the U.S. Fish and Wildlife Service construct and carry out recovery plans for all listed species, which initiated efforts in 1977 to conserve wolves in the west and strive towards reintroducing them back into their natural habitats.

In the late 1980s, two programs were launched to reintroduce wolves to their historical habitat in the western United States, namely the Rocky Mountain Wolf Recovery Plan and the Mexican Wolf Recovery Program. These programs have had varying degrees

of success, as there are now over 1,700 wolves across Idaho, Montana, Wyoming, and Oregon due to reintroduction and natural migration from Canada; however, Arizona and New Mexico currently only support about 110 wolves (Restoring the Gray Wolf, n.d.). In order for wolf populations to stabilize, wolf packs need metapopulations or connected communities to maintain genetic diversity and larger population sizes, but wolves currently occupy less than 10% of their historical range and the species as a whole is threatened by human activity (Restoring the Gray Wolf, n.d.).

Despite the fact that current wolf populations are still considerably lower than they were in the 1800s, efforts began in 2003 on behalf of the U.S. Fish and Wildlife Service to reduce or remove protection of wolves under the ESA. Although these efforts were repeatedly turned down by state and federal courts because populations were not fully sustained, the U.S. Fish and Wildlife Service responded by publishing separate rules that removed protections on wolves and allowed for hunting in the northern Rockies and western Great Lakes. Although several court battles ensued over this issue and protection was reinstated for a short while, Congress attached a rider to a must-pass budget bill in 2011 that eliminated protection of wolves under the ESA in all of Montana and Idaho, the eastern third of Washington and Oregon, and parts of northern Utah (Restoring the Gray Wolf, n.d.). Wolves in Wyoming still remained protected at this time, but efforts were made by the Fish and Wildlife Service in September of 2012 to remove them from federal protection in Wyoming (Restoring the Gray Wolf, n.d.). The removal of the wolves from the ESA was the first time in the history of the Act that a species was removed from the endangered species list by means of politics rather than science.

Controversy over wolf reintroduction programs continued in 2013, as the Obama administration issued a proposal to remove wolves from the endangered species list and all associated protection in the lower 48 states, except for the Southwest where the Mexican gray wolf still had extremely low populations. However, two federal court rulings in September and December of 2014 reinstated federal protection of wolves in Wyoming and the western Great Lakes states because the judges found the U.S. Fish and Wildlife Service violated the ESA. But it is important to note that these rulings do not provide protection of wolves in Montana and Idaho, eastern third of Washington and Oregon, or parts of northern Utah that were included in the Congress' bill. The Obama administration's proposal has since been put on hold, but this proposal and several others are still pending and attempting to remove wolves once again from the endangered species list in more areas of the United States.

Although the majority of US citizens are in favor of wolf reintroduction and believe wolves should be reestablished in their native habitats, the main drivers of wolf opposition are the livestock and hunting industries (The Cultural Significance of Wolves, n.d.). The reason wolves became endangered in the mid-1900s was due to hunting, poisoning, and trapping of wolves to protect livestock, and today's ranchers still have the same ideology that these newly established populations of wolves are a predatory threat to their livestock and overall livelihood. Confirmed wolf depredations are generally a small portion of all livestock losses, but some ranchers are significantly impacted more than others because of their proximity to wolf packs or protection measures. In 2015, confirmed wolf depredations in Idaho, Montana, Wyoming, Oregon, and Washington resulted in 158 cattle, 218 sheep, 5 dogs, and 3 horses killed, which is relatively insignificant compared to the

tens of thousands of livestock deaths that result from illness or weather each year (Northern Rocky Mountain Wolf Recovery Program 2015 Interagency Annual Report, 2016)(Livestock Losses, 2011). Elk populations have also declined by about 15% in some areas since wolves were first reintroduced, causing revenue from hunting licenses to wane (Gershman, 2014). By removing the wolf from the endangered species list and lifting protections, ranchers and hunters may be granted the right to kill any wolf that poses a threat and states are also able to implement their own population control strategies such as wolf hunting seasons or volunteer control groups.

Colorado is the most recent state involved in the wolf reintroduction controversy due to the lack of success of the Mexican gray wolf reintroductions in Arizona and New Mexico. Several environmental groups sued the U.S. Fish and Wildlife Service for not managing the Mexican gray wolf properly to allow for population growth, and were thus ordered by a federal judge to develop a new recovery plan by the end of 2017 (Fixler, 2016). New proposals could reintroduce the Mexican gray wolf to Arizona's Grand Canyon region and southwestern Colorado, in addition to the 110 wolves in New Mexico and Arizona's juniper woodlands. The proposed regions are considered prime habitats for wolves with the potential to support a population of about 1,000 wolves that is not being utilized (Kohler, n.d.). Majority of Coloradans are in favor of wolf reintroduction and nearly 71% of Coloradans would vote in favor of wolf reintroduction while 29% would vote against it (Pate, 1996), but the Colorado Commission of Wildlife has recently opposed the reintroduction because Colorado is not in the Mexican gray wolf's historic range (Explanation of Wolf Resolution, 2016). The Colorado Commission also understands that

ranchers and hunters are highly resistant to the reintroduction because they do not want to suffer the economic consequences of a new top predator on livestock and game.

The Colorado Parks and Wildlife Commissioners approved a resolution in January of 2016 that was against any federal action to reintroduce either gray wolves or Mexican wolves in Colorado. Because the federal government has final oversight of these projects, this decision was a symbolic gesture to tell the U.S. Fish and Wildlife Service that Colorado's state government was against any sort of wolf reintroduction program. To emphasize this notion, Governor Hickenlooper sent a letter of opposition to the Department of Interior stating they were against the Mexican gray wolf reintroduction, signed by himself and the governors of New Mexico, Arizona, and Utah. The letter was also used to recommend the delisting of wolves under the ESA so individual states would have the authority to decide how to manage wolves within their state lines. Essentially, Colorado's state government would rather have the right to develop and implement their own management of wolves that migrate into Colorado, rather than having no control over the management and impacts of reintroduced populations of wolves.

In 2004, the Colorado Department of Wildlife (CDOW) formed a group of wolf experts to develop a management plan for wolves that were beginning to migrate into Colorado if federal delisting of wolves in Colorado were to occur. Implementation of the program has yet to occur because wolves are still federally protected in Colorado, however, when wolves are no longer protected by the U.S. Fish and Wildlife Service, the ideal outcome would be the application of a new wolf protection policy that revisits the previous guidelines in the 2004 document published by the Colorado Wolf Management Working Group. The new policy would improve upon the current guidelines and goals and work to

satisfy interest groups involved in wolf repopulation including Colorado ranchers, hunters, wildlife conservationists, citizens, the Colorado and U.S. governments, and wolves.

Methods

I will be identifying opportunities for improvements and recommending changes to the *Finding and Recommendations for Managing Wolves that Migrate into Colorado* (CO Wolf Plan) by the Colorado Wolf Management Group. I will be using the very successful *Northern Rocky Mountain Wolf Recovery Plan* (NRMt Plan) by the U.S. Fish and Wildlife Service as a comparative case study, in addition to current research and information about wolf management to inform future decisions about wolves in Colorado. I will act as a change agent by revising the 2004 CO Wolf Plan published by the Colorado Wolf Management Working Group to improve upon the current guidelines. The primary purpose of a change agent is to identify difficult challenges within a system and resolve them with effective solutions, and their efforts are critical to “sustaining results in today’s dynamic, non-linear world” (Carter, 2013). This process is often performed as a continuous loop and allows organizations to constantly improve upon their current system.

I will be following Louis Carter’s method of change outlined in his book titled *The Change Champion’s Field Guide: Strategies and Tools for Leading Change in Your Organization* as a model for my thesis (Carter, 2013). His method includes the assessment of the current system, identification of opportunities for redesign, implementation of these changes, and evaluation of the effects of these changes. His methods also include very specific details about the characteristics that a change agent must possess for the efforts to be successful, but my thesis is more focused on the changes that should be made to the

current system rather than actually implementing these recommendations as a change agent. Carter's book included examples of this method being utilized within the realm of health care, business, technology, urban development, and environmental science, but can be applied to any sort of system or model.

The process can often take multiple years to fully complete the cycle and successfully identify the best improvements; therefore I will only be conducting a portion of Carter's method. This includes the assessment of the 2004 CO Wolf Plan, identifying opportunities for change within the current system, and recommending changes to be made to the program based on current information and research related to wolf management, while omitting implementation and evaluation due to constraints on time and resources. Assessing a system and identifying significant opportunities for change are extremely important to the success of the entire process because an inadequate effort given to the planning stage will result in undesired results (Carter, 2013). Thus, my goal is to thoroughly evaluate the current plan to manage wolves in Colorado and find ways in which to make it more efficient, more effective, and more successful by increasing wolf populations and gaining support from key interest groups that are negatively impacted.

Data will consist of a case study of the *Northern Rocky Mountain Wolf Recovery Plan* as a comparative model, survey research, field research, current events, news articles, and government published reports. This will then be used to make recommendations for wolf repopulation in Colorado based on the guidelines presented in the *Findings and Recommendations for Managing Wolves That Migrate Into Colorado* (CO Wolf Plan).

Case Study

Title:	Northern Rocky Mountain Wolf Recovery Plan
Author(s):	U.S. Fish & Wildlife Service
Date:	1987~2011/2012 <ul style="list-style-type: none"> • Primary goal reached in 2002 • Federally delisted under ESA in 2011 in Montana and Idaho • Will be federally delisted in Wyoming in 2017
Location:	Northwest Montana, central Idaho, and the Greater Yellowstone Area in Wyoming
Primary Goal:	Establish 10 breeding pairs of wolves in each of the 3 recovery areas for 3 consecutive years
Recovery Zone Requirements:	<ul style="list-style-type: none"> • Year round abundant source of natural prey • A minimum of 3,000 square miles of habitat • Connected land • Less than 10 percent of private land ownership • Absence of livestock • Seclusion from urban development
Key Findings:	<ul style="list-style-type: none"> • The establishment of specific goals for wolf recovery before federally delisting • Multi-agency cooperation is involved in wolf management and funding • The use of different management zones with various levels of wolf protection to limit conflict • The current population of wolves is approximately 2,000 individuals in the three recovery areas and surrounding states as a result of the program

In this section I will be outlining the NRMt Plan that was implemented by the U.S. Fish and Wildlife Service as a fundamental comparison for improvements that could be made to the CO Wolf Plan by the Colorado Wolf Management Working Group. The NRMt Plan was exceedingly successful in restoring wolf populations in the locations it encompassed and I believe it is a particularly valuable resource for informing future wolf

management practices in Colorado. This section simply describes the goals the U.S. Fish and Wildlife set to restore wolf populations in Wyoming, Idaho, and Montana, the methods they used to obtain these goals, and how they went about increasing support from interest groups that are often opposed to the establishment of new wolf populations. It will also include the current state of wolf management in each of these areas.

Northern Rocky Mountain Wolf Recovery Plan by the U.S. Fish & Wildlife Service

The Northern Rocky Mountain Wolf Recovery Plan was officially proposed in 1987 and provided guidelines for recovering gray wolf populations in areas of their historical range in the Northern Rocky Mountains of the United States. The specific areas included in the plan were northwest Montana, central Idaho, and the Greater Yellowstone Area in Wyoming. The intended purpose of this project was to remove the Northern Rocky Mountain wolf from the endangered species list and repopulate an area that has not seen wolves in over 50 years. According to this plan, the wolf would be removed from the Endangered Species list once a minimum of ten breeding pairs of wolves were securely established in each of the recovery areas for three consecutive years (Northern Rocky Mountain Wolf Recovery Plan, 1987). This project included the translocation of wolves by natural re-colonization in northwest Montana and central Idaho, but also reintroduction in Yellowstone Nation Park due to geographic isolation of Yellowstone from established populations of wolves in the wild.

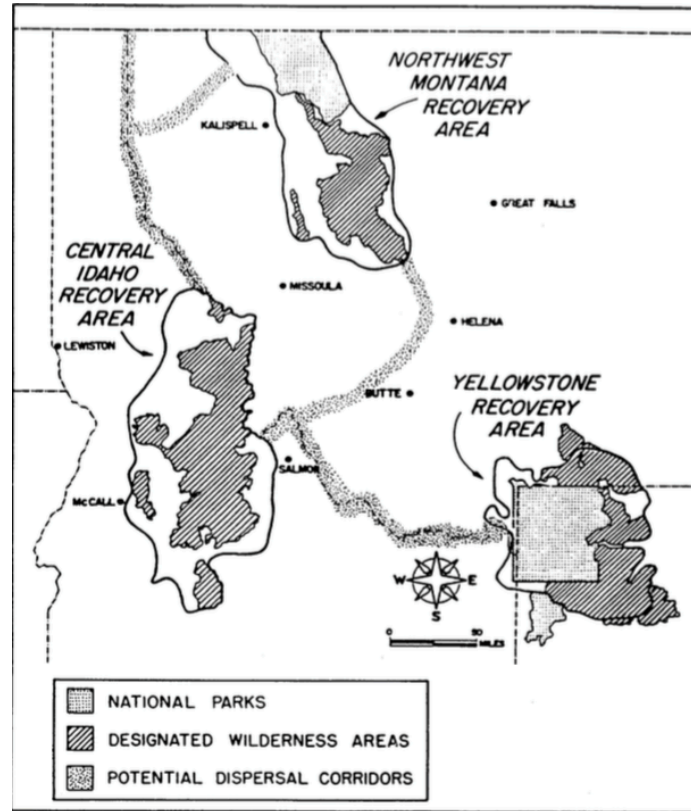


Figure 1. Map of wolf recovery areas in Wyoming, Idaho, and Montana designated by the U.S. Fish and Wildlife Service. Reprinted from *Northern Rocky Mountain Wolf Recovery Plan* (p. 18) by The U.S. Fish and Wildlife Service, 1987, Denver, CO.

The U.S. Fish and Wildlife Service designated specific recovery zones within the historic range of the Northern Rocky Mountain wolf and included areas of northwestern Montana, central Idaho, and the Greater Yellowstone Area in the northwest corner of Wyoming. Each recovery area established a distinct conservation strategy and management plan that would focus on rebuilding and sustaining populations in their given area. These locations were chosen based on a year-round source of abundant natural prey, a minimum of 3,000 square miles of adjoining area, less than 10 percent of private land ownership with the exception of railroad grant lands, ideally the absence of livestock to avoid conflict, and adequate seclusion from human activity to protect 10 breeding pairs of

wolves (Northern Rocky Mountain Wolf Recovery Plan, 1987).

After a comprehensive literature review and numerous discussions with U.S. and Canadian biologists and wolf researchers, the Service determined that the primary objective for removing the Northern Rocky Mountain wolf from the endangered and threatened species list was to establish 10 breeding pairs in each of the three recovery areas for a minimum of three consecutive years. The key reason for this is because three established populations in different geographic regions ensures one or two populations would survive if a catastrophic event were to suddenly occur. The Service also identified these three locations as the main geographic areas that wolves historically occupied that were also suitable for wolf existence and recovery given the criteria previously stated (Northern Rocky Mountain Wolf Recovery Plan, 1987).

The NRMt Plan also included secondary and tertiary objectives that were supplemental to the primary objective of sustaining 10 breeding pairs in the three recovery areas for three consecutive years. The tertiary objective was to reclassify the Northern Rocky Mountain wolf as threatened in an individual recovery area. This would be accomplished by establishing a minimum of 10 breeding pairs in single designated area for a minimum of three consecutive years. Once this has been verified, individual states would be given more flexibility of wolf management such as control options, while also adhering to particular regulations developed for each individual population. When the third objective has been met, the specific population would then be eligible to be “listed under similarity of appearance.” This means that the particular local population is no longer facing a threat of extinction, but the species as a whole is still endangered (Northern Rocky Mountain Wolf Recovery Plan, 1987). However, relisting under similarity of appearance is

only possible after distinct regulations of wolf management have been developed and an adequate state wolf-management plan has been implemented.

Once the third objective has been completed, the secondary goal for delisting the Northern Rocky Mountain wolf was to reclassify the Rocky Mountain wolf to threatened (rather than endangered) by establishing 10 breeding pairs for three consecutive years not only in the recovery areas but the three historic regions in northwestern Montana, central Idaho, and the Yellowstone Area. This would further increase the chances of species survival by allowing more area for populations to expand and diversify. Though, the Service notes that government implemented protection will not be sufficient enough to maximize survival rates as these wolves migrate to other areas where protection is not. Therefore, they recommend that individual land and wildlife management agencies are given straightforward and specific guidelines for protection and management of wolves to ensure wolf recovery is implemented in other agencies' planning and management strategies.

Both the Montana and Idaho locations had the possibility of natural recolonization from a Canadian corridor that had not proved successful when the program was published, but with the right management strategies this option has become much more viable. The U.S. Fish and Wildlife Service established integrative programs with Canada that would promote wolf migration to the northwest Montana and central Idaho recovery areas. These programs resulted in management practices that favored wolf relocation and survival such as safe travel corridors, abundant wolf habitat, and protection of the wolf populations in British Columbia and/or southwestern Alberta (Northern Rocky Mountain Wolf Recovery Plan, 1987). This type of method required that U.S. and Canadian biologists closely monitor

dispersal patterns of Canadian wolves to better adjust the management and protection policies. It also called for habitat conservation efforts on behalf of the U.S. Fish and Wildlife Service that would promote survival of the migrating populations by funding public outreach and information programs in order to increase wolf education and acceptance.

As for the Greater Yellowstone area, the possibility of natural recolonization of wolves was extremely limited because of its remote location to other wolf populations and lack of suitable travel corridors. Because of this, the translocation of wolves to this area was essential for re-establishing a population in Yellowstone. The relocated wolves in the Yellowstone area were termed an “experimental population” under the 1982 Amendments to the Endangered Species Act (ESA), which provided greater management flexibility in this zone and ultimately increased public and agency approval of the transplant proposal (Northern Rocky Mountain Wolf Recovery Plan, 1987). The local public had reasonable concerns about the reintroduction of a top predator to an area that it has been absent from for decades, and by designating the population as experimental, the Fish and Wildlife Service was able to impose control options that would otherwise not be possible if the population was just listed as threatened. Some of the flexible options for controlling this experimental population in Yellowstone included the ability for livestock owners to kill a depredating wolf if the killings were verified to be domestic livestock on designated private land, to delist or reclassify wolves outside of the designated recovery zones as “listed under similarity of appearance”, to conduct control management practices early in the recovery process to limit significant impacts on prey populations, and to initiate wolf control on packs that hunt herds of prey outside of the Yellowstone National Park area (Northern Rocky Mountain Wolf Recovery Plan, 1987).

The Service itself notes that public outreach and education is extremely critical to the success of the Greater Yellowstone wolf population, even more so than the Idaho and Montana locations, because this population was implanted into this area rather than naturally recolonized. This area also experiences much more frequent interactions between wolves and humans due to tourism, hunting, and other human traffic and the lack of knowledge and understanding of wolves has ultimately limited the effectiveness of wolf recovery efforts. However, the Fish and Wildlife Service advised that public outreach in all three states would be essential for public acceptance of the plan. They knew that not everyone would support wolf repopulation, but outreach and education would ultimately reduce the number of oppositions to wolf reintroduction.

Through their education and outreach efforts, the U.S. Fish and Wildlife Service wanted to inform the public about the natural history wolves have with this region of the United States, the status of their endangerment, and factual information about wolves and the management program itself. They believed that public outreach methods such as issuing news releases, publishing articles, holding community meetings, and hosting public hearings would be sufficient in building support from the general public. Educating those who come in direct contact with wolves, like ranchers or other agencies, about the wolf protection guidelines under the ESA would be vital in preventing unlawful killing of endangered wolves that could result in a fine of \$20,000, 1 year in prison, and loss of licenses or permits for use of public land (Northern Rocky Mountain Recovery Plan, 1987).

To further prevent conflicts between wolves and humans and increase the acceptance of this newly introduced species, the U.S. Fish and Wildlife Service established three separate management zones in each of the three recovery areas. These management

zones were developed to ultimately gain support for the program from the livestock industry and were used to minimize livestock depredation and human interactions as much as possible by distinguishing wolf habitat from human and livestock populations.

Management Zone I was designated as the primary habitat for wolves and should have an area larger than 3,000 continuous square miles with an adequate abundance of prey to support the ten breeding pairs of wolves. The area in zone I should have less than 10% private land ownership and less than 20% grazing land to minimize the chance of encounters with humans and livestock (Northern Rocky Mountain Recovery Plan, 1987). Management in this zone focused primarily on the protection of wolf populations, conservation and improvement of wolf habitat, and limiting conflicts with livestock. The needs of the wolves were the primary factor in management decisions and control options should only be used as a last resort that must be directed by the Regional Director of the Fish and Wildlife Service.

Management Zone II is the buffer zone between Zone I and Zone III and should still have key habitat and prey for wolves, but not necessarily enough to support large wolf populations. Wolf conservation and protection was not the main priority in this area of land and other land uses may have precedence over wolf habitat use. Control options could be used on wolves that depredate on lawfully present livestock as directed by the Regional Director of the Fish and Wildlife Service.

Management Zone III is the zone of human activity, development, and livestock, and is not suitable for wolves due to the conflicts that would arise. The highest priority in this zone is to minimize conflicts between humans, livestock, and wolves, and management of wolf habitat is not considered. Any wolf that depredates on livestock will be controlled and

any wolf that has been determined to frequently pose a threat to livestock may also be controlled.

In Management Zones I and II, clear evidence of wolf depredation must be presented to qualified State or Federal personnel before the wolf would be controlled, and there must be an indication that the wolf would continue to depredate on livestock if it was not controlled. The Service states that not all wolves that live near livestock pose a threat, therefore problem wolves should be translocated rather than killed and only single wolves should be moved rather than entire local populations (Northern Rocky Mountain Wolf Recovery Plan, 1987). The problem wolves would be captured, tattooed, ear-tagged, radio-collared, and relocated to an area within Zone I that have very little conflict with other interests to ensure further problems would not occur. If a wolf made several offenses it would be removed from the wild and placed in captivity, and lethal control would only be considered if the relocated wolf returned to the original site of conflict multiple times and no other facilities were willing to take in the wolf. The Service also notes that developing a Task Force that designates compensation to ranchers that experience livestock loss was important for limiting the need for drastic control methods in Zone I and II.

The U.S. Fish and Wildlife Service had specific methods for monitoring gray wolf populations, habitat, and prey in each of the three management zones in order to ensure populations would meet their respective goals. They often used monitoring systems to determine areas that were newly occupied by wolves, and conducted wolf surveys in areas with high reports of wolf sightings during the fall season and in summer during mating season in order to track population growth. They also monitored known populations of wolves using radio tracking to determine their home ranges, estimated numbers of packs,

pairs and individual wolves, approximate pup to adult ratios, average litter sizes, and overall population trends (Northern Rocky Mountain Wolf Recovery Plan, 1987). This monitoring and management effort demanded the support and funding from organizations outside of the Fish and Wildlife Service because of the effort required to track and protect these growing populations.

Many of the organizations involved in the wolf reintroduction program knew that the management of wolf habitat and livestock conflicts was not the only critical factors that would promote the success of wolf repopulation in the Northern Rocky Mountains. The U.S. Fish and Wildlife Service also considered the repercussions wolves would have on game populations, timber harvesting and fire management, recreation, and energy and minerals development. Working closely with agencies involved in these different sectors was extremely important to the development of this program because without their support for the presence of the wolves there was little chance of reaching the population recovery goals. Furthermore, the U.S. Fish and Wildlife Service would not be able to solely fund the various management actions that are needed. Some of these agencies involved in the program include Idaho Department of Fish and Game, Montana Fish, Wildlife and Parks, Wyoming Game and Fish Department, National Park Service, USDA Wildlife Services, several different Native American tribes, and state level departments of natural resources (Northern Rocky Mountain Wolf Recovery Program 2015 Interagency Annual Report, 2016).

The U.S. Fish and Wildlife Service was able to reach the recovery goal of 10 breeding pairs in each of the three recovery areas for 3 consecutive years in 2002, and by 2011 wolves were delisted in Montana and Idaho and shortly after in Wyoming in 2012. Efforts

to delist wolves in the Northern Rocky Mountain area were initiated in 2007, but Montana and Idaho did not have enough resources to properly implement their management plans until 2011 and Wyoming's state laws were not sufficient for conserving the newly established wolf populations until 2012 (Endangered and Threatened Wildlife and Plants, 2007). The Wyoming population was relisted in 2014 in order to continue to receive federal protection because their management efforts were not providing proper protection, but in early 2017 a U.S. appeals court approved the removal of wolves in Wyoming under the ESA because it appears Wyoming now has an adequate wolf management program to put in place (Volz et al., 2017). This means that gray wolves in the west must now be protected by individual state efforts and states are given the right to manage wolves without any input or intervention from the federal government (Northern Rocky Mountain Wolf Recovery Program 2015 Interagency Annual Report, 2016).

To hold states accountable, the agencies previously mentioned and several others publish an Interagency Annual Report that overviews their wolf management efforts for each year. States that contribute to the report include Idaho, Montana, Wyoming, Oregon, and Washington, and it is primarily comprised of their individual population monitoring, research, outreach, conservation, and funding for the protection of wolves. There are now approximately 2,000 wolves scattered around the western United States because of the Rocky Mountain National Wolf Recovery Plan, and this number will continue to increase as more states and agencies work together to bring back wolves to their historic range (Northern Rocky Mountain Wolf Recovery Program 2015 Interagency Annual Report, 2016).

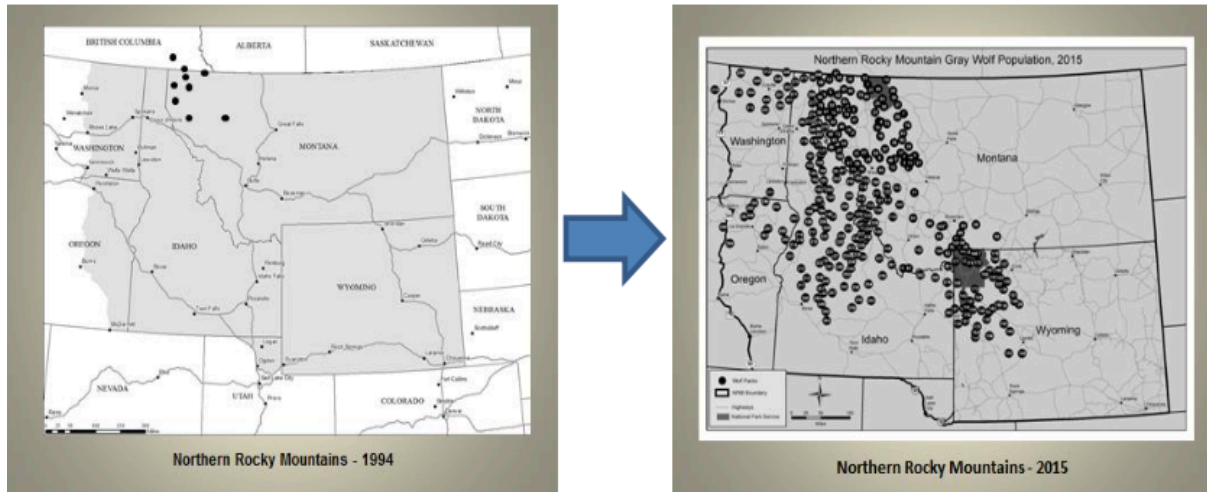


Figure 2. Map of known wolf packs in the Northern Rocky Mountains in 1994 and 2015. Reprinted from *Northern Rocky Mountain Wolf Recovery Program 2015 Interagency Annual Report* (p. 1) by The U.S. Fish and Wildlife Service et al., 2015, Helena, MO.

Discussion: Assessment

In this section, I will first be describing the basic framework of the *Finding And Recommendations for Managing Wolves that Migrate Into Colorado* (CO Wolf Plan) developed by the Colorado Wolf Management Working Group. I will then identify opportunities I believe are missing or could be improved to make their wolf management practices more successful. Once I have acknowledged the flaws within their system, I will suggest changes that could be made to the program that would both expand wolf populations within Colorado and increase the support from interest groups that are currently against wolf repopulation in Colorado. Groups that have most recently expressed their opposition to wolf repopulation include ranchers, hunters, and the Colorado State government.

Map Current System

Findings and Recommendations for Managing Wolves That Migrate Into Colorado by the

Colorado Wolf Management Working Group

Title:	Findings and Recommendations for Managing Wolves that Migrate Into Colorado
Author(s):	Colorado Wolf Management Working Group, 14 members including: <ul style="list-style-type: none"> • 4 livestock producers • 4 wildlife advocates • 2 wildlife biologists • 2 sportsmen • 2 local government officials
Date:	2004
Location:	The State of Colorado, mostly western Colorado
Primary Goal:	Establish an effective wolf management plan once wolves were removed from the ESA in Colorado
Primary Principles	<ul style="list-style-type: none"> • Impact-based management • Adaptive management • Monitoring • Damage payments/public outreach

The Colorado Wolf Management Working Group was formed in April of 2004 by the Colorado Division of Wildlife, and appointed 14 members to develop a plan that would protect wolves that were migrating into Colorado as a result of reintroduction programs in nearby states if federal protection were to be lifted. The group consisted of four livestock producers, four wildlife advocates, two wildlife biologists, two sportsmen, and two local government officials to ensure all interest groups would be considered in the management of newly established populations of wolves (Colorado Wolf Management Working Group,

2004). The primary goal of the group was to form an effective State management plan once wolves were removed from the Endangered Species Act (ESA) and no longer federally protected.

All 14 appointed members recognized that there would be several positive and negative outcomes that would result from growing wolf populations in Colorado; but the recommendations for the final report were based on consensus of the issues, regardless of each member's interest group. Some benefits emphasized in the document include improved ecological conditions in certain ecosystems, decreased number of ungulates in overpopulated areas, and a new aesthetic appeal to Coloradans and tourists. Some noted disadvantages include a decline in wild ungulate populations, loss of pets, increased depredation on livestock, and potential property damage (Colorado Wolf Management Working Group, 2004). In order to address each of these impacts, the CO Wolf Plan aimed to provide the tools, flexibility, and funding that would limit the negative effects of wolves and promote the positive.

Summary of the Four Primary Principles Outlined in CO Wolf Plan

Impact-based Management	<ul style="list-style-type: none"> • Focused on monitoring areas that are impacted by wolf presence • Aims to avoid lethal control through the use of alternative control methods • Requires multi-agency and livestock producers' cooperation
Adaptive Management	<ul style="list-style-type: none"> • Takes into account the natural changes that occur over time to the program and people's attitudes • Improve upon the plan every 5 years using the most current research and information
Monitoring	<ul style="list-style-type: none"> • Continual use of several different wolf monitoring techniques to gauge the degree and distribution of wolf presence • Track interactions and impacts between wolves and humans/livestock

Damage Payments & Public Outreach	<ul style="list-style-type: none"> • Compile and distribute information based on current wolf management activities in Colorado to educate public • Engage with key interest groups through non-specific outreach efforts • Pay livestock owners and hunters 100% market value for confirmed wolf depredation and 50% for probable kills
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The Colorado Wolf Management Working Group collectively developed four primary principles that were presumed necessary to managing wolves in Colorado and involved impact-based management, adaptive management, monitoring, and damage payments or other proactive measures for losses. Impact-based management recognizes that the impacts of wolves will vary based on location, density of wolves, distribution of ungulate species, patterns of land ownership, and proximity to livestock, but also understands that monitoring these different impacts as well as human attitudes is critical for proper wolf management (Colorado Wolf Management Group, 2004). In cases where conflict does occur, lethal control methods should be avoided, and instead the group suggests using alternative resolutions that would still mitigate the issue without harming wolves. Some methods they suggest include relocating problem wolves or packs, providing damage payments to livestock owners, or utilizing a combination of several management tools to find the best possible solution for a given area.

For wolf management actions to be effective and efficient, the Working Group highlights that there must be “a high degree of cooperation and coordination among management agencies and the private sector” (Colorado Wolf Management Group, 2004). The Colorado Department of Wildlife (CDOW) and USDA APHIS Wildlife Services are the agencies most involved in this wolf protection program and work closely with livestock

owners that are negatively impacted by wolves. These groups also provide wolf education and outreach about wolves, their implications, and their management to key interest groups like ranchers, hunters, conservationists, nearby homeowners, and policy makers. The CO Wolf Plan points out that a key component of impact-based management is the supply of available funding to guarantee each aspect of the protection plan will be properly and efficiently implemented, and this funding would primarily be from agencies like the CDOW, Wildlife Services, and several other non-government organizations (NGOs) (Colorado Wolf Management Group, 2004).

Adaptive management takes into account the changes that will occur over time to the wolf management program and suggests the CDOW be fully engaged in measuring and adapting to these changes. This would involve annually assessing the positive and negative impacts of wolves and using this information along with new peer-reviewed literature, input from the public, wildlife experts, and other agencies to improve upon the plan at least every five years (Colorado Wolf Management Group, 2004). The Group suggests surveying public attitudes and acceptance of wolves should be an ongoing project and a primary effort of adaptive management because it will keep the public informed and involved. Adaptive management is extremely important to the longevity of the program because the public must be supportive of the plan and tolerant of the negative impacts of wolves in order for wolf populations to establish and thrive (Colorado Wolf Management Group, 2004).

The third management strategy outlined by the Colorado Wolf Management Group is monitoring the distribution of wolves to gauge the degree of wolf presence and to also improve upon current management methods. Monitoring methods suggested by the Group

include aerial tracking, snow tracking, scent marking, howling surveys, radio collaring, remote photography, and genetic profiling (Colorado Wolf Management Group, 2004).

These efforts would be implemented and funded by the CDOW and may be used in varying degrees depending on the information needed from the monitoring. Information collected could potentially be used to help prevent and verify depredation of livestock, determine the ecological effects of wolves, mark changes in ungulate populations as a result of wolves, answer wolf related research questions, track unlawful killings of wolves, and continually update the program (Colorado Wolf Management Group, 2004).

However, in order for wolf monitoring to be initiated, local communities must be the first to act by reporting all accurate wolf sightings. If there are numerous reports of sightings or livestock depredation in the same area over the course of a few weeks, a wildlife expert will visit the location to verify these reports and potentially implement further monitoring efforts. The Group realizes that each community will have its own set of unique threats and conditions as a result of wolves, therefore they suggest that monitoring efforts be specialized for each individual area that is directly impacted. They also insist that the CDOW develop specific community networks with local residents that allow ranchers to quickly be notified of nearby wolf pack presence so they can act accordingly.

Lethal control of problem wolves should only be used as a last resort in the monitoring and management of wolves in Colorado. Instead the state and non-government organizations (NGOs) were recommended to develop proactive solutions alongside livestock producers that would best fit their individual need. This would include actions such as providing guidance on proper carcass disposal, investing in extra protective fencing, installing scare devices, and testing of other developmental non-lethal methods

(Colorado Wolf Management Group, 2004). Farmers and ranchers that participate in the use of alternative and experimental control methods would also be provided with an incentive for their cooperation and willingness to make the program successful. Monitoring the actions of livestock producers and offering them alternative methods for management is the best possible solution to preventing the unlawful killing of wolves by ranchers and further promote the establishment of wolf populations by encouraging the coexistence of humans and wolves.

In addition to monitoring wolf presence and their interactions with communities and livestock producers, the Working Group also finds it critical to monitor the unlawful hunting of wolves, wolf health and disease, urban interactions with wolves, and further research that is needed for management decision-making. The Group believes that tracking these factors is essential for developing a holistic wolf protection program because it addresses the major threats that would inhibit the establishment of wolf populations. The research would be conducted by the CDOW and be used to determine natural population trends as well as inform future management plans pertaining to wolf distribution, wolf-livestock and wolf-human interactions, habitat health, and ungulate population trends (Colorado Wolf Management Group, 2004).

The final principle outlined in the CO Plan is the implementation of a program for education and information, as well as a program for damage payments for wolf depredation. In terms of the informative program, the Group recommends that the CDOW compile and distribute information based on current wolf management activities in Colorado with the intent to provide scientific and factual information about wolves (Colorado Wolf Management Group, 2004). The Group believes this will make the public

more knowledgeable about wolves and thus more objective about their management, and increase the likelihood of the program being successful. Outreach efforts would primarily be focused on informing the general public, students, tourists, hunters, wildlife advocates, agency personnel, and the agricultural community on things like basic wolf information, wolf populations and distribution in Colorado, species identification, general wolf ecology, and the values and challenges related to wolves and their management (Colorado Wolf Management Group, 2004). The educational program would require the frequent circulation of current and relevant information about wolves in Colorado, and would only be possible with the cooperation from volunteers, NGOs, and other government organizations to ensure the information is effectively distributed to key interest groups.

The Working Group recognized that the most important aspect to consider in the development of their wolf protection plan is the relationship between wolves, hunters, and livestock producers because of their notable influence in the U.S economy. Growing wolf populations pose a threat to ranchers' income and hunters' game because of wolf depredation on ungulates, and unless ranchers and hunters are provided insurance for the losses that occur they are extremely unlikely to endorse the program and refrain from killing protected wolves. To increase wolf acceptance by these interest groups, the CO Wolf Plan suggests the CDOW manage a fund within the Colorado Game Damage Program that would pay hunters and ranchers for both confirmed and probable wolf kills. It is sometimes difficult to confirm a case of wolf depredation because they often do not leave a carcass or other signs of evidence, therefore the CO Wolf Plan understood that it would also need to compensate those who experience wolf depredation without sufficient evidence to prove it. Confirmed kills would be paid at 100% of the current market value and probable kills

would be paid at 50% of market value, and these cases would be reviewed by the Department of Wildlife Management to approve or deny the payment (Colorado Wolf Management Group, 2004).

Expenses related to wolf management and damage payments would not be taken from sportsman or livestock producers dollars, nor would they impact the existing game damage programs for bears and lions or the ongoing predator management programs for coyotes, bears, and lions (Colorado Wolf Management Group, 2004). The primary goal is to implement wolf protection in Colorado in a way that limits the negative impacts on the interest groups that are most involved as much as possible. The Working Group also notes that the CDOW must bear the costs of wolf presence in Colorado instead of ranchers and sportsman in order for the program to be successful. The CO Wolf Plan does not specifically say where majority of the funding for wolf management and damage payments will come from because the Colorado Wolf Management Working Group is not an official government affiliated group, but they do however recommend that the CDOW identify the specific sources needed for funding wolf management in Colorado (Colorado Wolf Management Group, 2004). Some recommendations for funding avenues include special interest license plates, fundraising through NGOs, support from Congress, grants, and donations.

In addition to the fund provided by the CDOW, a non-profit wildlife advocacy organization known as the Defenders of Wildlife also created the Bailey Compensation Trust because they wanted to increase the likelihood of wolf repopulation. They did so by funding over \$400,000 for compensation of livestock losses throughout the Northern Rocky Mountains in order to shift the economic cost of wolves away from ranchers and sportsman and onto wolf advocates (Colorado Wolf Management Group, 2004). They also

pay 100% of the market value for confirmed losses and 50% for kills without solid evidence of wolf depredation. The Defenders of Wildlife additionally invested more than \$200,000 in alternative wolf prevention methods, as well as providing assistance to ranchers for things like extra materials for fencing or leasing supplemental pasture area for more protection against wolf depredation (Colorado Wolf Management Group, 2004). Furthermore, the Defenders of Wildlife will pay ranchers \$5,000 per wolf den to allow the wolf pack to raise their pups on the rancher's private land (Mech, 1995). As long as wolves are listed as endangered under the ESA, the Defenders of Wildlife have stated they will continue to invest in their protection and strive to recover wolf populations in the western United States (Colorado Wolf Management Group, 2004).

Identify Opportunities for Change

In spring of 2004, the CDOW requested input from Colorado citizens about issues the Colorado Wolf Management Group should address in their program and general opinions related to wolves and their presence in Colorado. The Group held six meetings around Colorado and also accepted input via mail and email, and over the course of the scoping period received over 250 comments from Colorado citizens (Colorado Wolf Management Group, 2004). Out of the 261 responses they received, 73% were in support of Wolves in Colorado, while 20% were against it and the remaining 7% were either neutral or unknown. Most (44%) of the responses came from the Front Range of Colorado, which is generally known for being pro-wolf, but the scoping process was only used to clarify and define the issues that needed to be addressed rather than used as an official vote (Colorado Wolf Management Group, 2004). The Working Group found that the largest challenges for Colorado citizens related to wolf repopulation are social and political factors rather than

biological or ecological issues. The issues citizens found to be the most pressing include the overall presence of wolves in Colorado, possible impacts on the livestock industry, human risk, development of a plan to manage wolves, their effect on ecosystems, and the impacts wolves may have on the economy in Colorado.

With the use of this feedback from the general public, the Working Group was able to identify specific challenges the Colorado wolf protection program would inevitably face during its implementation. These include “wolf depredations on livestock and the associated economic losses, loss of management flexibility by federal and state land management agencies, land-use restrictions, impacts to big game populations, and reduced hunting opportunity,” as well as the overarching fact that wolf management is expensive, political, and controversial (Colorado Wolf Management Group, 2004).

Nearly all of the issues listed above are universal concerns related to wolf protection and reintroduction around the globe, including the successful Northern Rocky Mountain Wolf Recovery Plan, and will continue to be issues for years to come. The Colorado Working Group tried their best to address each of these issues in their own program utilizing methods like the livestock and game depredation fund, educational and outreach programs, statewide monitoring efforts of both wolves and their prey, alternative control methods, and adaptive management techniques. However, several factors may inhibit the program from being successful if enacted in the near future including the lack of any measurable goals for wolf repopulation in Colorado, the absence of buffer zones to prevent conflicts between wolves and urban areas as much as possible, the lack of attention given to the sources of funding for wolf depredation payments and management strategies, and the non-holistic plan to educate and inform the public and other interest groups.

Summary of Identified Opportunities for Change

<p>Measurable Goals</p>	<ul style="list-style-type: none"> • CO Plan was more focused on the mitigation of wolf presence and their negative impacts rather than increasing wolf populations in Colorado • NRMt Plan had very specific goals that allowed wolf populations to drastically increase
<p>Buffer Zones</p>	<ul style="list-style-type: none"> • CO Plan has no designated land between livestock and wolf habitat to limit conflict between humans and wolves • NRMt Plan had 3 separate management zones with different degrees of wolf acceptance and protection that limited conflict and increased acceptance from opposed groups
<p>Funding for Depredation Payments and Wolf Management</p>	<ul style="list-style-type: none"> • Managing and controlling of wolves is very expensive, time-consuming, labor intensive, and requires specially trained personnel to trap or kill the depredating wolves • CO Plan outlined vague sources of funding such as special interest license plates, fundraising through NGOs, the government, grants, and donations – not enough \$\$ to ensure consistent management
<p>Public Education & Outreach</p>	<ul style="list-style-type: none"> • Neither CO Wolf Plan & NRMt Plan had a sufficient plan to educate and engage with the public – they were more focused on dispersing information rather than personal outreach • Personal engagement is essential to eliminating fear and stigma about wolves and increasing acceptance of their presence, but neither plan aimed to do so • Education and outreach outlined in CO Wolf Plan was never actually implemented

Measurable Goals

The U.S. Fish and Wildlife Service is required to develop a wolf recovery plan for the Mexican gray wolf in the western United States by the end of 2017 (Fixler, 2016); therefore, Colorado should at least strive to recover wolf populations within the state to enhance the likelihood of achieving the objectives proposed in the new 2017 plan. The NRMt Plan is a great example of goal setting because it had very specific objectives outlined in the program that were meant to increase wolf populations at a sustainable rate in Idaho,

Montana, and Wyoming, and ensure their populations thrived. Several smaller goals led up to the primary objective of the NRMt Plan, which was to establish 10 breeding pairs in each of the three recovery zones for three consecutive years, but these smaller goals ensured recovery efforts were successfully establishing wolf populations before lessening or altering management practices.

The CO Wolf Plan had four primary principles they believed were important to follow in order to properly manage migrating populations of wolves, but the plan had no specific intentions of increasing wolf populations within Colorado. Instead, it appeared like the program was primarily trying to please each of the involved interest groups rather than creating a space for wolf populations to form. The principles outlined by the CO Wolf Plan include impact-based management, adaptive management, monitoring, and damage payments or other proactive measures for losses, but these principles only focus on mitigating the problems associated with the presence of wolves rather than aiming to increase populations. Colorado possesses many of the species wolves typically prey on such as deer and the largest population of elk in North America, and scientists have estimated that Colorado has enough land to support about 1,000 wolves (Kohler, n.d.). However, this large of a population would only be able to flourish with the implementation of strict guidelines, specific goals, and the intent to unconditionally protect wolves in certain areas of Colorado.

Buffer Zones

Another reason the NRMt Plan was so effective at restoring wolf populations in each recovery zone and surrounding states was because of the attention given to prevent the interactions between wolves and humans through the use of buffer zones. Wyoming, Idaho,

and Montana each designated three separate areas of land within their protection zones that had different primary land uses and varying degrees of wolf protection. The purpose of this was to limit the number of conflicts between humans and wolves, and increase support from interest groups that were concerned with land-use restrictions and livestock depredation (Northern Rocky Mountain Wolf Recovery Plan, 1987). This also reduces the number of wolves that must be controlled for and the money that must be paid to ranchers for livestock depredation, which overall decreases the need for resources that would otherwise be necessary to operate the program without buffer zones.

Colorado's wolf management program had absolutely no mention of implementing buffer zones or designating separate land for wolf habitat and ranching communities, which I believe is a huge mistake. The Colorado government claims that wolves migrating into Colorado are able to live with no boundaries where they find habitat, but will inevitably be controlled for if negative impacts arise (Northern Rocky Mountain Wolf Recovery Plan, 1987). Conflicts between ranchers and wolves are extremely difficult to avoid in areas where suitable wolf habitat is in close proximity to livestock operations, especially as wolf populations and the livestock industry continue to increase, and essentially hinders the possibility of wolves safely establishing populations without the threat of being killed or relocated. The CO Wolf Plan states that wolf distribution would ultimately be determined by the ecological needs of wolves and the social tolerance of people, thus Colorado should implement buffer zones to provide wolves with an area of land that meets their ecological needs and also increase the social tolerance of ranchers and other interest groups to eventually see a growth of wolf populations (Northern Rocky Mountain Wolf Recovery Plan, 1987).

The East Fork wolf pack in Alaska's Denali National Park is prime example of the lack of consideration given to the importance of buffer zones. This particular family group of wolves has been continuously studied for over 70 years and researchers were thoroughly tracking 15 members of the family by the 1990s, however, that pack has now been reduced to just one wolf as a result of hunting seasons and the lack of management zones that designate different levels of wolf protection (Holleman, 2016). Hundreds of thousands of people visit Denali National Park each year with the anticipation of spotting a wolf. Half of the visitors prior to the killings of the East Fork wolf pack were seeing wolves in the park, but now that most of the pack is gone, only about 5% of visitors are able to spot a wolf in Denali's park annually (Holleman, 2016). Many conservationists are pleading for the Alaska's State government to implement buffer zones around Denali National Park that would restrict hunting and trapping of wolves and increase protection in those areas, but the government has rather decided to shorten the wolf-hunting period in the upcoming 2017 season. If Colorado chooses to not invest in buffer zones between wolf habitat and urban development, wolves will face the same fate as those in Alaska and have little chance for survival.

Funding for Depredation Payments and Wolf Management

Although the CO Wolf Plan was well aware of the importance of including mitigation strategies related to wolf depredation on livestock in the development of their plan, I do not believe they quite understood the extent of funding and resources needed to implement these approaches. Since the implementation of the NRMt Plan in 1987 and until it ended in 2012, 117 wolves were moved and 1,905 wolves were killed in response to depredation on livestock (Paul, 2014). Efforts to remove wolves not only disrupt the

dynamics of the wolf pack, but it is also very time-consuming, labor intensive, and requires specially trained personnel to trap or kill the depredating wolves. Idaho alone budgeted \$1.63 million in 2015 for wolf related management such as depredation, monitoring, legal hunting and trapping oversight, enforcement, research, and administration, but this was before the government cut some of the funding to the program (Landers, 2017).

The CO Wolf Plan suggests some of the funding for the program in Colorado come from avenues like special interest license plates, fundraising through NGOs, the government, grants, and donations. These resources will definitely provide some of the funding needed, but the suggestions are extremely vague and there is no way to ensure a stable budget for proper management year to year. The CO Wolf Plan also pointed out that the Defenders of Wildlife would bear some of the burden by paying 100% of the market value for confirmed wolf depredations on livestock and 50% of the market value for probable cases, exactly like the CDOW would, but only until wolves are delisted under the ESA and no longer receiving federal protection. This means that once the Colorado state wolf management plan is implemented, the CDOW would no longer receive assistance from the Defenders of Wildlife to pay livestock owners for depredation losses because wolves would no longer be federally protected. Between 1987-2009 the Defenders of Wildlife paid out \$1,368,043 to livestock producers in Montana, Idaho, and Wyoming, which is about the same amount needed to run Idaho's entire wolf management program for a year. Without assistance from the Defenders of Wildlife, Colorado's wolf management fund would have to be reallocated to wolf depredation payments rather than proper management efforts, and could negatively impact all aspects of the program.

Additionally, wolf depredation payments only consider confirmed or probable wolf kills, but ranchers are not compensated for injured calves that must be sold for a loss, the costs of treating an injured animal, or the lower weights as a result of stress from depredating wolves (Thomas, 2013). This could be addressed by monitoring ranchers' incomes and livestock numbers during wolf repopulation to determine if wolves are negatively impacting the livelihood of the ranching community. Wolf depredation often significantly impacts individual ranchers or communities, therefore monitoring ranchers in addition to monitoring wolves could provide a bit of insight on how to better allocate resources and mitigate problem wolves.

Public Education and Outreach

The primary goal of wolf education and outreach programs is to increase the likelihood of wolf populations establishing in Colorado and limiting the use of lethal control methods; however, this would only be possible with the support from majority of the citizens of Colorado and compliance from those most impacted by wolves like ranchers, hunters, and homeowners. This goes beyond just informing the public about wolf biology, natural history, and ecology, but must also include scientific research on wolves and other species, how this science can inform better decision-making, and provide people with realistic strategies for coexisting with wolves to reduce conflict (Troxell et al., 2009). Most people that are familiar with wolves are also aware of the important role they play in maintaining many ecosystems, but this fact alone is not enough to gain popular support from the public and key interest groups.

Neither the NRMt Plan nor the CO Wolf Plan had a well polished education and outreach program that planned to actively engage with the people in close proximity to

wolf presence or those directly impacted by wolves. This sort of engagement is essential to eliminating fear and stigma about wolves and increasing acceptance of their presence. Both wolf management plans intended to disperse information on a regular basis about current practices and related wolf news to primary interest groups, but the chances of this information being received and understood by every group in a productive way is highly unlikely because it does not address specific concerns. Instead, Colorado should focus their efforts on developing individual education and outreach programs that are directly catered to the fears and misconceptions of each specific interest group. Generally, rural residents and older citizens are those most opposed to wolf restoration, therefore majority of the outreach efforts should be spent on working with these interest groups to address their specific needs and work together to create the most effective program possible (Black et al., 2007). The outreach program described in the CO Wolf Plan was never actually implemented, therefore the future program in Colorado should invest much more time and energy into proper education and outreach efforts.

Propose Change for Wolf Management in Colorado

Regardless of the political debate concerning wolf reintroduction in Colorado, wolf populations are migrating to western Colorado from the growing populations in surrounding states (Gulliford, 2016). It has been nearly 13 years since the CO Wolf Plan was developed in April of 2004, and although the issues related to wolf policy are generally the same, it is time to update or improve upon the CO Wolf Plan to promote further recovery of wolf populations throughout the United States and North America. The plan that must developed by the U.S. Fish and Wildlife Service to restore the Mexican gray wolf by the end of 2017 will have significant implications for Colorado because wolves will

undoubtedly migrate here from reintroduced populations in Arizona and New Mexico, and may possibly be reintroduced in Colorado as well.

The current program in place in Colorado is more focused on trying to address the concerns of each interest group in their protection of wolves rather than focusing on restoring wolf populations. Many of the guidelines they explained in their plan were also never actually implemented like the education and outreach program, revisitation of the plan every few years, and strict monitoring of wolf populations and related conflicts. The NRMt Plan has been a prime example of how humans and wolves can coexist in a way that not only benefits each other, but also the ecosystem, the economy, and the connection humans have to our nation's natural heritage. Colorado's program seems more concerned about the negative impacts wolves may have on the ranching and hunting communities rather than the positive impacts Colorado may experience. To shift away from a policy that is simply catered to specific interest groups like ranchers and hunters, I believe there are several changes that could be made to the Colorado wolf management program that would benefit wolf conservationists, the U.S and Colorado government, hunters and ranchers, and rural and urban communities. These changes include implementing specific and obtainable goals to restore wolves, designating buffer zones for different land uses, finding alternative methods for funding the program like tax dollars from marijuana or lottery sales, and improving upon the education and outreach program to be more effective at changing behavior of people. If these modifications along with the rest of the program developed by the Colorado Wolf Management Working Group were to be successfully applied and continually monitored, I believe wolf populations would undoubtedly increase throughout Colorado.

Summary of Proposed Changes to CO Wolf Plan

<p>Measurable Goals</p>	<ul style="list-style-type: none"> • Would be ideal to establish 3 separate wolf recovery zones in Arizona, New Mexico, and Colorado, similar to the NRMt plan • Goal setting ensures a steady management program is in place before giving the individual state control over wolf management • Examples: Establish 5-10 breeding pairs in next 10 years or reduce livestock depredation by 50% in next 5 years
<p>Buffer Zones</p>	<ul style="list-style-type: none"> • Designate land in Colorado between livestock and wolf habitat that has productive land uses like mining or logging, that way land is being used but also limiting conflict • Buffer zones decrease the amount of livestock depredation, the unlawful killing of wolves, and opposition from citizens and interest groups
<p>Funding for Depredation Payments and Wolf Management</p>	<ul style="list-style-type: none"> • Marijuana tax: Over \$80 million was collected in first year of legalization, could provide \$.5-1 million to wolf management • Lottery tax: Already focused on funding wild lands restoration in Colorado, could provide \$.5-1 million out of budget of \$88 million annually • Tourism: Generated \$1.13 billion in tourism taxes last year, wolf tourism could further increase the already growing tourism industry in Colorado <ul style="list-style-type: none"> ▪ Shifts financial burden from those opposed to wolves in Colorado onto those who are visiting Colorado and taking advantage of the unique attractions
<p>Public Education and Outreach</p>	<ul style="list-style-type: none"> • Simply distributing scientific information to key interest groups on a regular basis is not enough to sufficiently educate the public and increase support for wolf management • Humans base decision making on emotion rather than factual information • Must develop an engaging program that is specific to the concerns and fears of each interest group • Intertwine education and mitigation strategies to coexist with wolves such as extra fencing around pastures, scare machines, or pellet guns to avoid lethal control methods and increase tolerance of wolf presence

Measurable Goals

The ideal situation for the U.S. Fish and Wildlife Service would be to mimic the NRMt Plan by having three separate recovery zones in Arizona, New Mexico, and Colorado to increase the likelihood of at least one state establishing a stable wolf population.

Regardless if the wolves are reintroduced or naturally recolonized, specific goals should be set within Colorado so all citizens and related interest groups are aware of the importance of not killing wolves and utilizing alternative methods for coexistence. This could include a series of smaller goals that allow for more freedom of wolf control methods, but only after certain wolf population goals are stabilized. Goal setting also ensures that a steady program is effectively protecting wolves before giving the state full control over wolf management.

The only wild population of Mexican gray wolves in the world consists of 113 wolves in southern Arizona and New Mexico, but with the right management goals and strategies Colorado has the potential to support over 1,000 wolves (What You Need To Know About The Mexican Gray Wolf, 2017) (Kohler, n.d.). The reason Colorado does not have larger populations of wolves already is because there is no ongoing effort to clarify the normative and technical components of recovery goals, therefore ranchers and hunters have no reservations in using lethal control methods either because they do not know better, they just do not care, or they do not have the means to do otherwise (Caroll, 2001). Outlining specific recovery goals such as establishing 5 to 10 breeding pairs throughout Colorado in the next 10 years will give the state motivation to hold the government and citizens accountable and shift away from traditional lethal control methods. Also establishing goals within certain communities could make citizens feel directly engaged in the recovery of this threatened species. An example would be reducing the number of

livestock depredations in a ranching community by 50% in the next 5 years. However, for this goal to be obtainable, the program must provide the community with the supplies and methods to effectively implement the changes and reduce the burden on those experiencing the most change.

Buffer Zones

The Colorado Wolf and Wildlife Center (CWWC) is a NGO that is actively striving to restore wolves by housing Mexican gray wolves on their sanctuary land and providing education to the public. They recently expanded their lands to house more wolves, but have purchased an additional twenty acres of sanctuary strictly for wildlife buffer zones (Kobobel, 2017). The CWWC is a fairly small plot of land located in Divide, Colorado near several ranching communities, but the organization understands that there will inevitably be conflict between wolves and livestock if they are in close proximity to one another. To reduce the risk of livestock depredation as much as possible they purchased extra land to minimize the chance of wolves traveling farther distances to prey on livestock. This is only a small example of the use of buffer zones in Colorado, but demonstrates that designating areas of land between wolf habitat and other land uses can be used as an effective strategy to ultimately increase support from interest groups and minimize unnecessary conflict in Colorado.

The reintroduction of wolves makes the formation and enforcement of buffer zones much easier because the location of the wolf populations is exactly known, but the Colorado wolf management plan would undoubtedly benefit from implementing different zones for wolf habitat, other land uses like mining or logging, and ranching and other human activity. Separating wolves from urban cities and ranching communities as much as

possible limits many of the issues associated with increased wolf populations. If Colorado were to implement buffer zones between wolf habitat and urban development, the amount of livestock depredation, the unlawful killing of wolves, and opposition from citizens and interest groups would all noticeably decrease (Northern Lights Wolf Centre, 2014). It also gives wolves the opportunity to thrive in their natural ecosystem without having to be translocated or controlled for because of their proximity to urban areas. All of these factors would ultimately result in less wolf killings, less conflict between interest groups, less money needed for livestock depredations, and fewer resources needed to implement the program.

Funding for Depredation Payments and Wolf Management

Although adequate funding for wolf management is vital to ensuring the program is properly implemented and fully carried out, it is extremely expensive to do so. Certainly, the sources outlined by the Colorado Wolf Management Working Group like interest license plates, NGO fundraising, grants, and donations would provide some of the funding for the program, but would be no where near the \$1.63 million Idaho budgeted in 2015. To reach this sort of funding goal, Colorado must find alternative sources of capital that are consistent enough to satisfy the needs of the program for years to come. Some suggestions I believe could fund Colorado's wolf management program would include proceeds from marijuana taxes, lottery taxes, and wildlife tourism within Colorado.

In the first year of the legalization of recreational marijuana in Colorado, over \$80 million was collected from retail and application fees and taxes; \$40 million of which was given to the Colorado Department of Education and \$40 million was given to the Public School Fund. If Colorado was able to allocate half a million to a million dollars each year to

wolf management from the \$80 million marijuana sales tax, the possibility for better wolf management would drastically increase, while the education programs would not suffer significantly from a 1/150th cut to their budget (Colorado Marijuana Tax Cash Fund Appropriations, 2017).

Colorado's lottery tax allocation is already focused on protecting the state's wilderness areas and has invested almost \$3 billion on the preservation of open space and creation of trails, parks, pools, and recreation areas since 1983, which is about \$88 million a year (Investing in Colorado, 2017). In 1994, Colorado voters decided half of the money would be given to the Great Outdoors Colorado (GOCO) Trust Fund, 40 percent would go to the Conservation Trust Fund, and 10 percent would be given to Colorado Parks and Wildlife (Investing in Colorado, 2017). If the Colorado wolf management program was able to receive just a tiny fraction of the \$88 million received from lottery winnings each year, the wolf protection efforts would fully coincide with the Colorado Lottery's mission to preserve the natural heritage of Colorado and protect the incredible biodiversity it has to offer.

Tourism is a key component of Colorado's economy and has been growing at a record-breaking rate over the last few years. Colorado saw 77.7 million visitors in 2015 and tourists spent about \$19.1 billion dollars over the course of the year, generating about \$1.13 billion in taxes (Blevins, 2016). Using tourism dollars for wolf management would shift the financial burden away from Coloradans that are opposed to wolves and their negative impacts and onto those who are visiting Colorado and taking advantage of the unique attractions that are offered. By funding wolf management, the tourism sector could potentially receive a return on their investment once populations of wolves increase and

wolf tourism can become an integral part of the Colorado tourism industry. The Colorado Tourism Office is currently developing a plan called the Colorado Tourism Roadmap that is designed to boost tourism in Colorado by developing a travel guide that focuses on sustainable tourism and unique experiences throughout the state. If wolf populations increase in Colorado, wolf tourism could be involved in their guide to raise awareness and acceptance of wolves and generate more income from tourism dollars (The Colorado Tourism Roadmap, 2017).

Public Education and Outreach

Despite the fact that wolf management programs must approach management strategies using the best available science and objective facts, it has been proven time and time again that humans are not always rational thinkers and we do not base most of our decision making on data, but rather emotion (Slagle et al., 2012). A study conducted by Slagle et al. surveyed almost 700 American citizens about their views of wildlife management and found that beliefs and emotions about the positive or negative outcomes that may result from wildlife management were the driving force in most people's decision making (Slagle et al., 2012). This means that simply distributing scientific information to key interest groups on a regular basis is not enough to sufficiently educate the public and increase support for wolf management. Instead, the program must develop a way to connect to interest groups through emotional means rather than facts in order to change behavior and opinions related to wolf management.

Those generally most opposed to wolf management include rural and older populations because of their emotional fear of wolves and the associated consequences of their presence; therefore, majority of the outreach efforts should be allocated to these

specific interest groups. Outreach efforts should primarily include the development of individual programs that engage with communities that are generally against wolf management or are significantly impacted by wolf presence in order avoid wasting outreach efforts on groups that are already in support of wolves. Efforts would be focused on discussing specific concerns related to that community and develop solutions to lessen their opposition and invest them in wolf recovery efforts. It has been shown that the use of live animals can be effective in wolf education to change people's negative perceptions, however, I am not certain this would work on livestock owners and older generations because of the preconceived notion that wolves are a nuisance and often compared to vermin (Black et al. 2007). However, a more effective solution would be to provide communities with alternative strategies to coexist with wolves such as extra fencing around pastures, scare machines, or pellet guns to avoid lethal control methods and increase tolerance of wolf presence. These resources would of course need to be provided by the state to further lessen the burden on those most negatively impacted by wolves.

Conclusion & Recommendations

The CO Wolf Plan was a great start to effectively managing wolves that were first to migrating into Colorado as wolf populations increased in nearby states, but that was nearly 15 years ago. Future wolf populations are inevitably going to increase in Colorado as a result of migrating wolves from the Northern Rockies and the new reintroduction program for the Mexican gray wolf in the Southwest United States, therefore it is time to revisit the 2004 document and improve upon the flaws within the current system. The flaws I found most pressing to the future of wolf protection in Colorado include the lack of measureable

wolf recovery goals, the absence of buffer zones between wolf habitat and ranching communities, inadequate sources of funding to properly implement the program, and an insufficient education and outreach program to increase support from opposing groups.

Through the analysis of the NRMt Plan and the 2004 CO Wolf Plan I was able to identify four major solutions to these issues. To address the lack of measurable goals, I believe the adaptation of concrete recovery goals for wolves within Colorado would ultimately increase the success of recovery efforts. I also believe the implementation of buffer zones between ranchers and wolves with versatile land-uses would decrease livestock depredation rates and increase support from key interest groups. In order to properly fund the program, I found that Colorado's marijuana tax, lottery tax, and tourism are all viable options for providing enough capital for consistent and correct wolf management. And finally, I believe the development of an education and outreach program that is specifically catered to addressing the fears and tapping into the emotions of important interest groups will ultimately increase statewide support for wolf repopulation.

Although these solutions will likely increase the possibility of wolf populations increasing throughout the state, it is important to consider that these solutions are not enough to fully prevent wolf conflict in Colorado. Wolf management requires support and cooperation for all interest groups that are involved because any sort of program could be perfect on paper, but if people are not willing to participate and engage in the program than it is completely purposeless. It is also essential to revisit the goals, management practices, and public opinions related to wolves as often as possible because science, technology, and views are always changing and it is important to stay as current as possible to ensure the program is working efficiently as possible. I also think it is important that we

intertwine the management of wolves and livestock to determine the actual economic impact of newly established wolf populations on ranching communities and focus efforts on communities most impacted.

Whether or not Colorado is fully prepared for wolves with a comprehensive plan to manage them within state lines, wolves are already beginning to migrate and establish populations within the state. Although it is illegal to kill wolves in Colorado because they are federally and state protected, most wolves that have been seen in the state have either been hit by a car or shot by hunters or ranchers. It is time we make it official that wolves are in fact establishing populations in Colorado and make sure all Coloradans are aware of their presence and the proper management and behavior that is expected by the state and citizens. Colorado has enough resources to support over 1,000 wolves, and negative opinions, poor management practices, and opposition from the government should not be the reason that inhibits the repopulation of wolves to a land that was once their own. Rather, we should find effective solutions to limit the negative impacts as much as possible, while also giving wolves a second chance to thrive.

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