IMPROVING THE MEXICAN GRAY WOLF RECOVERY PLAN THROUGH ANALYSIS OF SUCCESSFUL REINTRODUCTION OF GRAY WOLVES IN THE NORTHERN UNITED STATES

by

Kari M. Schoenberg

A Thesis
Submitted in partial fulfillment
of the requirements for the degree of
Master of Environmental Studies
The Evergreen State College
June 2012

This Thesis for the Master of Environmental Studies Degree

by

Kari M. Schoenberg

has been approved for

The Evergreen State College

by

_____

Timothy Quinn
Habitat Program Chief Scientist, Washington Department of Fish & Wildlife
Adjunct Member of the Faculty

June 30, 2012

_____

Date

ABSTRACT

Improving the Mexican Gray Wolf Recovery Plan
Through Analysis of Successful Reintroduction of
Gray Wolves in the Northern United States

Kari M. Schoenberg

The wolf continues to be one of the most controversial wildlife species in the U.S. Once persecuted to the point of near extinction in the U.S. the gray wolf was one of the first species to be listed under the Endangered Species Act in 1973. Reintroduction programs as part of recovery efforts for this endangered species have generally been successful as measured by increasing wolf populations and the number of breeding pairs in the wild in the northern U.S. Indeed, the reintroduction of wolves into Yellowstone National Park is regarded as one of the best-known recovery successes in the U.S. However, reintroduction of the Mexican gray wolf in the southwestern U.S. has not been as successful by most measures. The Mexican gray wolf recovery plan called for 100 Mexican wolves in the wild by 2006, yet there have never been more than 60 wild Mexican wolves in the recovery region. Failure of the program is likely due to a mixture of biological and social reasons.

The purpose of this study was to identify factors that facilitate successful wolf recovery. In particular, I conducted a literature review of gray wolf recovery in the northern U.S. in an attempt to understand why some wolf reintroduction efforts are relatively successful compared to Mexican wolf reintroduction efforts. Further, I developed a questionnaire survey and sent it to biologists working with wolves in Montana, Wyoming, Idaho, Washington, Oregon, New Mexico, and Arizona. The intent of the survey was to better understand what biological and social factors biologists think may be related to successful reintroduction programs.

Two main stakeholder groups, the scientific and rancher community, have widely varying opinions and perceptions about wolves and wolf recovery. To better understand these differences I sent questionnaires to ranchers affected by gray and Mexican wolf reintroductions in each of the seven states mentioned above. My intent here was to explore: *a) how attitudes about wolves may have shaped wolf management*, and *b) how perceptions of wolves may affect the success of reintroduction*.

Biologists believed that avoiding wolf/human conflicts was the most important social component of successful wolf recovery plans. Biologists also believe that the Mexican Wolf Recovery Plan has not been successful because the recovery region was too small and because ranchers were generally intolerant of wolves. Ranchers associated with Mexican wolf recovery were more negative about recovery success than ranchers dealing with gray wolves. Compensation programs associated with wolf recovery were found to be inadequate by both biologists and ranchers but for different reasons. Importantly, ranchers believed that they are undercompensated for true loss of their livestock. However while biologists agreed with ranchers that compensation programs

are inadequate they still believed that compensation was fair in contrast to ranchers who believed them to be unfair.

Ranchers dealing with Mexican wolves thought there would be less cooperation between biologists and ranchers through time while ranchers dealing with gray wolves were slightly more positive and believed the relationship would stay relatively unchanged. Interestingly a majority of ranchers would be willing to learn more about wolves and wolf recovery as well as be willing to ranch with wolves if provided certain compensation or tools such as guard dogs, barriers, range riders, and scare tools.

TABLE OF CONTENTS

LIST OF FIGURES

ABBREVIATIONS

BRWRA- Blue Range Wolf Recovery Area

DPS- Distinct Population Segments

ESA- Endangered Species Act

ESPA- Endangered Species Preservation Act

FEIS- Final Environmental Impact Statement

SSP- Species Survival Plan

USFWS- United States Fish and Wildlife Service

ACKNOWLEDGEMENTS

I would like to thank my thesis advisor and reader, Dr. Tim Quinn for all the help and support he gave me. This paper would not have been possible without his input and guidance. To all those who took the time to take my survey and provide me with the feedback I needed to complete this project, I thank you for your input. I would also like to thank the TESC faculty for helping me to bring my vision and ideas into a workable project. Their guidance was greatly appreciated. Lastly I would like to thank my friends and family for their encouragement and inexhaustible patience. This project would not have been possible without everyone's support.

CHAPTER ONE

INTRODUCTION

The wolf (*Canis lupus*) is one of the most charismatic and controversial wildlife species in North America. Some people see it as a symbol of the wild or an example of successful recovery under the Endangered Species Act (ESA), while others regard the species as a predator of domestic livestock or a competitor with humans for deer and elk (Houston, Bruskotter, & Fan, 2010). Indeed our modern history with the wolf in the U.S. starting in the 1600s underscores this dichotomy (Houston et al., 2010). The first European settlers in America brought with them a long standing history of living with the wolf along with negative perceptions of the wolf based on fairy tales and religious beliefs (Browne-Nuñez & Taylor, 2002) which reflected a cultural bias against wolves. For example the Bible contains analogies equating the wolf with wickedness and sin: 'For I know this, that after my departure, savage wolves will come in among you, not sparing the flock' (Acts, 20:29 New King James Version) and 'Beware of false prophets, which come to you in sheep's clothing, but inwardly they are ravening wolves' (Matthew, 7:15 New King James Version) (McCann, 2004). In addition, stories such as Little Red Riding Hood, Peter and the Wolf, and The Three Little Pigs, are well known fables depicting the wolf as a menacing and predatory antagonist and a symbol of evil.

These literary depictions of the wolf in part helped fuel antagonism and hostility towards the species that eventually led to wolf persecution (Browne-Nuñez & Taylor, 2002). Along with habitat loss associated with a growing human population, wolves were effectively eliminated from most of their historic range in the U.S. during the 20th century with just a small population remaining in northern Minnesota (Tukua, 2005; U.S.

Department of Agriculture, 2002). It was not until the late 1930s that public perception of the wolf began to shift (Willard, 2008). Biologists began to better understand the interconnectedness of species and processes in nature by studying ecosystems as a whole rather than in parts[1] (Willard, 2008). This better understanding helped lead to the development of the ESA in 1973 which directed the U.S. Fish and Wildlife Service (USFWS) to "protect and recover endangered and threatened species" (Willard, 2008, p. 7). The gray wolf along with the grizzly bear and bald eagle were some of the first species to be listed under the ESA, which made it a crime to kill endangered species. Once protected under the ESA wolves successfully emigrated from Canada into the U.S. and began to naturally recolonize Montana in the 1970s and 1980s. Because wolves were naturally recolonizing their range in Montana the USFWS considered the possibility of successful wolf recovery in the western U.S. and supported wolf reintroduction into Yellowstone National Park in 1995 and 1996. Since being listed under the ESA, gray wolf numbers in the U.S. have increased from less than the 300 living mostly in Minnesota to over 4,000 today spread out across a number of western states (Jimenez, et al., 2012).

As stated in Houston et al. (2010, p. 389), "Once hunted and killed with more passion than any other animal in U.S. history, wolves now stand on the precipice of recovery largely because of human efforts to protect and restore the species." However, public attitudes towards wolves, wolf recovery, and wolf reintroduction are still extremely varied, and not surprisingly many legal and political battles over how to best

[1] One of the best examples of this shift in attitude is shown in a quote by Aldo Leopold "In those days we had never heard of passing up a chance to kill a wolf…I thought …that no wolves would mean hunters' paradise…Since then I have lived to see state after state extirpate its wolves…I have seen every edible bush and seedling browsed, first to anemic desuetude, and then to death…I now suspect that just as a deer herd lives in mortal fear of its wolves, so does a mountain live in mortal fear of its deer…Perhaps this is the hidden meaning in the howl of the wolf, long known among mountains, but seldom perceived among men" (Kellert et al., 1996).

protect and manage the gray wolf continue today. Since the time of its ESA listing gray wolf numbers in the U.S. have grown steadily, causing many to argue that protection is no longer necessary. As gray wolf numbers in the U.S. have changed so too has the wolf's ESA protection status. It has been classified as endangered, threatened, experimental (discussed in Chapter 2), and even delisted or removed from protected status under the ESA (U.S. Congressional Research Service, 2011) at different times in the last 39 years.

Abundant research has documented public attitudes towards wolves (Browne-Nuñes and Taylor, 2002; Huston et al., 2010; Naughton-Treves, Grossberg, & Treves, 2003). These studies show that farmers and ranchers living near wolf populations or proposed reintroduction sites have the most negative attitudes towards wolves. Monitoring social attitudes towards wolves proves to be one of the most important aspects of guaranteeing a successful wolf reintroduction program plan. Huston et al. (2010) showed individual attitudes towards wolves were strong predictors of behavior. Other research done by Browne-Nuñes and Taylor (2002) demonstrated importance of understanding "human dimensions" of natural resource issues such as beliefs and attitudes of the public. Many of those familiar with the gray wolf history in the U.S. believe that wolf recovery and management goes well beyond issues of wolf biology and that the socio-political aspect of wolf reintroduction is still largely misunderstood (Nie, 2003).

In 1976 the Mexican wolf (*Canis lupus baileyi*) was listed on the ESA as a separate subspecies of gray wolf (Stoopen, 2004). Between 1977 and 1983 recovery efforts included capture of wild wolves and the creation of a joint U.S. Mexico captive breeding program (Stoopen, 2004). Reintroduction efforts started in 1998 with the first

release of Mexican wolves in the wild (Carnes, 2011; Stoopen, 2004). However, while the reintroduction of the gray wolf in the northern U.S. was showing signs of success, the reintroduction efforts of the Mexican wolf into the southwestern U.S. resulted in little increase in wild Mexican wolf populations.

The primary objective of my thesis was to identify important factors that have contributed to success of wolf recovery plans and to provide insight into why Mexican wolf recovery in the southwestern U.S. has not been as successful as gray wolf recovery in the northern U.S. I suspected that attitudes and perception of wolves would prove to be important factors as had been shown elsewhere (Browne-Nuñes and Taylor, 2002; Huston et al., 2010; Naughton-Treves et al., 2003). While I looked at other potential factors including difference in the ecology between wolf subspecies, my main focus was on better understanding how public attitudes might shape management of the wolf. In particular, I explored how perceptions of wolves, by major recovery participants i.e., the biologists and rancher community, might affect reintroduction success. This study was informed through a literature review and questionnaire surveys mailed to biologists working on gray wolves and Mexican wolf recovery plans and to ranchers affected by wolf recovery in their area.

CHAPTER TWO

REVIEW OF THE LITERATURE

GENERAL GRAY WOLF BIOLOGY

The gray wolf (*Canis lupus*), also known as the timber wolf or tundra wolf, is the largest canid in North America (Tukua, 2005). Mature males can weigh 38-52 kg and can vary in total length from 1.27 to 1.64 m from nose to tail (Paquet and Carbyn, 2003; Tukua, 2005). Adult females are typically smaller, weighing 22-45 kg and are 1.37 to 1.52 m in total length (Paquet and Carbyn, 2003; Tukua, 2005). Gray wolves range in coloration from grizzled gray or black to all-white depending on their habitat and age, and typically live four to five years in the wild (U.S. Fish and Wildlife Service, 2010).

In spite of many phenotypical differences, all wolf species share a similar social structure based on family groups (Tukua, 2005). Wolves, live, travel, and hunt in family structures called packs (Tukua, 2005; U.S. Fish and Wildlife Service, 1987). Pack size is ultimately dependent on prey species availability, but generally ranges from four to eight individuals and is comprised of a single dominant male and female referred to as the alpha pair (Carnes, 2011). The alpha pair controls the pack, is typically monogamous, and is usually the only pair that breeds within the pack (Carnes, 2011; Tukua, 2005). Other members of the pack include young of the year, siblings from previous litters, and a few others that may or may not be related to the alpha pair (U.S. Fish and Wildlife Service, 1987).

Breeding takes place between January and April, depending on latitude (Paquet and Carbyn, 2003) with northern populations breeding later in the year than southern populations. Gestation lasts approximately 63 days and litters generally produce between

four to six pups (Stoopen, 2004; U.S. Fish and Wildlife Service, 1982). Pups are completely dependent on their mother from birth to about six to eight weeks of age until they are weaned (Tukua, 2005). After weaning the entire pack is involved in rearing the pups. Some pack members will hunt for the young, while other pack members watch over them (Tukua, 2005). Pups reach sexual maturity between 9 and 46 months but generally do not mate until they are at least three years old because of the social structure of the pack (Paquet and Carbyn, 2003).

Wolves predominately prey on hoofed animals including deer, moose, bison, elk, and caribou, and hunting is a pack effort. Where a single wolf may not be able to catch a large prey animal the whole pack working together can often outrun larger prey and take it down as a group (Tukua, 2005). The pack will often single out the weaker member of a herd, such as the sick, old, or young because these individuals are easier to catch than animals in their prime (Tukua, 2005). When larger prey is hard to find wolves have also been known to eat smaller animals, such as rabbits, beavers, small rodents, and even fish (Tukua, 2005).

Two species of wolves are found in North America, the gray wolf (*Canis lupus*), with its various subspecies, and the red wolf (*Canis rufus*), which is genetically distinct from the gray wolf and coyote (White, 2013). In North America the gray wolf is divided into five subspecies: the Mexican, the Great Plains, the Rocky Mountain (or Mackenzie Valley), the Eastern timber, and the Arctic [2](Sullivan, 2012). According to the U.S. Congressional Research Service (2011) definition of a subspecies is a:

[2] At one point (until about 1995) there were 24 recognized subspecies of the gray wolf in North America based on the use of cranial features, external measurements, and pelage characteristics. Closer examination of specimen's biogeography suggested fewer subspecies (Paquet and Carbyn, 2003).

"Taxonomic category that subdivides species into morphologically distinct groups of individuals representing a step toward the production of a new species, although they are still fully capable of interbreeding. Subspecies are usually geographically isolated."

For the purpose of this paper, I considered only the population of gray wolf reintroduced into Yellowstone National Park (the Rocky Mountain subspecies), and the Mexican gray wolf.

MEXICAN WOLF BIOLOGY

The Mexican gray wolf (*Canis lupus baileyi*) is the smallest subspecies of gray wolf and the most genetically distinct form of existing gray wolves in North America (Stoopen, 2004). It is about the size of a German Shepard weighing between 22-36 kg and stretches from about 1.5-2.0 m in total length (Carnes, 2011). While many wolf species range in coloration from white to black, Mexican wolves are never solid black or white but rather a combination of gray, tan, buff, and black (Carnes, 2011).

"Commonly referred to as lobos, Mexican wolves came by their namesake due to their unique ability to flourish in rugged terrain" (Carnes, 2011, p. 6). In the U.S., Mexican wolves were historically distributed in southeastern Arizona, southern New Mexico, and western Texas (Carnes, 2011). In Mexico their historical range included the states of Chihuahua, Coahuila, Nuevo Leon, Durango, and Zacatecas and the adjoining highlands south to Mexico City (Figure 1) (Stoopen, 2004).

Figure 1. Historic range of the Mexican wolf (Parsons, 1996).

Mexican wolves, like all wolf species, are extremely wide-ranging, with pack home ranges varying between 390 to 650 km^2 in size (Carnes, 2011). Mexican wolves are highly adaptable to their surroundings. Though they prefer high elevations and forest cover, they can exist in other more open cover types such as shrubland (Carnes, 2011). Mexican wolves kill and eat a variety of prey: including elk, mule deer, white-tailed deer, and javelina[3] (Carnes, 2011). Like other canines, wolves have an extremely good sense of smell and can detect prey 3.2 kg or more away (Carnes, 2011). Many types of dead, diseased, or dying animals can attract scavengers including animals that are both scavengers and hunters such as wolves, bears, and eagles. Wolves will prey on livestock

[3] A javelina is a type of wild pig found in the southwestern U.S.

and this behavior can be reinforced if they are allowed to scavenge on livestock carcasses that die from natural causes (Defenders of Wildlife, 2008). The afterbirth from calving can attract wolves as well (Defenders of Wildlife, 2008).

There are currently about 300 captive Mexican wolves in 49 facilities in the U.S. and Mexico. Mexican wolves from these facilities that are identified for potential release are first sent to one of three pre-release facilities to undergo an acclimation process (U.S. Fish and Wildlife Service, 2011). These facilities include the Sevilleta and Ladder Ranch Wolf Management Facilities located in New Mexico and Wolf Haven International located in Tenino, Washington (U.S. Fish and Wildlife Service, 2011). Wolves selected for release are chosen for their genetic makeup (most genetically diverse based on pedigree) among other things (U.S. Fish and Wildlife Service, 2011) and will be genetically redundant to the captive wolf population. All Mexican wolves alive today, in captivity and in the wild, are descended from seven founders. Risk of inbreeding depression is not considered a present threat to the captive population due to active management. However, while biologists work to optimize genetic diversity this small original gene pool could be a hindrance to recovery. Pup counts of the Mexican wolf population in the Blue Range Wolf Recovery Area (BRWRA; discussed below) are smaller than other gray wolf species or Mexican wolves in captivity suggesting that inbreeding depression may be an issue (U.S. Fish and Wildlife Service, 2010). Inbreeding depression in the wild Blue Range Population has been considered a contributing factor to the lack of success of the Mexican Wolf Recovery Program and one reason why Mexican wolf recovery has not been as successful as gray wolf recovery programs in the northern U.S. according to the U.S. Fish and Wildlife Service (2010).

THE ERADICATION OF THE GRAY WOLF

Wolves were once one of the most widely distributed of all wild mammals in the world. Before European settlement the gray wolf was common throughout most of North America (Figure 2) (Tukua, 2005).

Figure 2. Historic range for the gray wolf in the U.S. (Tukua, 2005).

After European settlement, however, wolves were eliminated from many parts of the country by the mid 1930s and their range was greatly diminished[4] (Tukua, 2005). Early settlers (mid 1600s)[5] went about eliminating the wolf with fervor in part because

[4] The sentiments of most Americans was "The good Lord put us here and the Good Book says, 'man shall have dominion over all creatures.' They're ours to use." If the animal was seen as a competition to either game or damaging to property they were to be eliminated (Tukua, 2005, p. 9).

[5] From the records of the Governor and company of the Massachusetts Bay in New England – November 9, 1630. "It is ordered, that every English man that killeth a wolf in any part within the limits of this patent shall have allowed him 1 d (one penny) for every beast & horse, & ob. (1/2 penny) for every weaned swine & goat in every plantation, to be levied by the constables of the said plantations" (Tukua, 2005, p. 9).

settlers often believed wilderness and wolves were symbols of evil (Willard, 2008). "They not only killed wolves for pragmatic reasons (e.g., protecting livestock), but also out of fear and loathing for a species that had been demonized [in Europe] for centuries in folklore and myth" (Houston et al., 2010, p. 389). People such as Aesop and the Brothers Grimm intensified peoples' fear of wolves by using wolves as symbols of evil in popular fairy tales. Additionally predator eradication was a way of imposing order and control to nature. Overcoming the wild was a moral obligation as well as a means of survival (Willard, 2008).

Wolves were killed in a variety of ways (e.g., hunting, trapping, and poisoning) and were nearly universally condemned during the 19th century (U.S. Fish and Wildlife Service, 1982). In the early 1900s the U.S. government implemented its first nationwide policy on wolf control (U.S. Fish and Wildlife Service, 1987; Willard, 2008). During that time the U.S. Department of Agriculture's Bureau of Biological Survey stated, "Large predatory mammals, destructive of livestock and game, no longer have a place in our advancing civilization" (Kellert, Black, Rush, & Bath, 1996, p. 979). The U.S. Department of Agriculture often exaggerated the number of livestock lost to depredation in order to gain support from ranchers and the public to continue the wolf's elimination (Willard, 2008). Even Theodore Roosevelt, father of the first National Park, declared the wolf as "the beast of waste and desolation" and called for its eradication (Kellert et al., 1996, p. 978; Willard, 2008). By the 1930s the wolf's range had been reduced to about 1% of its original range with only a small population remaining in northern Minnesota (U.S. Department of Agriculture, 2002).

THE ERADICATION OF THE MEXICAN WOLF

While the gray wolf was being eliminated in the northern U.S., the Mexican wolf was also being persecuted. The Mexican wolf was eliminated from its historic range by many of the same attitudes and forces that affected the gray wolf population such as predator control programs, human encroachment, and habitat degradation (Stoopen, 2004). Other factors included, commercial and recreational hunting and trapping; killing of wolves by wildlife managers to provide more game animals for hunters; habitat alteration; and human safety concerns (U.S. Fish and Wildlife Service, 1996). Wolves were killed through use of steel leg-hold traps, poisons placed in baits (e.g. arsenic and compound 1080), denning, shooting, and roping (U.S. Fish and Wildlife Service, 1982). However, while many factors contributed to the Mexican wolf's decline, its reputation as a livestock killer was predominate (U.S. Fish and Wildlife Service, 1996).

Ranchers and federal, state, and local governments developed wolf eradication campaigns beginning in the late 1800s. By the mid-1900s the Mexican wolf was extirpated from the wild in the U.S. making it possibly the most endangered wolf subspecies in the world (Nie, 2003; Stoopen, 2004). During the 19th century cattle ranching dominated the Southwest and the livestock industry soon pressured western congressional representatives for additional predator control. In 1915, Congress instructed the U.S. Bureau of Biological Survey to begin exterminating wolves (Fitzgerald, 2006). From 1915 -1925 the Predatory Animal and Rodent Control Service reported over 900 Mexican wolves killed by government trappers or cooperators (Parsons, 1998). The fight against wolves did not stop there however. In 1950 the Bureau's successor agency, the U.S. Fish and Wildlife Service (USFWS) launched a program that eliminated almost all wolves in Mexico by the mid 1970s (Povilitis,

Parsons, Robinson, & Becjer, 2006). "These extermination campaigns reflected an industrialized anti-predator alliance between the U.S. government and the livestock industry" (Povilitis et al., 2006, p. 942).

Unfortunately because of this eradication scientists were never able to thoroughly study Mexican wolves in their historic range (U.S. Fish and Wildlife Service, 1982). What is known today about this species comes from the writings of early settlers and trappers and what can be observed from current Mexican wolf populations in captivity and in reintroduction zones. The Mexican wolf still faces many threats but one of the biggest threats today is illegal hunting despite the fact that this subspecies is protected under the Endangered Species Act (ESA) and otherwise benefitting from recovery efforts (U.S. Fish and Wildlife Service, 2010).

GRAY WOLVES MAKE A COMEBACK

In 1966 the federal Endangered Species Preservation Act (ESPA) was created and became the first law that would protect wolves, but only on federal land (Tukua, 2005). When the gray wolf was listed under the ESPA in 1967 it was listed as two subspecies, the Eastern timber wolf, and the Northern Rocky Mountain wolf (U.S. Congressional Research Service, 2010). In 1973 the ESA, which was the successor to the ESPA, was enacted and officially protected the wolf that same year (Endangered Species Act). In 1974 three subspecies of gray wolves, the Eastern timber wolf, Northern Rocky Mountain gray wolf, and Mexican wolf were listed as threatened by the ESA (U.S. Congressional Research Service, 2011). The ESA helped to protect species that were in danger of becoming extinct and made it illegal to harm a wolf in anyway under penalty of fines or incarceration (Tukua, 2005). In 1978, the USFWS relisted the gray wolf species (*Canis*

lupus) as endangered at the species level throughout the lower 48 states, with the exception of Minnesota, where it was listed as threatened (U.S. Congressional Research Service, 2011; U.S. Congressional Research Service, 2010). To assist managers the 1978 ESA amendments use the term *distinct population segments* (DPS) to allow vertebrate species to be divided into distinct groups, based on geographic and genetic distinctions (U.S. Congressional Research Service, 2010). At the time of the wolf's listing in 1974, the range of the wolf included only a small area in northern Minnesota (Figure 3) that contained approximately 20 breeding pairs (Tukua, 2005).

Figure 3. Gray wolf range at time of listing under the ESA in 1974 (Tukua, 2005).

While most wolf populations in the U.S. were extirpated, gray wolves persisted in Canada. In the late 1970s and 1980s wolves from Canada crossed the border into the

U.S. and began to naturally recolonize Glacier National Park in northern Montana (Ramler, 2009).

After this immigration the USFWS began considering the possibility that wolves could recover in the western U.S. (Willard, 2008). The main question concerning wolf recovery was whether wolves should be allowed to emigrate from Canada passively or whether wolves should be actively reintroduced (Willard, 2008). Under the ESA, a threatened species may not be killed or harmed unless it is subject to special rules that allow taking[6]. In order to ease local concerns over species reintroduction, Congress amended the ESA in 1982 by adding section 10(j) to allow experimental populations of endangered or threatened species to be reintroduced into their former habitats (U.S. Congressional Research Service, 2011; U.S. Fish and Wildlife Service, 1987). Section 10(j) allows the USFWS to determine whether an experimental population is "essential" or "nonessential" to the continued existence of the species (Cribb, 1998).

In 1994, the Final Environmental Impact Statement (FEIS) for the recovery of gray wolves in the Northern Rocky Mountains deemed active reintroduction "the preferred option because it could facilitate recovery within the foreseeable future rather than the unknown future of natural recovery"[7] (Willard, 2008, p. 8). Once that decision was made, the preparation of the FEIS and the implementation of the preferred decision for active reintroduction "involved more scientific inquiry, media coverage, public attention, and controversy than almost any other North America natural resource issues" (Fritts et al. 1997, p. 23).

---

[6] "Take" is defined by the act as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct (Endangered Species Act).

[7] Willard got this quote from The U.S. Fish and Wildlife Service and Department of Interior, 1994.

One of the most controversial moments in gray wolf policy over the past century was the decision to actively reintroduce wolves into Yellowstone National Park and Idaho. This decision resulted in an intense political battle pitting scientists and conservationists against ranchers and the livestock industry. In 1995 and 1996, after an absence of more than 50 years, 66 Canadian gray wolves were released into Yellowstone and into the Frank Church Wilderness of Idaho (Grant, 2010; U.S. Fish and Wildlife Service, 2000). This reintroduction has often been called the "greatest wildlife experiment in North America" (Grant, 2010, p. 1) and became another important step in the government's effort to restore the Northern Rockies ecosystem to reflect conditions before European settlement (Grant, 2010).

When gray wolves were reintroduced into Yellowstone they were deemed *non-essential, experimental* populations, a designation that meant that wolves would be treated as threatened species under most but not all circumstances (The Wildlife Society, 2011). Under this designation, the federal government affords the USFWS greater management flexibility to "reduce local concern about excessive government regulation on private lands, uncontrolled livestock depredations, excessive big game predation, and the lack of state government involvement" (The Wildlife Society, 2011, p. 1).

The reintroduction of wolves into Yellowstone has been extremely successful from the perspective of wolf ecology. At the end of 2011 there was an estimated 98 wolves in 10 packs plus two loner wolves within Yellowstone National Park (Jimenez, et al., 2012). Not only have wolves increased in Yellowstone but the gray wolf continues to increase throughout the U.S. The wild wolf population in the U.S. has grown from less than 300 in the 1930s to over 4,000 today. Figure 4 shows the current range of the gray wolf population in the U.S.

One recent example of increased wolf numbers is in Washington State. In 2008 the first breeding pack was confirmed in the state since the 1930s (Wiles, Allen, & Hayes, 2011). Wolves have begun naturally dispersing into Washington from adjacent states and provinces (Idaho, Montana, Oregon, and British Columbia) (Wiles et al., 2011). Since July 2011 there have been five confirmed packs in Washington and this number will likely increase (Wiles et al., 2011).

Figure 4. Current range of the gray wolf (Tukua, 2005). Note that this does not include relatively new expansion into Washington State.

THE IMPORTANCE OF WOLVES FOR RESTORING ECOSYSTEM STRUCTURE AND FUNCTION

The famous conservation visionary Aldo Leopold (Brown & Carmony, 1990, p. 205) wrote:

> "Deer irruptions [population explosions] are unknown. Mountain lions and wolves are still common… There are no coyotes in the mountains…I submit for conservationists to ponder the question of whether the wolves have not kept the coyotes out? And whether the presence of a normal complement of predators is not, at least in part, accountable for the absence of irruption [of deer population]? If so, would not our rougher mountains [in Arizona and New Mexico] be better off and might we not have more normalcy in our deer herd, if we let the wolves and lions come back on reasonable number?"

Leopold's observations may have been ahead of their time but were very accurate. Today research shows that top predators can influence the entire ecosystem through a cascade of effects. Elk, deer, bighorn sheep, and antelope change their behavior in the presence of wolves and tend to avoid staying in one place and thus overgrazing certain areas. This is important because it allows vegetation to grow, which in turn provides habitat and food for other species as well as contributing to maintenance of other ecosystem structures and functions such as soil stability and shade on stream banks. After wolves were extirpated from Yellowstone, elk populations increased dramatically and parts of the ecosystem were dramatically overgrazed particularly vegetation in open, low-lying areas and along stream beds (Lister & McDaniel, 2006). The decrease in woody vegetation particularly willows, aspens, and cottonwood trees resulted in the disappearance of many songbird species, which rely on these tree species, and decreases in beaver populations that use the willows as a food particularly in winter (Lister & McDaniel, 2006). The reintroduction of wolves into the Yellowstone ecosystem has set off a chain of environmental effects. Wolves prey upon and can influence the distribution and behavior of herbivores (Ripple & Beschta, 2003). The decline in elk,

wolves preferred prey in the ecosystem, and the change in elk behavior has resulted in changes in flora (Figure 5) (Lister & McDaniel, 2006; Ripple & Beschta, 2003).

Figure 5. Before and after reintroduction of the gray wolf into Yellowstone National Park (Ripple & Beschta, 2003).

Willows, cottonwoods, and aspens have been allowed to regenerate particularly along riverbeds and other exposed areas (Lister & McDaniel, 2006; Ripple & Beschta, 2003). The diminished pressure on willow stands has in turn resulted in increased beaver populations (Lister & McDaniel, 2006). The increased presence of beavers in the ecosystem has increased the occurrence of beaver dams throughout the park, which in

turn has had profound impacts on species diversity (Lister & McDaniel, 2006). Beaver dams create pools of water, which increases growth rates of trees, shrubs, and vegetation and which provides food and shelter for dozens of other species (Lister & McDaniel, 2006). As woody species continue to grow ecological benefits to aquatic and riparian habitats will increase. These benefits include increased shading and thermal moderation, increased availability and recruitment of large wood and litter inputs, increased rooting and stream bank stability, and improved food web support (Ripple & Beschta, 2003). These ponds provide new habitat for a variety of species such as otters, muskrat, moose, and fish (Lister & McDaniel, 2006). Wolves have not only affected elk population but the coyote population has been dramatically affected as well. Before the reintroduction of wolves coyotes were extremely abundant in Yellowstone. Once wolves were released the coyote population declined 90% within the first two years (Lister & McDaniel, 2006). This decline caused a surge in the main prey of coyotes- voles, mice, and other rodents and an increase in coyote's competitors such as foxes and birds of prey (Lister & McDaniel, 2006). In addition, wolves provide carrion from partially eaten prey supporting a variety of scavengers such as magpies, ravens, eagles, and grizzly bears (Lister & McDaniel, 2006). In short, wolf reintroduction into Yellowstone has created a more biologically diverse ecosystem.

Reintroduction of the Mexican wolf could potentially have similar impacts on the Southwest environment. Like the wolves in Yellowstone, the Mexican wolf may contribute to changing the behavior of wild herbivores, which could have similar effects to the ecosystem (Robinson, 2005). These wolves will also provide carrion for scavengers such as eagles, badgers and bears, and could potentially change the relationship between species such as foxes and coyotes. So far, however, Mexican

wolves are still so few in number that they will likely need to be restored to greater population densities before impacts can be seen.

MEXICAN WOLF RECOVERY EFFORTS

In 1976 the Mexican gray wolf was listed as endangered under the ESA and a Mexican Wolf Recovery Team was appointed by the USFWS in 1979 (Stoopen, 2004). Between 1977 and 1980 five (four males and one pregnant female) of the few remaining wild wolves were caught in Durango and Chihuahua Mexico and transferred to the Arizona Desert Museum in Tucson, Arizona (Parsons, 1996; Stoopen, 2004). These wolves were captured for the purpose of a bi-national captive breeding program between the U.S. and Mexico (Carnes, 2011). In 1978 the pregnant female gave birth to a litter of five pups (Parsons, 1996). The only female pup in the litter died four days later (Parsons, 1996). The wild caught female gave birth again in 1981 to her second litter consisting of one male and three female pups (Parsons, 1996). All four pups survived and later reproduced. Finally in 1982, the recovery team finished writing the Mexican Wolf Recovery Plan (Carnes, 2011). The USFWS soon established the BRWRA (Figure 6), which covers public lands in east-central Arizona and west-central New Mexico (Povilitis et al., 2006).

"The objective was to establish a population of at least 100 wild wolves in 9 years [by 2006] within the 17,752 km^2 Gila and Apache national forests" (Povilitis et al. 2006, p.942).

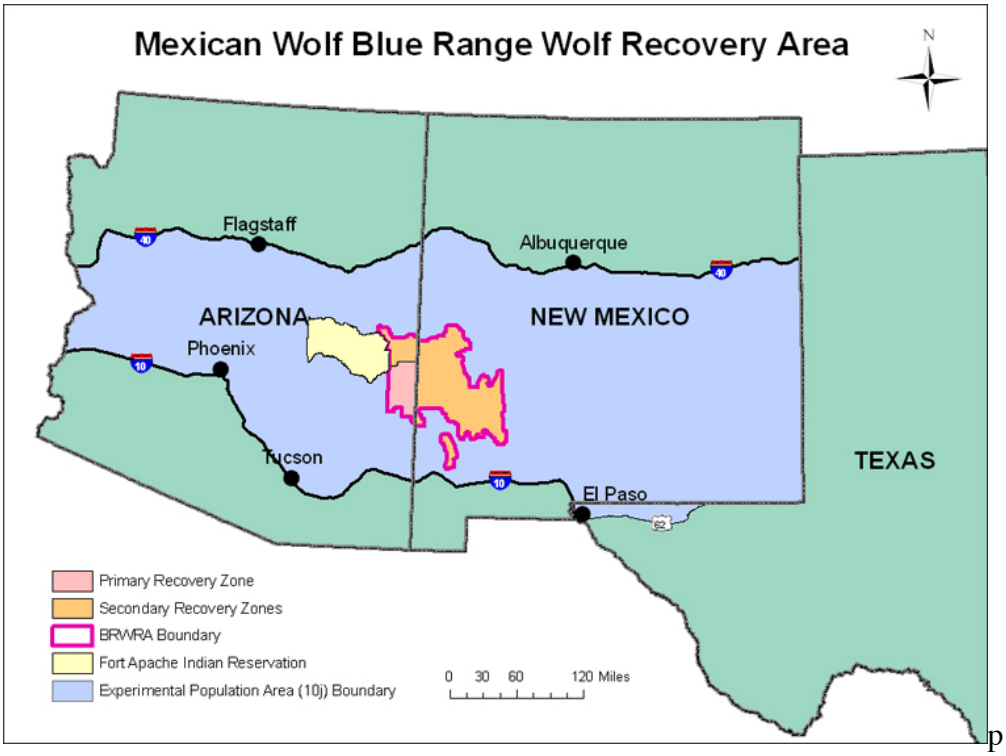

Figure 6. The Mexican wolf Blue Range Wolf Recovery Area (U.S. Department of Agriculture, 2002).

By 1983, the captive breeding program was firmly established with the birth of 3 litters totaling 15 pups. Based on DNA results two additional lineages of captive Mexican wolves were certified for inclusion in the official breeding program for Mexican wolves in July 1995 (Hedrick & Fredrickson, 2008; Parsons, 1996). As stated above, today all Mexican wolves, wild and in captivity, are based on seven founders (five caught in the wild and two born in captivity) from these three lineages (McBride, Aragon, and Ghost Ranch) (Barrett, 2012; Hedrick & Fredrickson, 2008; U.S. Fish and Wildlife Service, 2010).

Since December 1993, management of the captive population has followed a Species Survival Plan (SSP) program developed and implemented by the American Zoo and Aquarium Association (Parsons, 1996; Stoopen, 2004). The objective of the SSP is

to establish and maintain a captive population, minimizing inbreeding and maximizing retention of the genetic diversity of the original founders (Parsons, 1996).

Although recovery planning for the Mexican wolf began in 1976, meeting recovery goals would prove to be difficult. Anti-governmental sentiments and reliance on livestock ranching throughout this region resulted in several major setbacks (Carnes, 2011). For example, in 1987 the USFWS decided to end the captive breeding program due to internal disagreements among ranchers and biologists about the best areas for reintroduction (Stoopen, 2004). The decision was later reversed in 1990 after environmental groups sued the Department of the Interior and the Department of Defense for failing to accomplish their prime directive to recover this endangered species (Stoopen, 2004). The following year in 1991 a new recovery team was established as well as a full time recovery coordinator (Stoopen, 2004). Approval for the first releases of Mexican wolves to the wild was granted by Secretary of the Interior, Bruce Babbitt in 1997 (Stoopen, 2004). In 1998 the USFWS released the first Mexican wolves into the wild in the BRWRA (Carnes, 2011; Stoopen, 2004). Like reintroduced wolves in Yellowstone, reintroduced Mexican wolves were designated under section 10(j) (the final rule) of the ESA as a "nonessential, experimental population" (Stoopen, 2004). This designation provided greater management flexibility by allowing the capture, translocation, or even the killing of specific individuals that caused damage to property (Stoopen, 2004).

Over the years the wild Mexican wolf population has varied but has never risen above 60 individuals, well below the goal of 100 wolves in the wild by 2006. In February of 2011 the USFWS appointed a new Mexican Wolf Recovery Team to update the 1982 recovery plan (U.S. Fish and Wildlife Service, 2011). The Team is made up of

four groups: science and planning, agency liaisons, tribal liaisons, and stakeholder liaisons (U.S. Fish and Wildlife Service, 2011). From 2008 to 2011 the Mexican wolf population has grown nearly 40% (from 42 to at least 58 individuals) (Barrett, 2012).

HOW CONFLICTS BETWEEN WOLVES AND RANCHERS AFFECTS RECOVERY

Wolf reintroduction has often been met with much opposition. As the USFWS began releasing Mexican wolves in 1998 to the BRWRA they did so with "major policy constraints that attempt to balance wolf restoration with perceived limits of social and political tolerance" (Povilitis et al., 2006, p. 942). The BRWRA is composed of the Gila National Forest in New Mexico and the Apache-Sitgreaves National Forests in Arizona collectively managed by the U.S. Forest Service (Beeland, 2008). In 2001 with the cooperation of the White Mountain Apache Tribe, the Fort Apache Indian Reservation land was added to the recovery area. In total the BRWRA spans an area of about 15,039 km^2 (approximately 9,345 $miles^2$) (Beeland, 2008). However, most of these lands are covered by grazing allotments that are used year-round (Gerfin, 2006). In the Southwest a significant portion of livestock grazing takes place on public lands that are managed by the Federal Bureau of Land Management and the U.S. Forest Service (Smith, 2003). This means the government has a responsibility to the ranchers who use the land. According to David Parsons, who headed the Mexican wolf program from 1990-1999, "recovery rules have become skewed to favor ranching, making it more likely biologists will have to trap, handle and relocate wolves as they come into conflict with livestock" (Gerfin, 2006, p.1). Although gray wolves who come in contact with livestock may be handled as well, it seems less likely since gray wolves have a greater area (about 4 million

hectare) of public land to roam that is not grazed year round (Gerfin, 2006). The Mexican wolf recovery program does not call for any reductions in livestock numbers, distribution, or changes in livestock husbandry practices to better accommodate wolves (Povilitis et al., 2006). "Unlike Yellowstone National Park where northern gray wolves were successfully reintroduced in the mid-1990s, the BRWRA lacks a large core area of livestock-free habitat where Mexican wolves can be lightly managed or left alone." (Povilitis et al., 2006, p. 942). Further, Mexican wolves have a 'three strikes, you're out' policy, that is, if a wolf is known or likely to have been involved in three livestock depredation incidents in a single year, federal officers may capture or kill the wolf (Povilitis et al., 2006). Unlike gray wolves in the northern U.S., initial releases of captive-born Mexican wolves are limited to a primary recovery zone (Figure 6) that is part of a smaller portion of the BRWRA (Povilitis et al., 2006). "This hampers the program's ability to release wolves where they are most needed, that is, in high-quality habitat lacking wolves, or for replacement of lost mates and genetic enhancement." (Povilitis et al., 2006, p. 942). Moreover, Mexican gray wolf recovery is constrained by the need to remove animals (lethally or non-lethally) that move outside the approved reintroduction area. Where northern gray wolves are not constrained by recovery-area boundaries, Mexican wolves are not allowed to colonize public lands beyond recovery-area boundaries[8] (Povilitis et al., 2006). Wolves require large areas to roam and without the ability to expand their range, the Mexican wolf population may not be able to grow. More wolves are trapped for leaving the recovery area than for any other reason (Dougherty, 2007), a fact that suggests that the recovery area may not be large enough to support 100 wolves. As stated in Gerfin (2006), if the program could utilize more of the

[8] "It is the only terrestrial mammal managed by the Fish and Wildlife Service that is supposed to stay within political boundaries" (Dougherty, 2007, p. 2).

Southwest's habitat with fewer roads, plenty of prey, and less livestock, the Mexican wolf population could better establish a sustainable breeding population.

To many ranchers the Mexican gray wolf is a physical threat as well as a symbol of government tyranny (Dougherty, 2007). Although there has only been one documented case of a wolf killing a human in North America, many people are still afraid of wolves (Dougherty, 2007). Between March 1998 and October 2007 Mexican wolves killed 110 head of cattle in the BRWRA according to the USFWS records (Dougherty, 2007). "That's only slightly more than 10 cows a year out of approximately 35,000 head of cattle that roam across the 4.4 million acres of public land" (Dougherty, 2007, p. 2). According to the *Mexican Gray Wolf Blue Range Reintroduction Project Five Year Review*, wolves have had no economic impact on the local cattle industry and far more cattle die each year from a host of other causes (Dougherty, 2007). Ranchers disagree however and say the numbers are biased low. According to New Mexican, Catron County manager Bill Aymar " you only find about one out of every eight that they kill" (Doughtery, 2007, p.2). Though scientists claim wolf predation causes relatively few livestock losses compared to other sources, any losses to individual livestock producers can still have profound effects on that individual's livelihood (Ramler, 2009).

ATTITUDES TOWARDS WOLVES

Attitudes towards the species have had tremendous impacts on wolf recovery programs. For example, the USFWS removed the Northern Rocky Mountain population of gray wolves from protection under the ESA in April 2009 (Houston et al., 2010). Removing gray wolves from the ESA allowed the USFWS to return management of the wolves back to the states. States such as Wyoming and Montana manage their wolves as

trophy game animals allowing people to hunt and trap the animals during certain times each year. This policy decision could have been influenced by attitudes towards wolves or wolf recovery. It could have also been a way to keep the wolf population near their carrying capacity. As they assessed threats to the wolf population, the USFWS noted that "human hostility toward wolves led to their initial extirpation in the region and, because of the impact that social attitudes have on wolf recovery, USFWS would require…adequate regulatory mechanisms…[to] balance negative attitudes…in places necessary for recovery" (Houston et al., 2010, p. 390).

Wolves tend to stir peoples' emotions as well as attract public attention (Naughton-Treves et al., 2003). There is abundant research documenting public attitudes towards wolves (Browne-Nuñes and Taylor, 2002; Huston et al., 2010; Naughton-Treves et al., 2003), which shows that support for wolves is strongest among young to middle-aged, college-educated, affluent urban residents, and women (Naughton-Treves et al., 2003). In all studies to date, farmers and ranchers living near wolf populations or proposed reintroduction sites had the most negative attitudes towards wolves (Naughton-Treves et al., 2003).

Today many people are working towards the reintroduction and recovery of wolves despite the fact that peoples' attitudes towards wolves still vary dramatically. Monitoring social attitudes towards wolves is important. For example Huston et al. (2010) demonstrated that individual attitudes about wolves were strong predictors of behavior. For example attitudes towards wolves and wolf restoration were strongly correlated with an individual's willingness to pay and vote for wolf restoration and influenced peoples' support for certain predator management policies and practices (Houston et al., 2010). As management strategies for wolf reintroduction have been

established the importance of understanding the "human dimensions" of natural resource issues has been recognized by those involved (Browne-Nuñes and Taylor, 2002). It is important to understand the beliefs and attitudes of the public because continued wolf recovery will depend partly on public support. Moreover, this information is key to making decisions that are more responsive to the public (Browne-Nuñes and Taylor, 2002; Huston et al., 2010).

COMPENSATION FOR WOLF DEPREDATION

Compensation programs are foundational to wolf recovery. "Financial compensation programs for livestock depredation developed as a management strategy for building tolerance and offsetting economic losses experienced by communities living alongside endangered carnivores" (Defenders of Wildlife, 2008, p. 456). In order to mitigate the ranchers' financial losses, Defenders of Wildlife, a non-profit conservation organization, was one of the first organizations to create a wolf-livestock compensation program. This program voluntarily compensated ranchers for wolf-killed livestock (Daugherty, 2007) throughout the Northern Rocky Mountains and the desert southwest and is definitely one of the best known conservation programs in the U.S. Ranchers were paid 100% of the market value for verified losses, and 50% for "probable" losses (Dougherty, 2007). Defenders of Wildlife has paid out more than $1.4 million for losses from wolves and grizzly bears since the program began in 1987 to its end date in 2010 (Defenders of Wildlife, 2009). Today other compensation programs in different states continue to compensate ranchers and farmers for economic losses associated with conservation efforts.

Most ranchers are dissatisfied with compensation programs. In a recent study of attitudes towards predation compensation, Vynne (2009) found that compensation programs were not meeting the needs of the ranchers and states "Although over 50% of respondents reported satisfaction with the amount of compensation they received, 100% reported dissatisfaction with the compensation process". Due to their distrust of those involved (e.g., the USFWS), wolf recovery, and the purpose of compensation, livestock producers felt that they were excluded from the program (Vynne, 2009). About 72% of ranchers viewed compensation as a publicity stunt by environmental organizations and believed the programs were not created with the livestock producers in mind. Nearly 75% believed wolves were a threat to humans and thus did not support any programs involved with wolf recovery.

"Compensation programs offer a means to redress the inequitable distribution of costs and benefits associated with restoring large-carnivore populations" (Naughton-Treves et al., 2003, p. 1501). Although most U.S. citizens support carnivore conservation and many might enjoy the aesthetic (seeing wolves in the wild) and economic (boon to the tourist industry) benefits, the direct costs of conserving these predators fall on the individuals in rural areas who are affected by these carnivores (Naughton-Treves et al., 2003). These compensation programs are often criticized for being inadequate, fraudulent, or cumbersome (Naughton-Treves et al., 2003). As wildlife conservation projects involving wolves and other types of carnivores expand across the globe it is important to consider community impacts and perspectives when developing programs that compensate for economic losses as a result of those conservation efforts (Vynne, 2009).

CHAPTER THREE

METHODS

OVERVIEW

The success of wolf recovery efforts in the U.S. varies dramatically. Some efforts such as those involving gray wolves in the northern U.S. are succeeding while others such as those designed to reestablish Mexican wolves in the southwestern U.S. are not. I addressed my research questions using two different types of inquiry. I first conducted literature reviews, one focused on wolf ecology and another on policy related to wolf recovery and public attitudes towards wolves. Second, I developed two survey questionnaires, one for biologists working on wolf recovery and the other for ranchers affected by wolf recovery. The biologist questionnaire was designed to mostly determine the important ecological components of crafting a successful recovery plan while the rancher questionnaire was mostly designed to better understand rancher attitudes towards wolves and wolf recovery. I was especially interested in how ranchers' attitudes might affect recovery plan success and in comparing responses of ranchers and biologists by region. Specifically, I wanted to compare responses of biologists working with gray wolves versus biologists working with Mexican wolves and similarly responses of ranchers living near gray wolves versus ranchers living near Mexican wolves.

By reviewing the literature, I sought to gain a greater knowledge of wolves and wolf recovery. I applied this knowledge to developing questionnaires that would allow me to distinguish how attitudes differ between recovery regions and how the interaction between wolf ecology and recovery planning might affect those attitudes. Although conducting interviews was not a part of my original study design, I did several personal

interviews by phone and email when I was contacted by individuals who wanted to talk more about wolf recovery.

LITERATURE REVIEW

I conducted literature searches using keywords such as wolf recovery plans, wolf reintroduction, wolf reintroduction/recovery success, wolf management, and human/wildlife attitudes to find relevant literature. I searched *The Evergreen State College library database*, *Google Scholar*, and *EBSCOhost*, and reviewed books, peer-reviewed articles, newspaper articles, and websites. I also studied government reports, relevant laws, and recovery and management plans created by the state and federal government agencies.

QUESTIONNAIRES

Any type of research at The Evergreen State College (TESC) that involves the participation of humans as subjects (e.g., questionnaires), requires college approval intended to protect the rights of those participants. I submitted a Human Subjects Review to the TESC Review Board and received approval to go ahead with my study in early August 2012 (Appendix A).

Prior to sending out questionnaires I sent a letter explaining the purpose of the study to participants. The goal of the study was explained in detail and the importance of their participation was discussed (Appendix B & C). All participants were kept anonymous and were offered a copy of the final paper should they desire it. I distributed questionnaires in mid August 2012. Participants were told it would take them an

estimated 15 minutes to complete the questionnaire and were asked to return the questionnaire to me in two weeks.

I sent biologist questionnaires (Appendix D) to people working with gray wolf and Mexican wolf recovery and management plans in the states of New Mexico, Arizona, Montana, Idaho, Wyoming, Oregon, and Washington. The states of New Mexico and Arizona are part of the recovery region for Mexican gray wolves while the states of Montana, Idaho, Wyoming, Oregon, and Washington are part of the recovery region for the Northern Rocky Mountain Distinct Population Segment (DPS) gray wolf population. I sent rancher questionnaires (Appendix E) to ranchers affected by wolf recovery in each of the seven states mentioned above.

In order to obtain a population of biologists from which to sample via questionnaire, I made phone calls and sent emails to organizations in these states working with wolf recovery. To obtain a population of ranchers from which to sample, I sent emails to a number of rancher and agriculture organizations in each of the seven states mentioned above. Because rancher and agricultural organizations have confidentiality agreements with their members and would not provide me with a mailing list, I provided a website link to the survey that allowed participants to take the survey while remaining anonymous.

The questionnaires were designed to be easily interpreted and provide information on participants' background, education, economic status, and opinions about wolves and wolf recovery. The majority of each questionnaire contained close-ended questions with a list of potential answers from which participants were asked to select the single best answer. For example *"what is the single best kind of information necessary to craft a successful wolf recovery plan?"* Some questions provided options for multiple answers,

that is, marking all answers that applied. For example *"if you believe the Mexican wolf recovery plan has been unsuccessful in anyway in the past, what are the main reason(s) for those beliefs?"* Participants were then instructed to *"circle as many as apply."* A few questions called for rating all answers with values indicating level of importance or strength of belief ranging from 1-5 or 1-6 depending on the number of answer options. To summarize answers to the questions that relied on rating multiple answers, I reported the mean rating (sum of all ratings/number of participants). I also provided several open-ended questions to allow participants the opportunity to cover material they may have missed in the close-ended questions or to elaborate on their answers (see Appendix C and D). Close-ended questions asked participants questions such as how acceptance of wolf reintroduction could be improved, what parts of the recovery plan concerned them the most, how to make the recovery plan better, and what changes to the plan they would like to see. The questionnaires were sent to participants using SurveyMonkey. SurveyMonkey (www.surveymonkey.com) is the world's largest survey company that provides access to questionnaires on the internet. SurveyMonkey also provides summaries of results to the questionnaire developer.

CHAPTER FOUR

RESULTS

OVERVIEW

I analyzed content from all questionnaires by specific themes or questions. Of the 66 biologist surveys that I sent out, 16 were returned, and out of those 16, 13 surveys had all questions completed. I received 54 rancher surveys; however, because I sent surveys through a secondary source (trade organizations) I do not know how many surveys were sent out in total. While I did not have enough biologist surveys to do a comparison between regions, I was able to compare rancher surveys between regions for selected questions.

BIOLOGIST SURVEYS

All 13 biologists who completed the survey were in some way associated with wolf recovery programs. My survey return rate and results were acquired from the SurveyMonkey analysis, which showed how many questionnaires were sent out and how many questionnaires were incomplete and complete. I also conducted one informal interview over the phone. Because of small survey size, I treated biologist surveys from gray and Mexican wolf recovery areas as a single group for analysis.

Of the biologists who responded 73.3% were between the ages of *30 and 49*, 80.0% had a *post graduate education*, 60.0% identified themselves as *moderate*, and 54.5% grew up in *rural* areas as a child (Figures 7, 8, 9, 10, respectively).

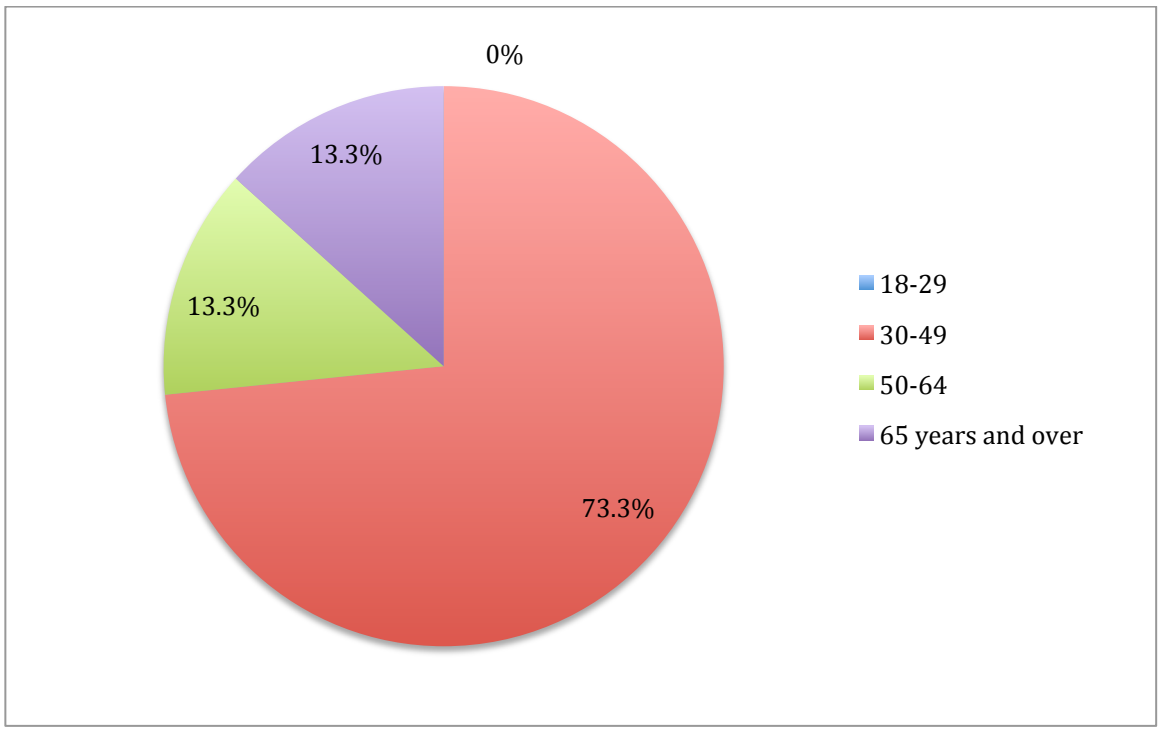

Figure 7. Age of biologists responding to the survey (n=13). None of the respondents were in the *18-29* age class.

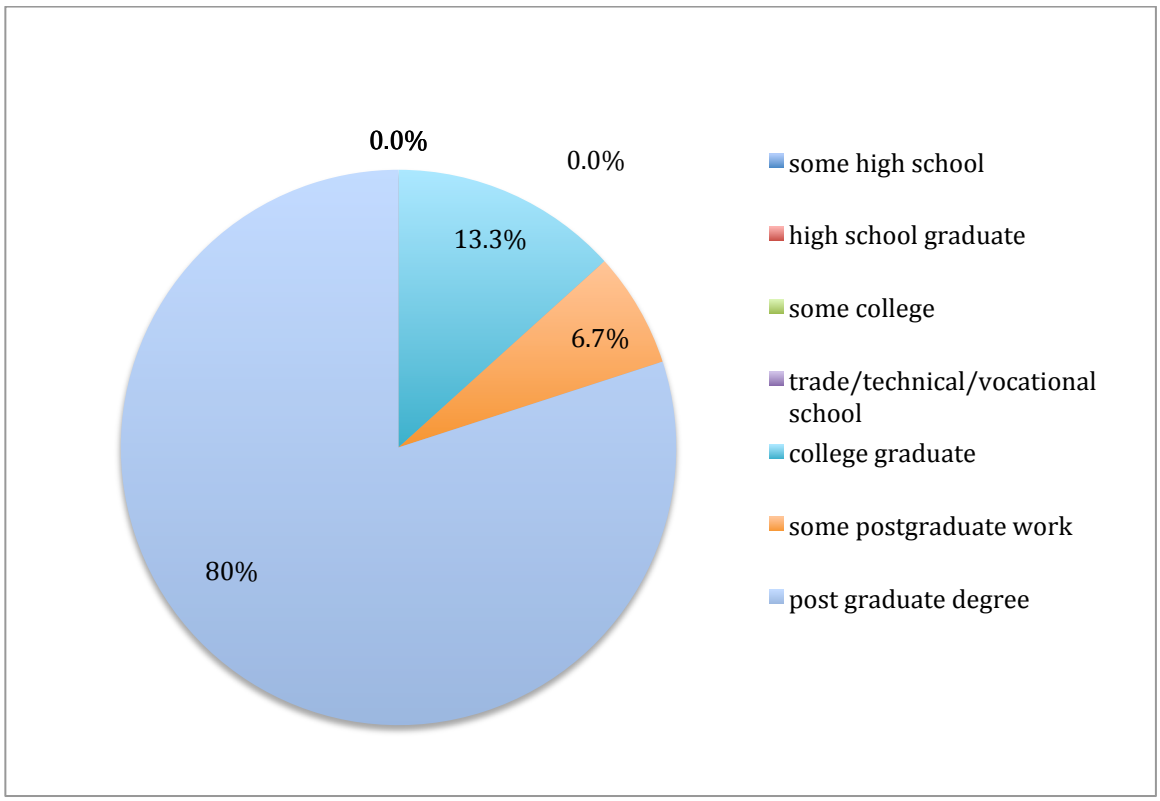

Figure 8. Highest level of education completed by biologists responding to the survey (n=13). None of the respondents characterized their education as *some high school, high school graduate, some college, or trade/technical/vocational school*.

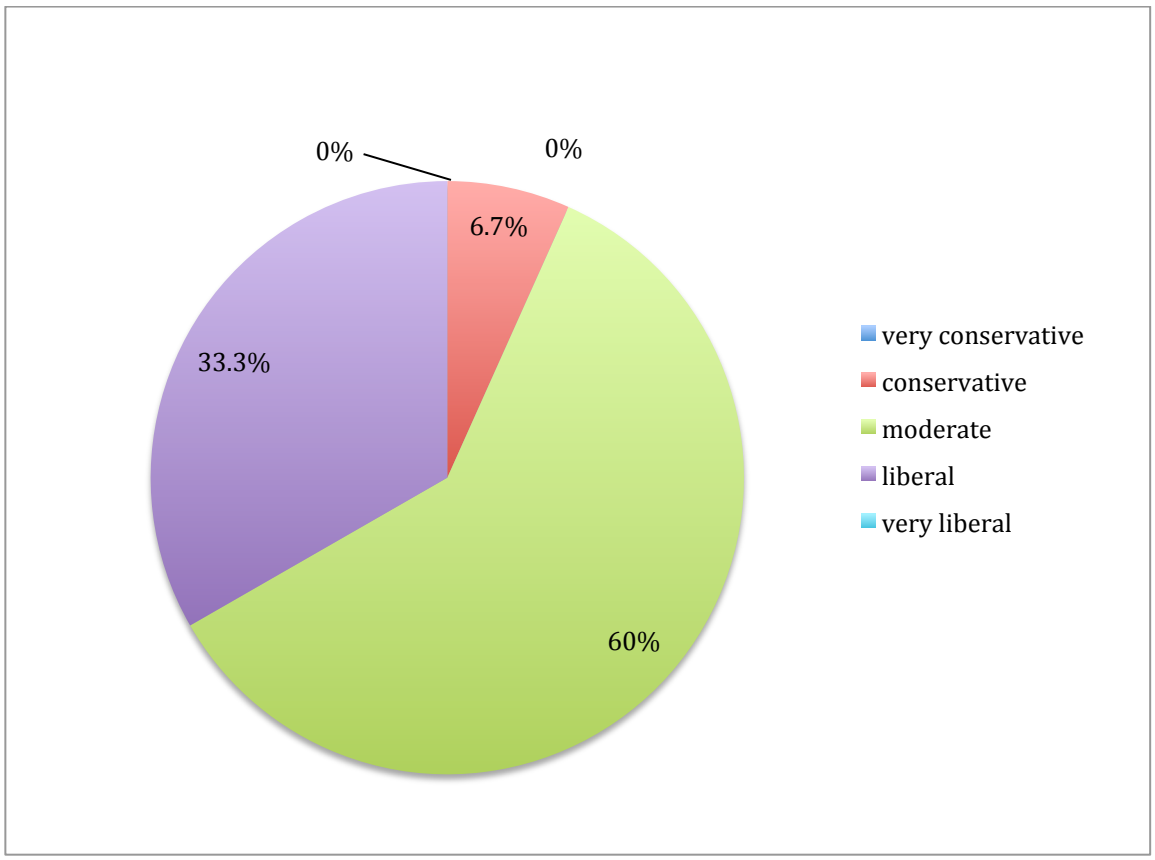

Figure 9. Political views held by biologists responding to the survey (n=13). None of the respondents characterized themselves as *very conservative* or *very liberal*.

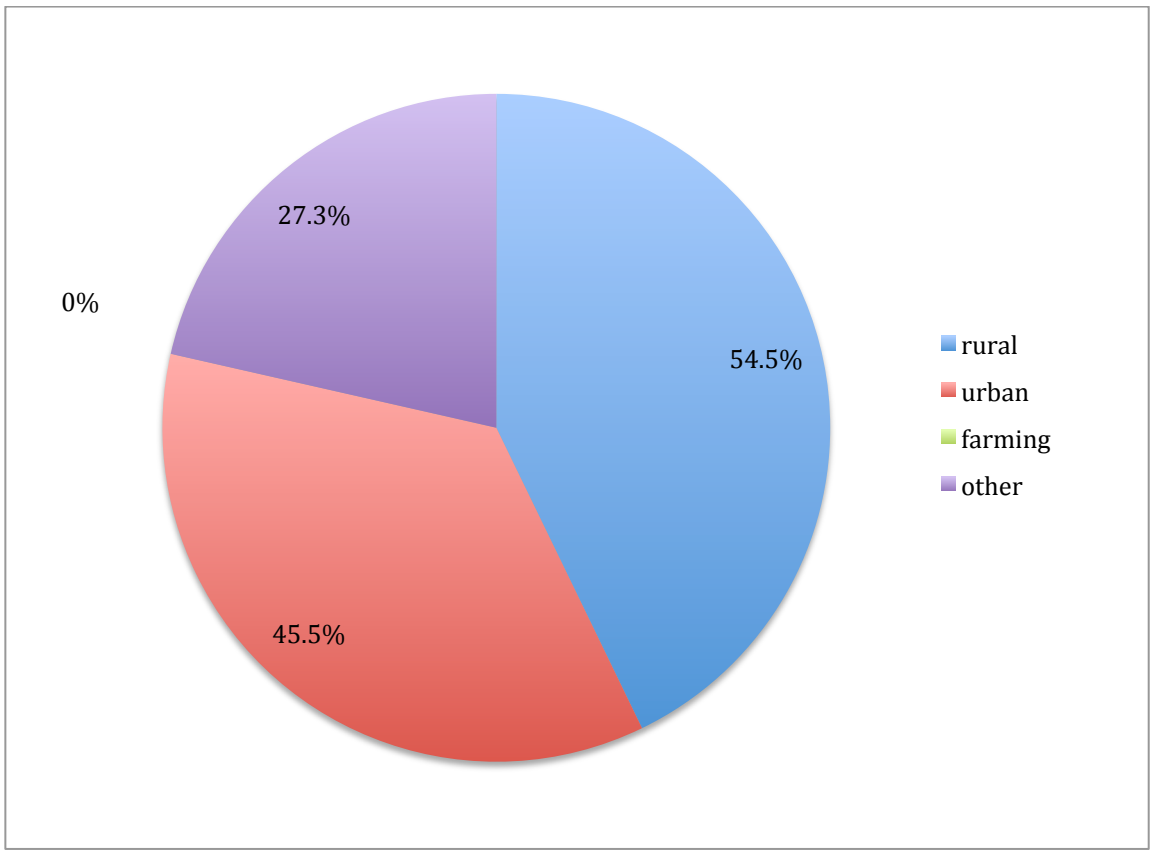

Figure 10. Childhood homes (up to age 18) of biologists responding to the survey (n=13). None of the respondents lived in *farming* areas as a child.

Although I sent emails to biologists working in Montana, Wyoming, Idaho, Oregon, Washington, New Mexico, and Arizona (the states working with gray and Mexican wolves) I received no responses from biologists in Wyoming or Arizona.

As stated in the methods section several questions called for rating answers with values ranging from 1-5 or 1-6 depending on the number of options. To summarize answers to the questions that relied on rating multiple answers, I reported the mean rating (sum of all ratings/number of respondents). Biologists ranked in order of importance from very low (1) to very high (5), each of five biological components needed to ensure short term (10 years) success of the wolf recovery plan in an area (Figure 11).

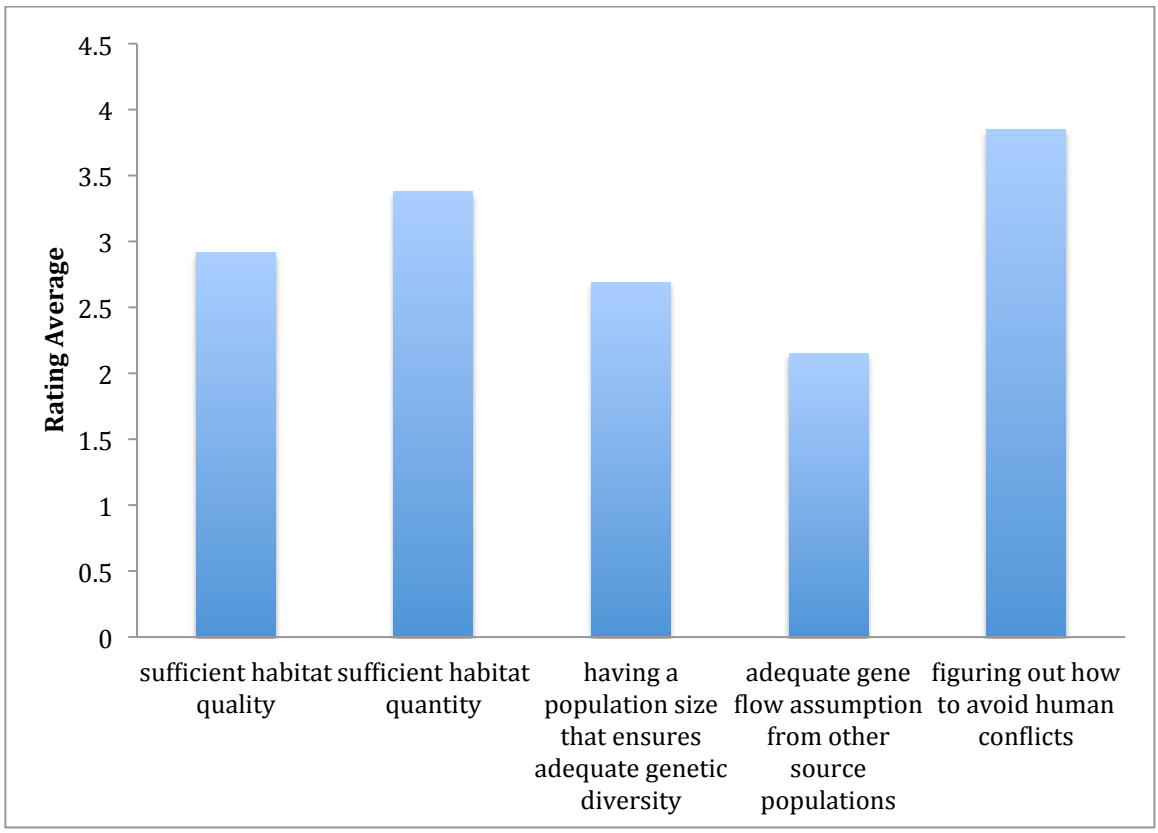

Figure 11. Biological components needed to ensure short-term (10 years) success of a wolf recovery plan in an area according to biologist respondents (n=13). This question called for rating answers with values ranging from 1 (low) to 5 (high) and rating was equal to the sum of all ratings/number of respondents.

Biologists largely thought that the most important biological component for ensuring short-term success was *figuring out how to avoid human conflicts* (3.85 rating average) while the least important was *gene flow* (2.15 rating average). The same question was asked about long-term (>10 years) success (Figure 12).

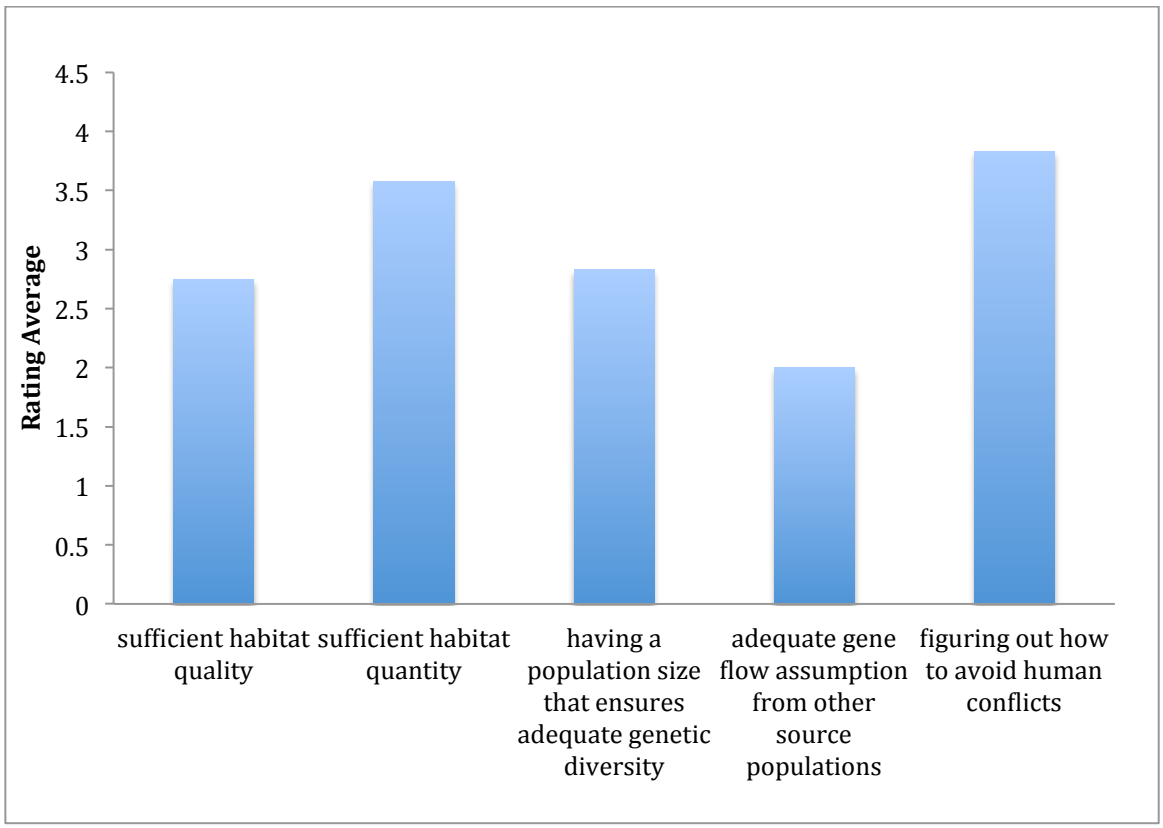

Figure 12. Biological components needed to ensure long-term (>10 years) success of a wolf recovery plan in an area according to biologist respondents (n=13). This question called for rating answers with values ranging from 1(low) to 5 (high), and rating average was equal to the sum of all ratings/number of respondents.

Similar to the previous question, the most important biological components for ensuring long term success was *figuring out how to avoid human conflicts* (3.83 rating average) while *gene flow* was again the least important (2.00 rating average). When limited to the choice between the values of habitat quantity versus quality, the majority of biologists (92.8%) agreed that while *habitat quality* was important or very important to the success of wolf recovery plans, all biologists thought *habitat quantity* was of greater importance (Figure 13).

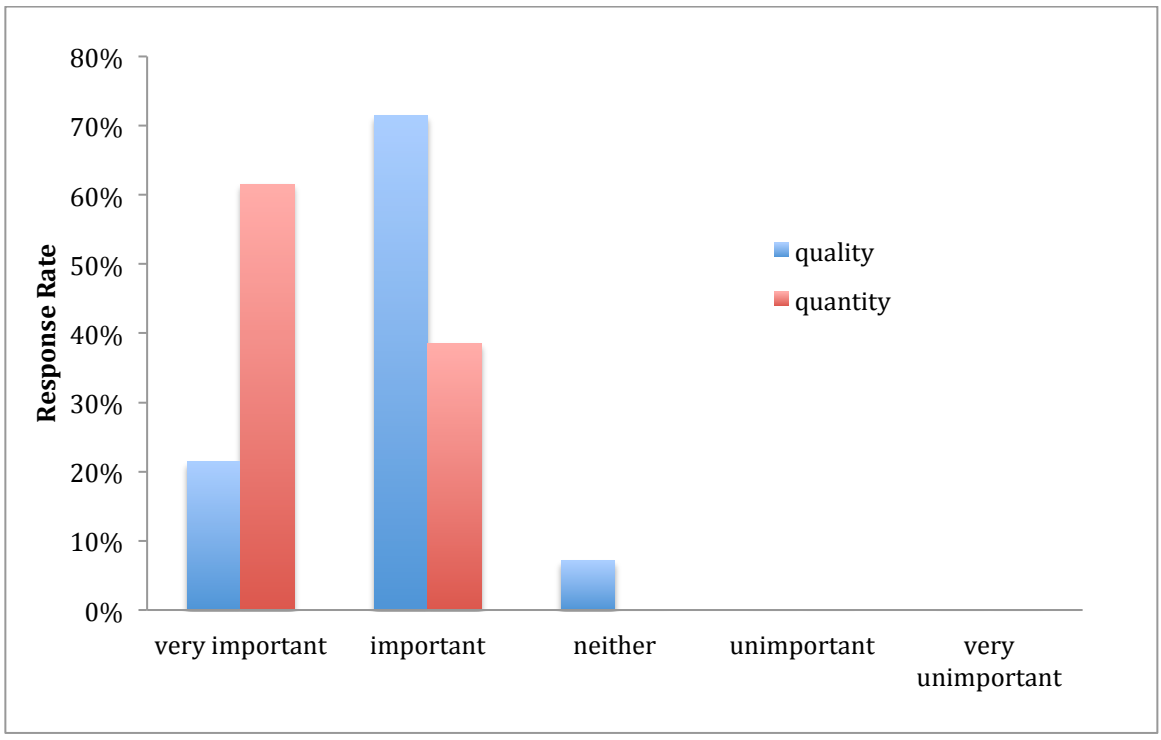

Figure 13. Importance of habitat quality vs. quantity to the success of wolf recovery plans according to biologist respondents (n=13).

Genetic diversity seemed to be a less important consideration compared to other aspects of wolf recovery. When asked to rate the success of gray wolf reintroduction (Figure 14) the plurality of biologists (42.9%) agreed that it has been *very successful*.

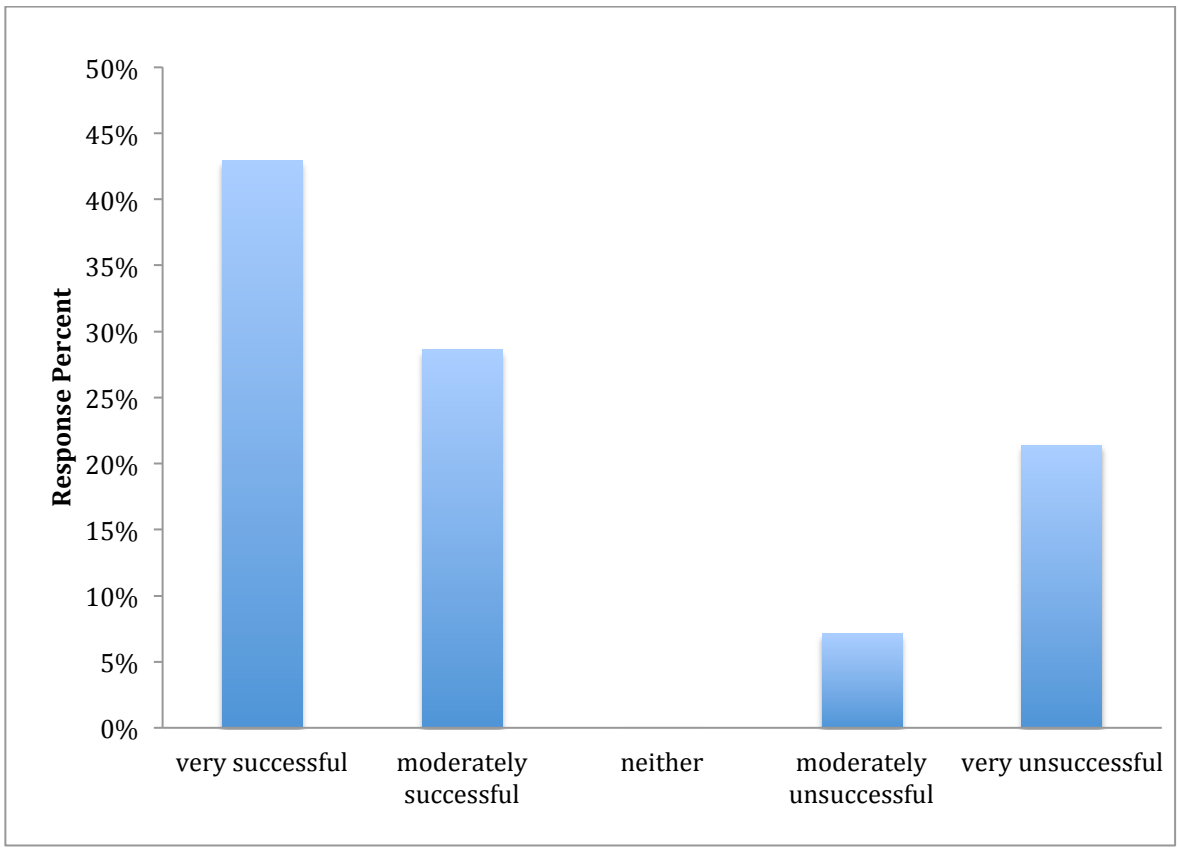

Figure 14. The success of gray wolf reintroduction rated by biologist respondents (n=13).

A plurality of biologists believed that gray wolf reintroduction was successful because it was *publically acceptable* (50%) and because of *adequate prey availability* (50%) (Figure 15).

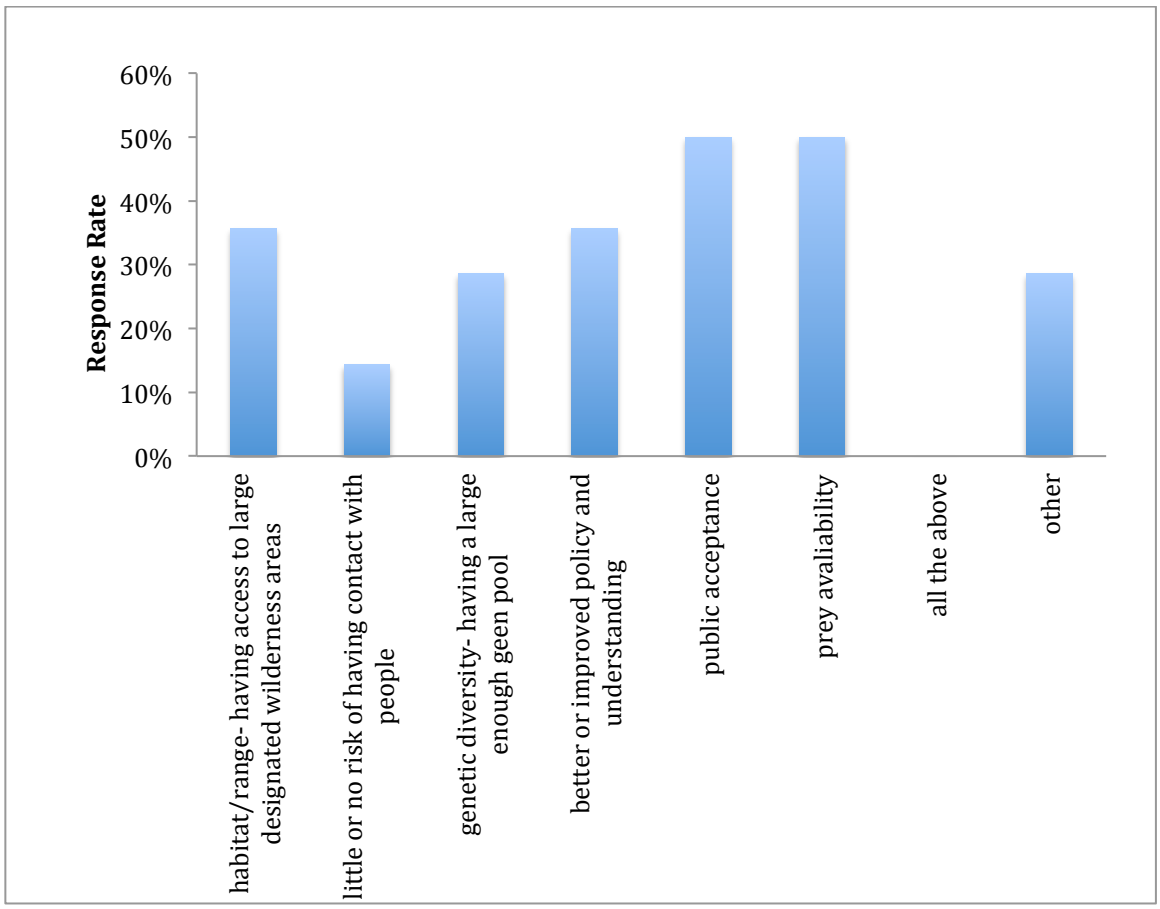

Figure 15. Reasons why surveyed biologists think gray wolf reintroduction has been so successful (n=13). Respondents could mark as many answers as they thought applied.

I asked biologists what they thought was the single best kind of information necessary to craft a successful wolf recovery plan. Because most wrote comments in the 'other' category, I created a new category entitled *"addressing and solving human/wolf issues"* that I thought best described what respondents had submitted. Out of all respondents, 41.7% indicated this to be the best kind of information necessary for successful recovery (Figure 16).

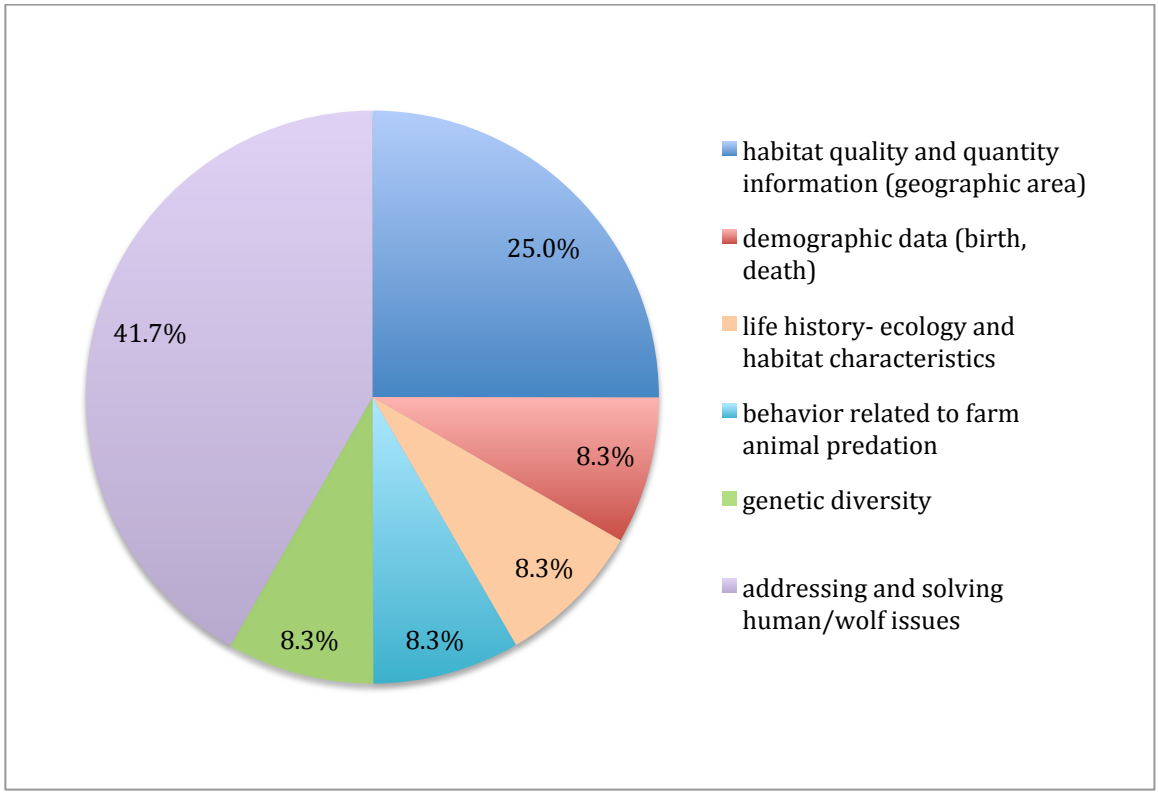

Figure 16. The single best kind of information necessary to craft a successful wolf recovery plan according to biologist respondents (n=13).

This same idea was reinforced in answers to the next question: *"What obstacles or information gaps with wolf/human interactions have you encountered in the planning process for wolf reintroduction."* Biologists were asked to rate each obstacle to recovery from 1-5 where 1 indicates least and 5 the most important. Not surprisingly *conflicts with ranchers and the livestock industry* were considered the biggest obstacles closely followed by *public perception of wolves* (Figure 17).

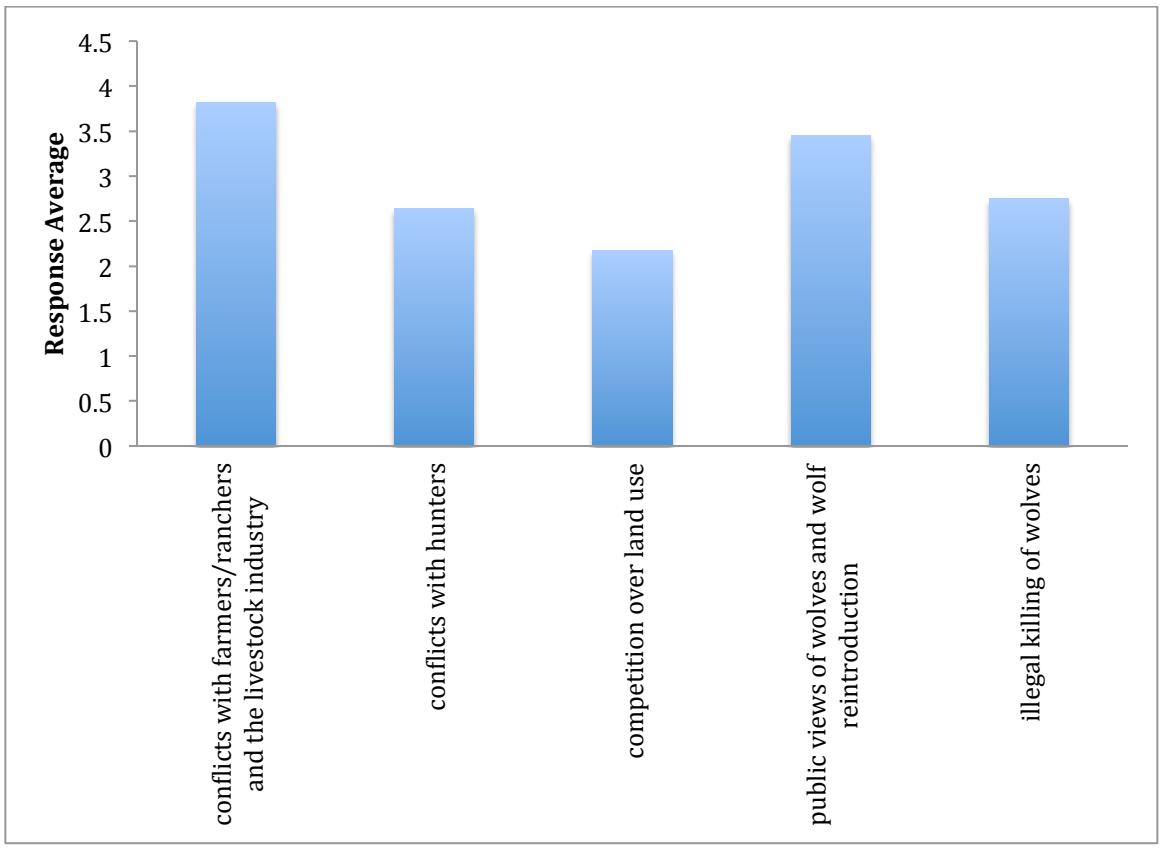

Figure 17. Obstacles and information gaps encountered when planning wolf reintroduction according to biologist respondents (n=13). This question called for rating answers with values ranging from 1 (least) to 5 (most) and rating average was equal to the sum of all ratings/number of respondents.

Of all biologist respondents 38.5% *agree* that the Mexican wolf recovery plan has been unsuccessful in the past (Figure 18).

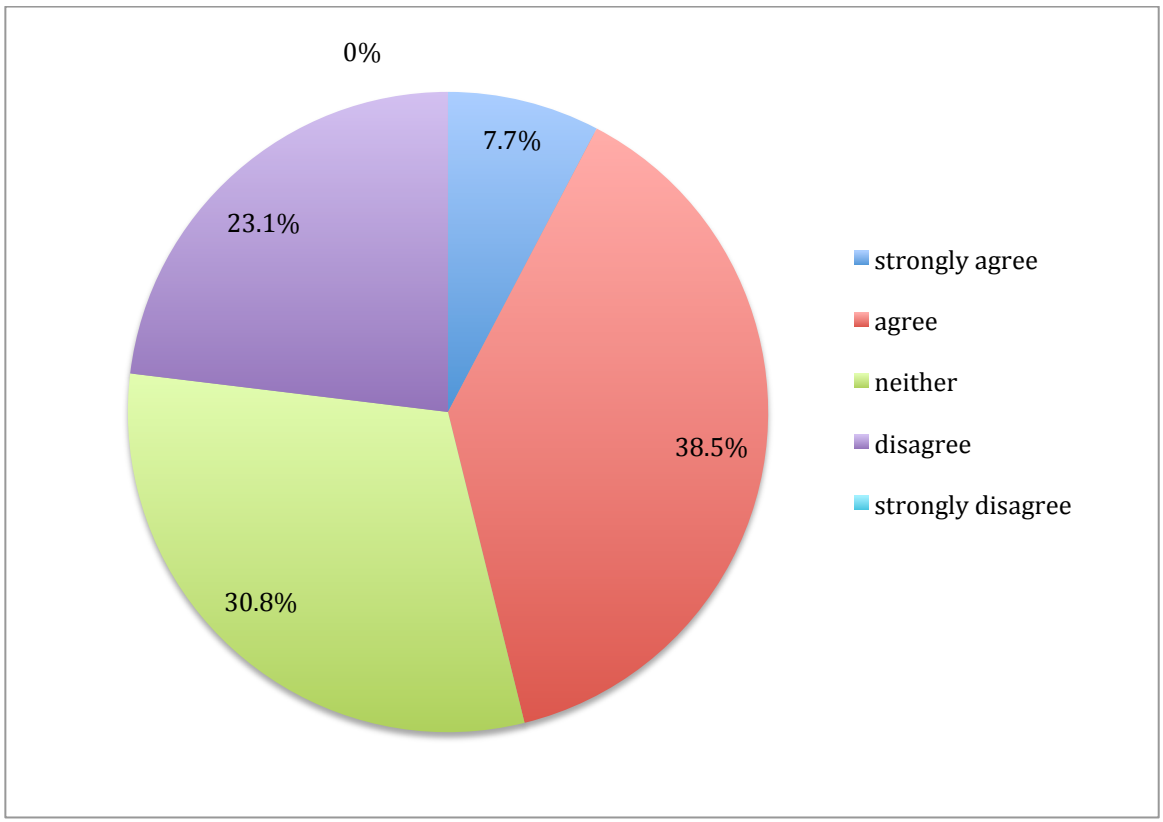

Figure 18. The degree to which biologist respondents believe the Mexican wolf recovery plan has been unsuccessful in the past (n=13). None of the respondents *strongly disagreed*.

Biologists were asked why they ranked the program as they did by identifying as many reasons as they thought applied (see Figure 18). Most biologists believed that the lack of success of Mexican gray wolf recovery was due to *human conflict* (60%) and an *inadequate habitat range* (60%) (Figure 19). Only three biologists answered *low genetic diversity, illegal killings, and inbreeding* due to *low genetic diversity*.

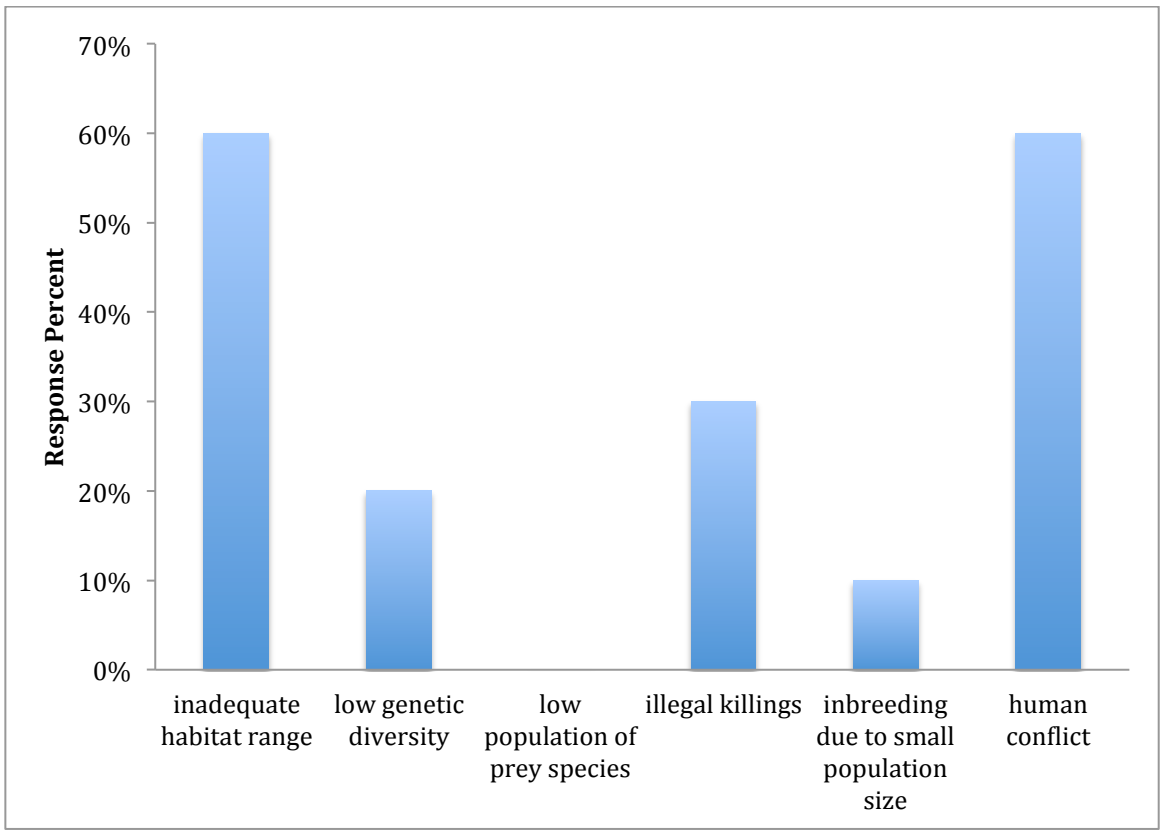

Figure 19. Reasons biologist respondents believe the Mexican wolf recovery plan has been unsuccessful in the past (n=13).

Opinions were mixed and more variable when biologists were asked if restrictions placed on land and grazing activities (limiting the density of cattle and their range) would increase Mexican wolf populations. Some biologists (30.8%) *agreed* that it would help while others (30.8%) *strongly disagreed* (Figure 20).

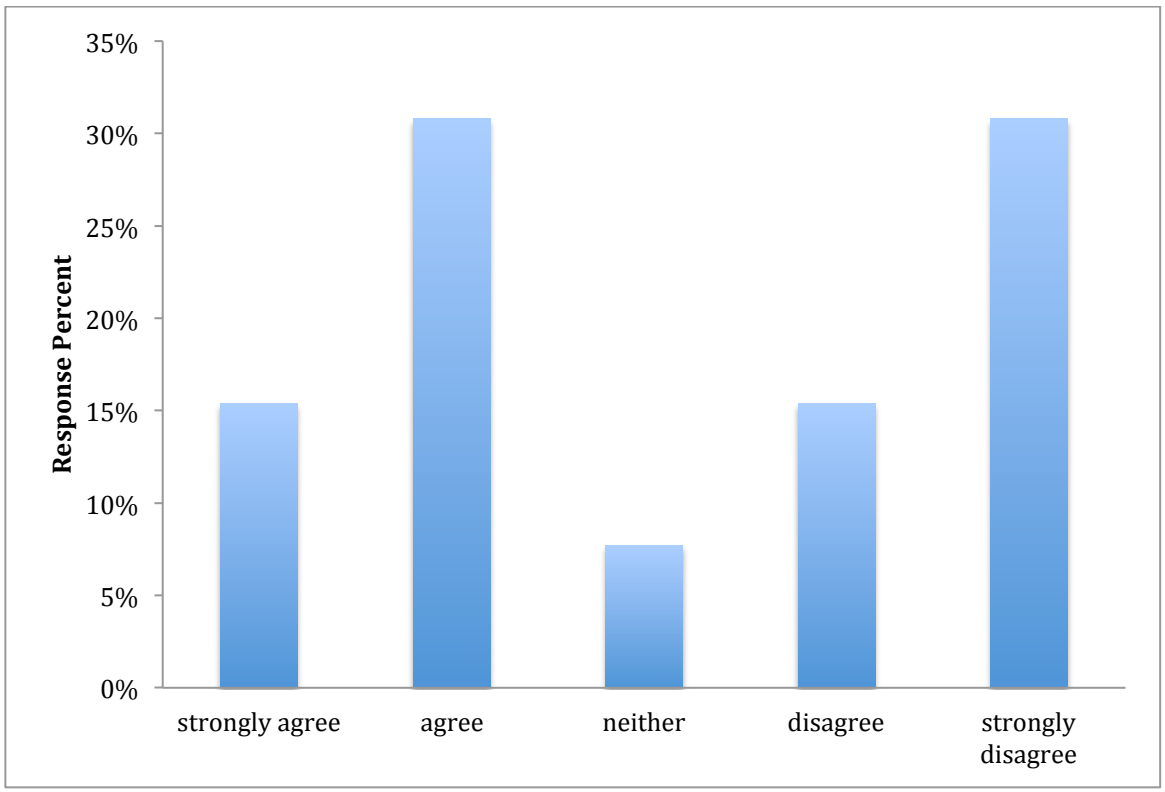

Figure 20. The degree to which biologist respondents believe that stronger restrictions placed on land and grazing activities would increase Mexican wolf populations (n=13).

Most respondents (38.5%) believed that new revisions to the Mexican wolf recovery plan would *neither* help nor hurt the plan's chances for success (Figure 21).

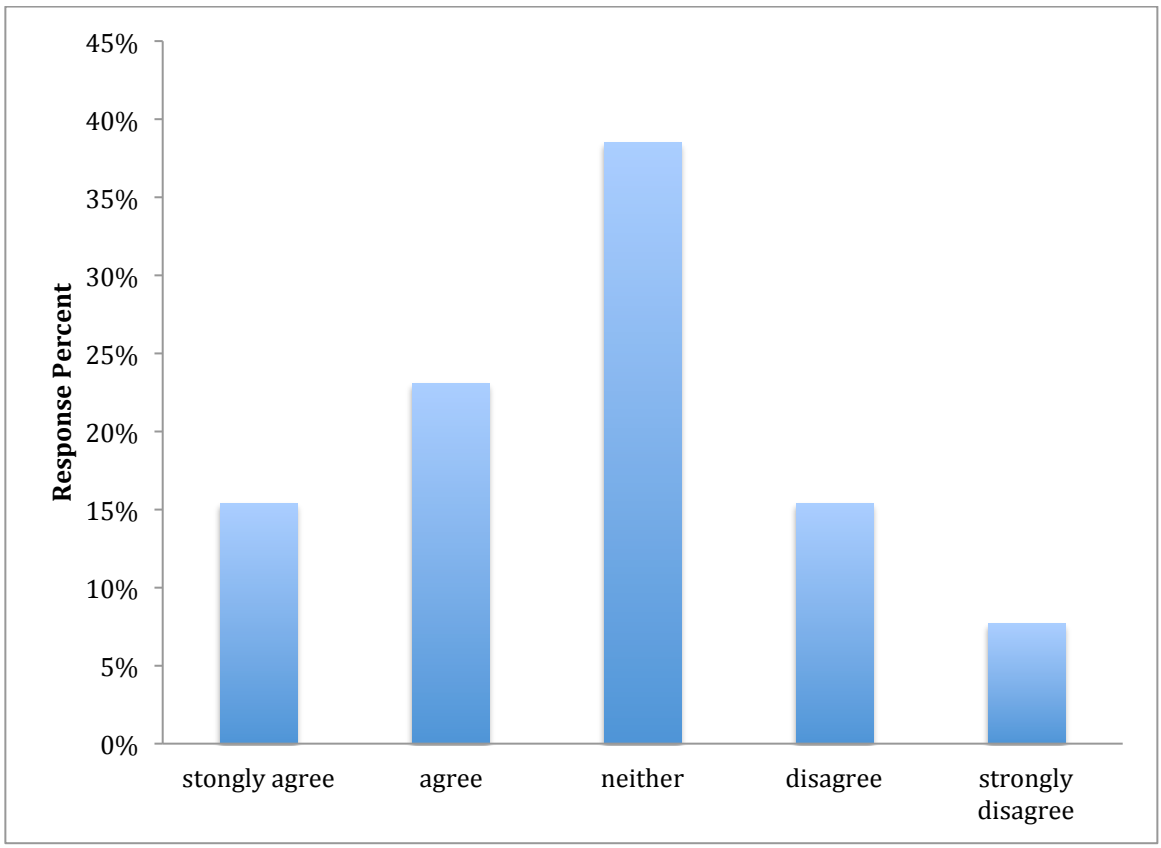

Figure 21. The degree to which biologist respondents believe that new revisions on the Mexican wolf recovery plan will help improve the likelihood of the species to maintain self-sustaining populations (n=13).

When asked about Mexican wolf populations in the future 33.3% believed there would be *no change* in wolf abundance (Figure 22).

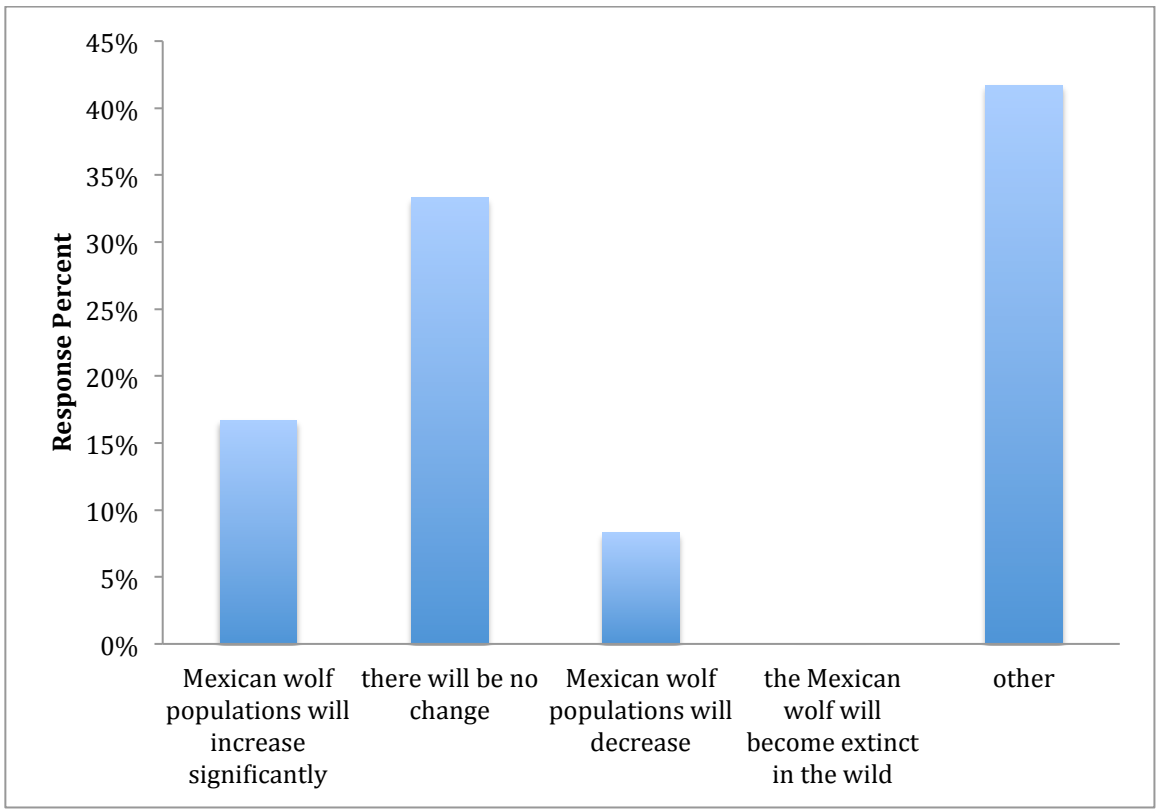

Figure 22. What biologist respondents believe about Mexican wolf recovery in the future (n=13).

Not surprisingly the plurality of biologists (38.5%) believed that the greatest obstacle for wolf recovery in the U.S. is *the degree to which land/livestock owners affected by wolves cooperate with the recovery efforts* and 46.2% *strongly agreed* that this cooperation is difficult to achieve (Figures 23 and 24, respectively).

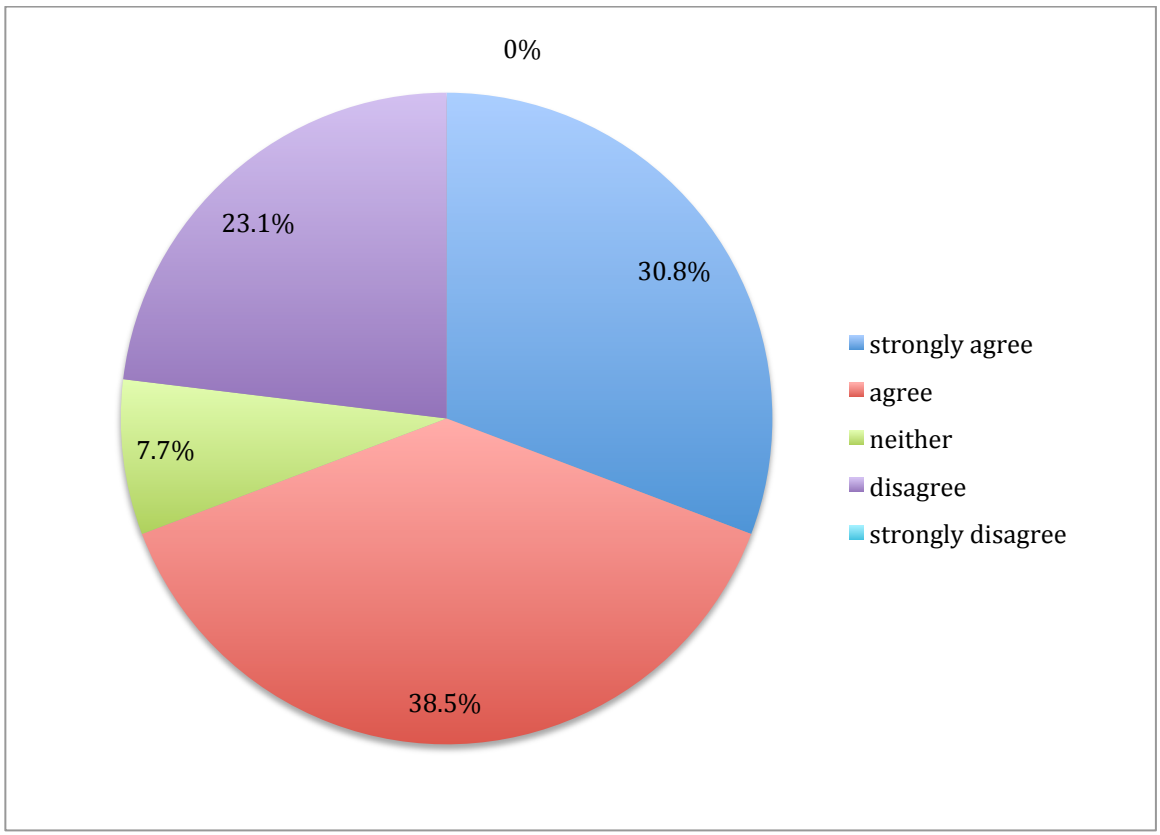

Figure 23. Biologists' response to the statement: The greatest obstacle to wolf recovery in the U.S. is the degree to which land/livestock owners affected by wolves cooperate with recovery efforts (n=13). None of the respondents strongly disagreed.

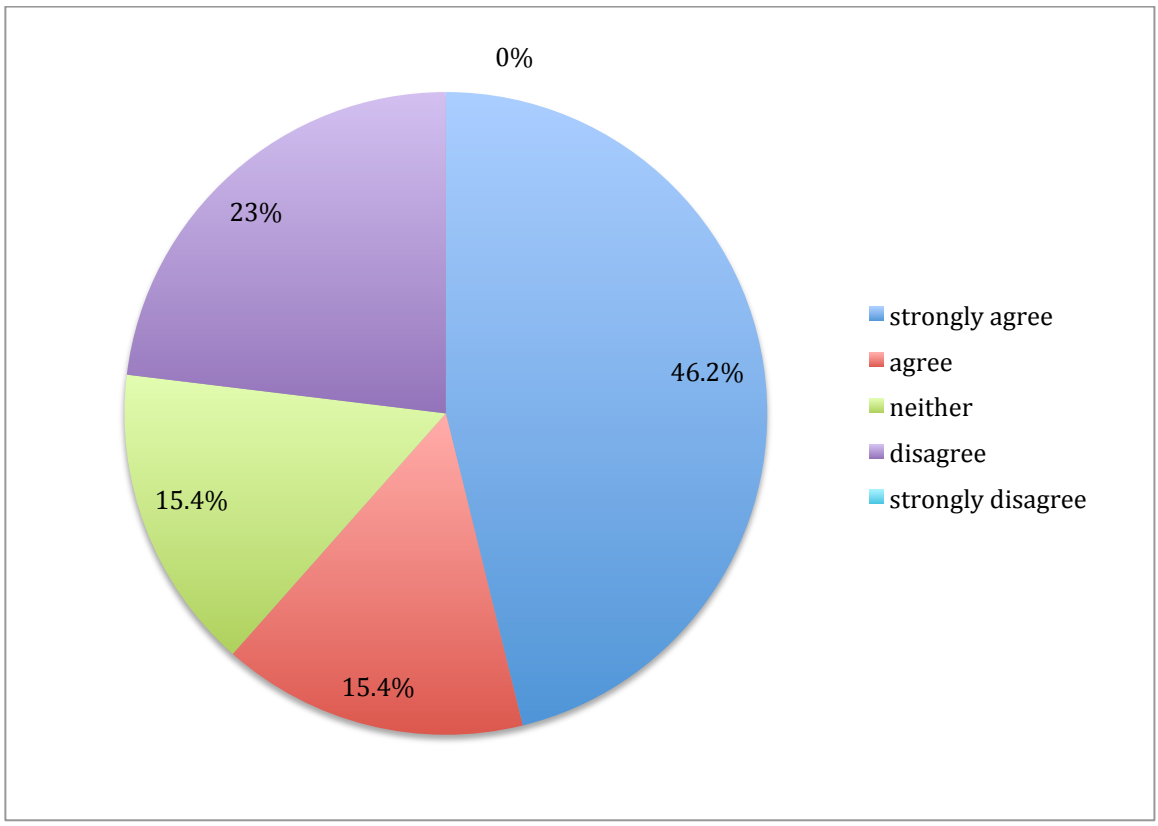

Figure 24. Biologists' response to the statement: *Cooperation with land/livestock owners is difficult to achieve* (n=13). None of the respondents *strongly disagreed*.

Compensation programs are important in helping ranchers whose livestock has been depredated by wolves (Naughton-Treves et al., 2003). However, 53.8% of biologists believe that current compensation programs are not working while at the same time only 46.2% of biologists *agree or strongly agree* those compensation programs are fair (Figure 25).

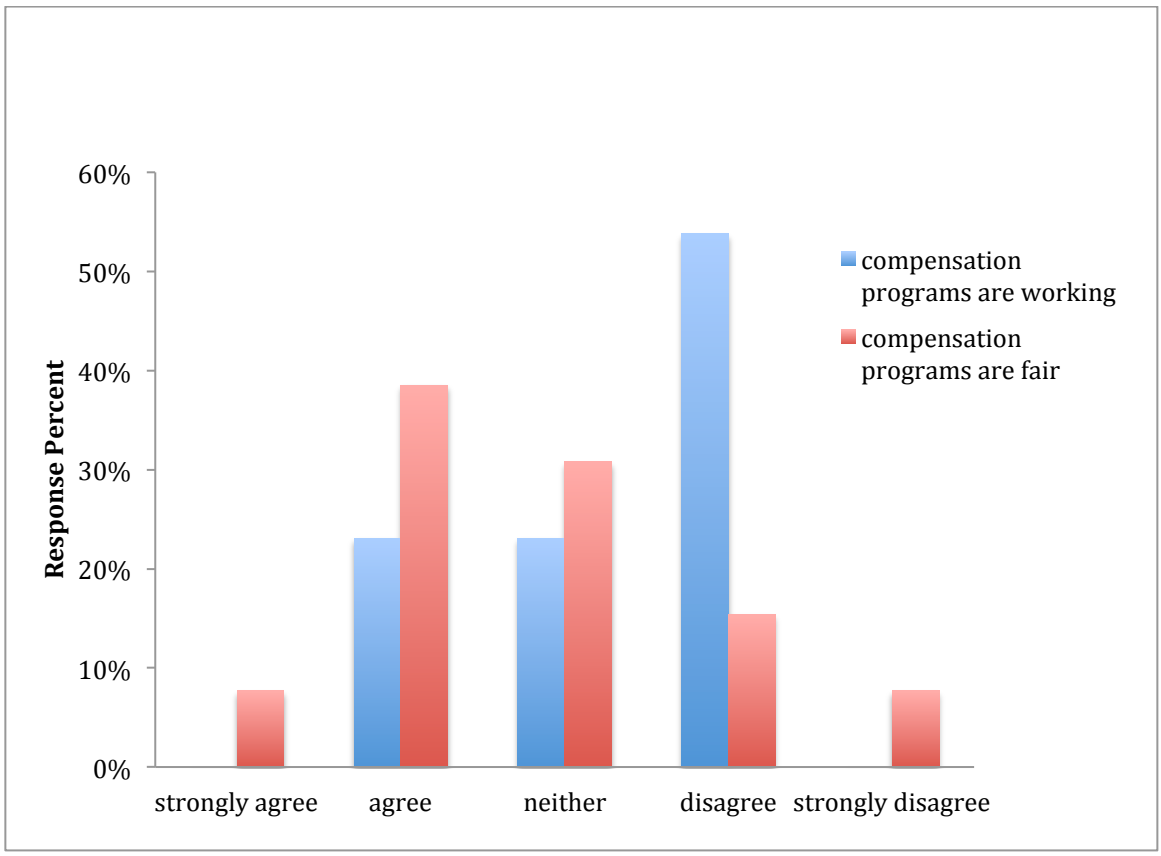

Figure 25. The degree to which biologist respondents believe that current compensation for wolf depredation on livestock is working vs. fair (n=13).

The plurality (33.3%) of respondents believe that wolf recovery efforts tend to divide the affected communities into biologists (generally supportive) and ranchers (generally not supportive) (Figure 26).

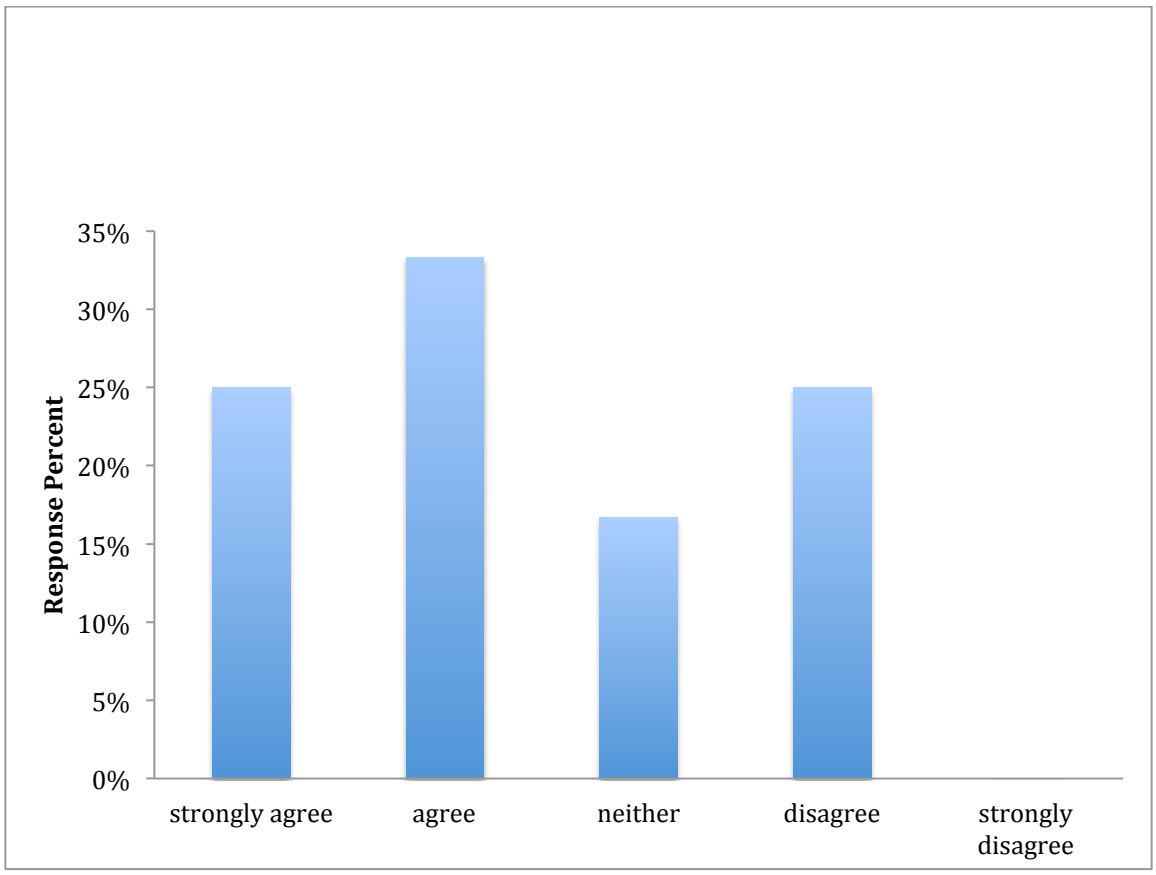

Figure 26. The degree to which biologist respondents believe that wolf recovery efforts tend to divide the affected communities into biologists (generally supportive) and ranchers (generally not supportive) (n=13).

As for improving cooperation through time, 41.7% of respondents believed that cooperation levels would *remain mostly the same* (Figure 27).

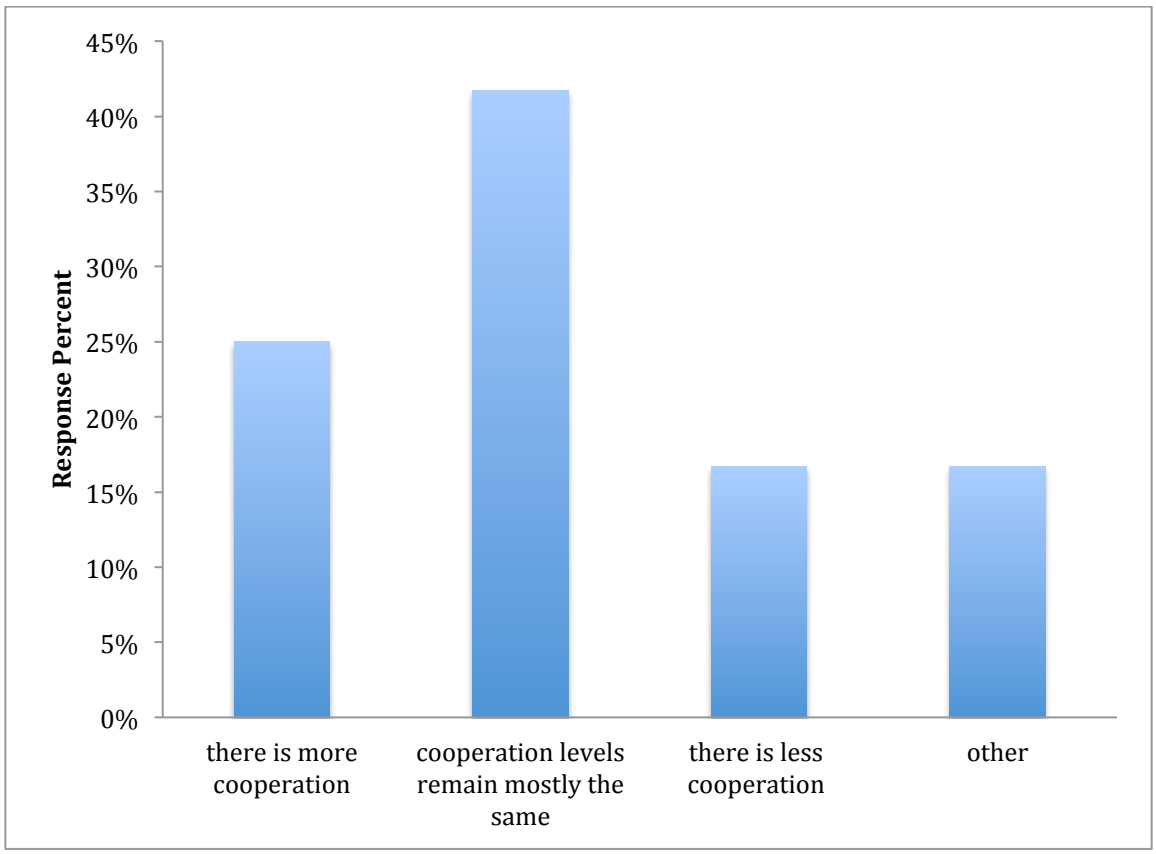

Figure 27. The fate of the divided community (biologists and ranchers) through time according to biologist respondents (n=13).

Interestingly, one biologist suggested that division is not between biologists and ranchers but rather between urban residents who he believed were supportive and rural residents who he believed were unsupportive of wolf recovery.

RANCHER SURVEYS

I received 54 completed surveys from ranchers; 31 were from ranchers in the gray wolf area and 23 were from ranchers in the Mexican wolf area. Since I received a larger number of rancher surveys, for certain questions I split them into two groups based on recovery areas (Mexican vs. gray wolf)-for comparative purposes. Although I sent emails to ranching organizations in Montana, Wyoming, Idaho, Oregon, Washington,

New Mexico, and Arizona, the same states I attempted to survey biologists in, I received completed surveys only from Wyoming, Oregon, New Mexico, Arizona, and Texas. I assumed that one rancher who responded that he lived in Texas owned land or ranched in New Mexico. No ranchers from Idaho, Montana, or Washington responded.

Of the ranchers who responded, 62.5% were between the ages of *50 and 64* years of age, 33.9% were *college graduates*, 42.9% identified themselves as *conservative*, and 49.1% grew up in *rural* areas (Figures 28, 29, 30, 31 respectively).

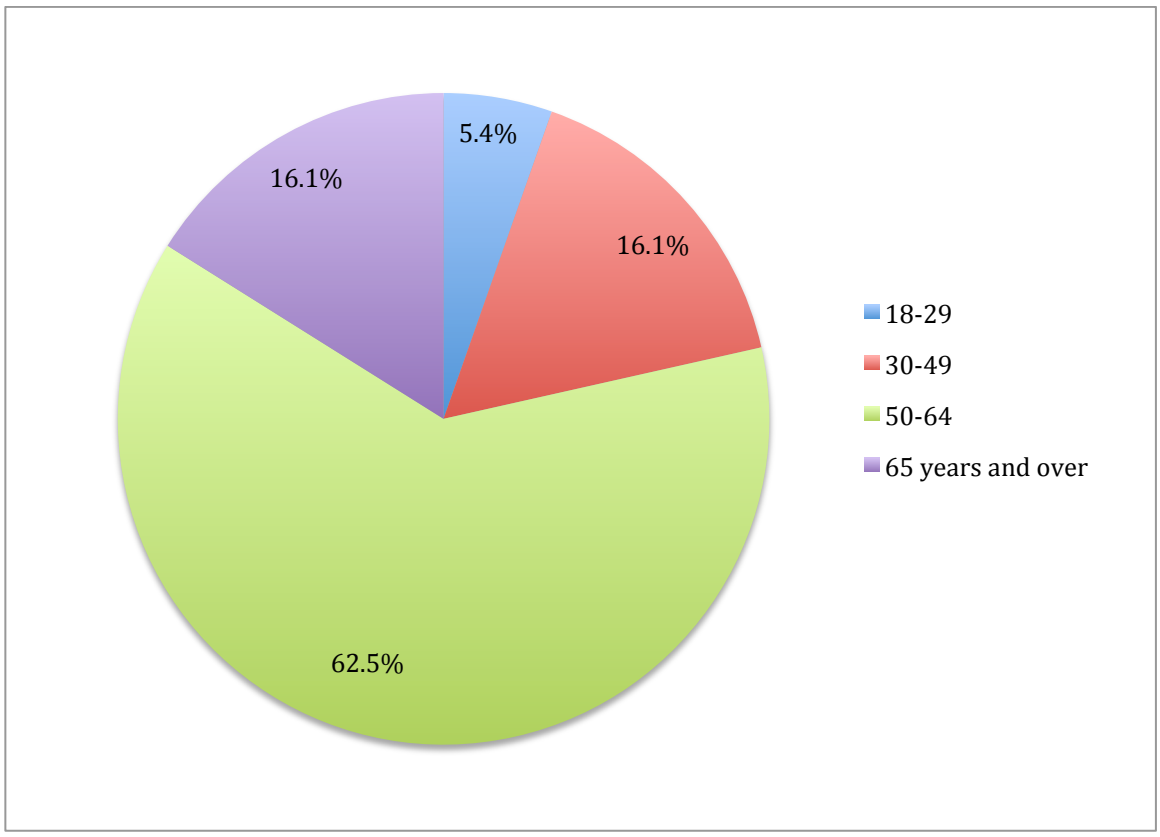

Figure 28. Age of ranchers responding to the surveys (n=54).

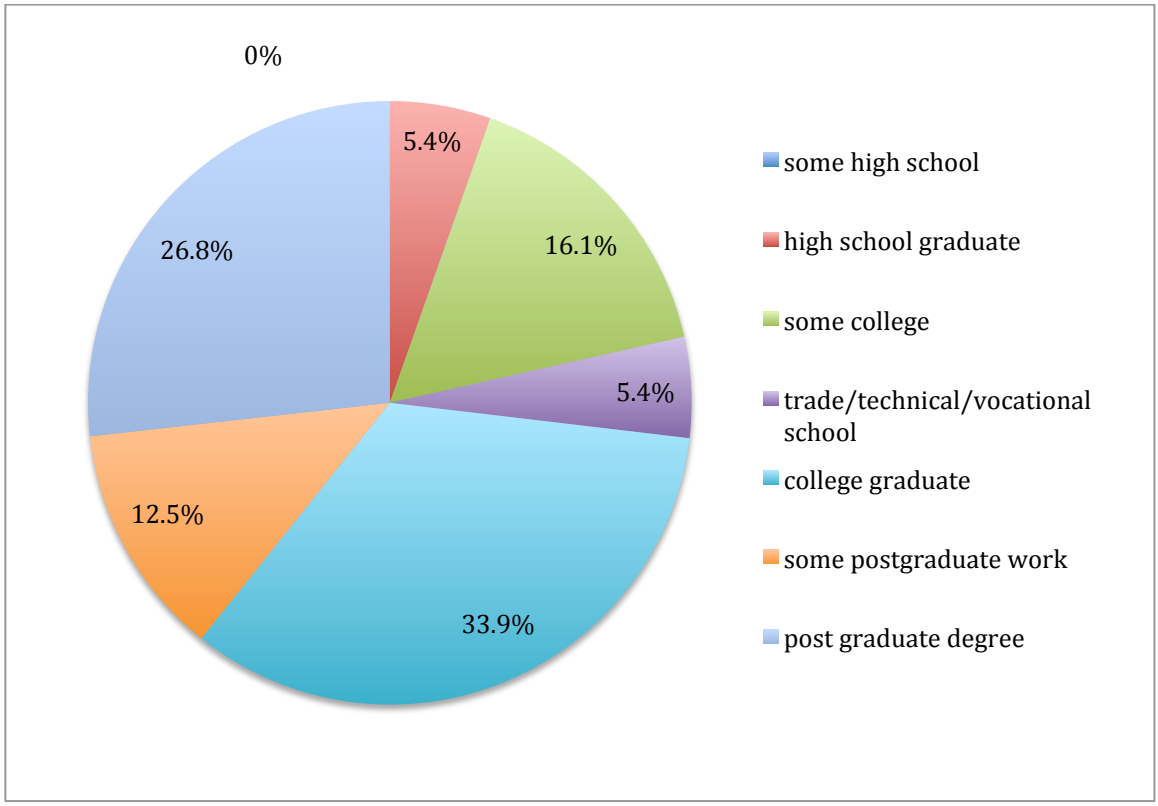

Figure 29. Highest level of education completed by ranchers responding to the survey (n=54). None of the respondents characterized their education as *some high school.*

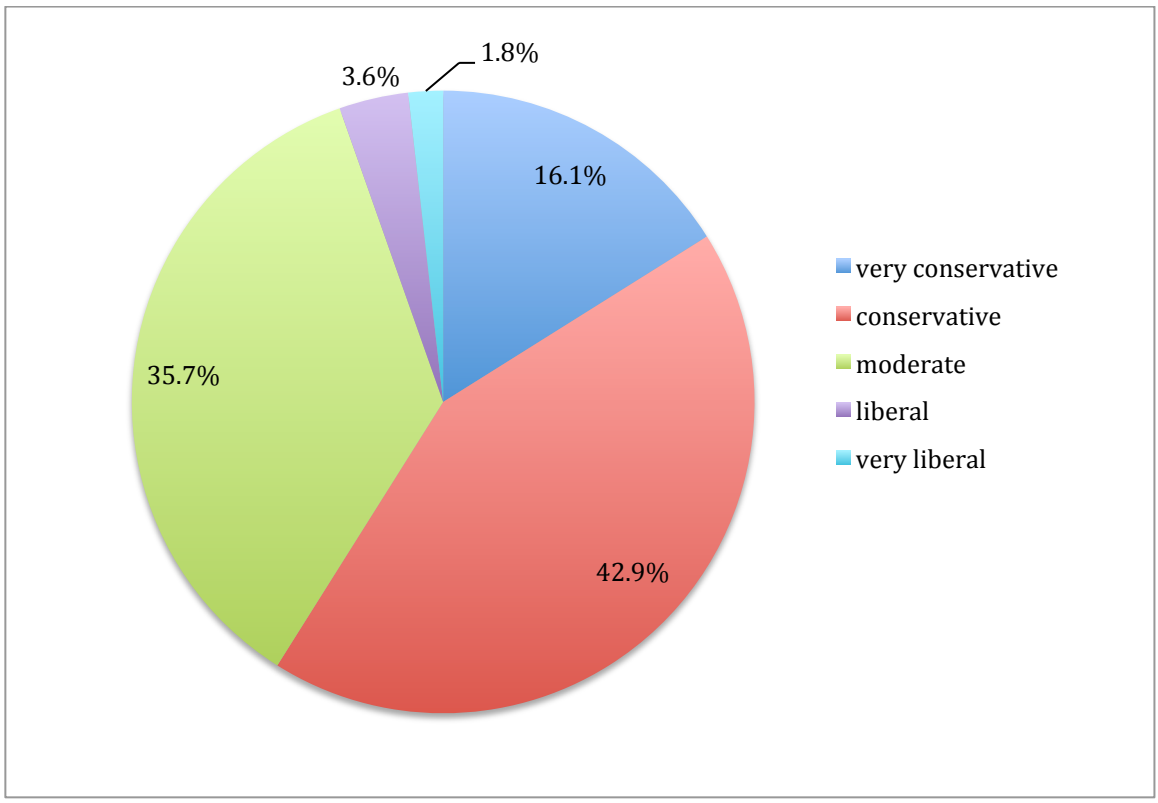

Figure 30. Political views held by ranchers responding to the survey (n=54).

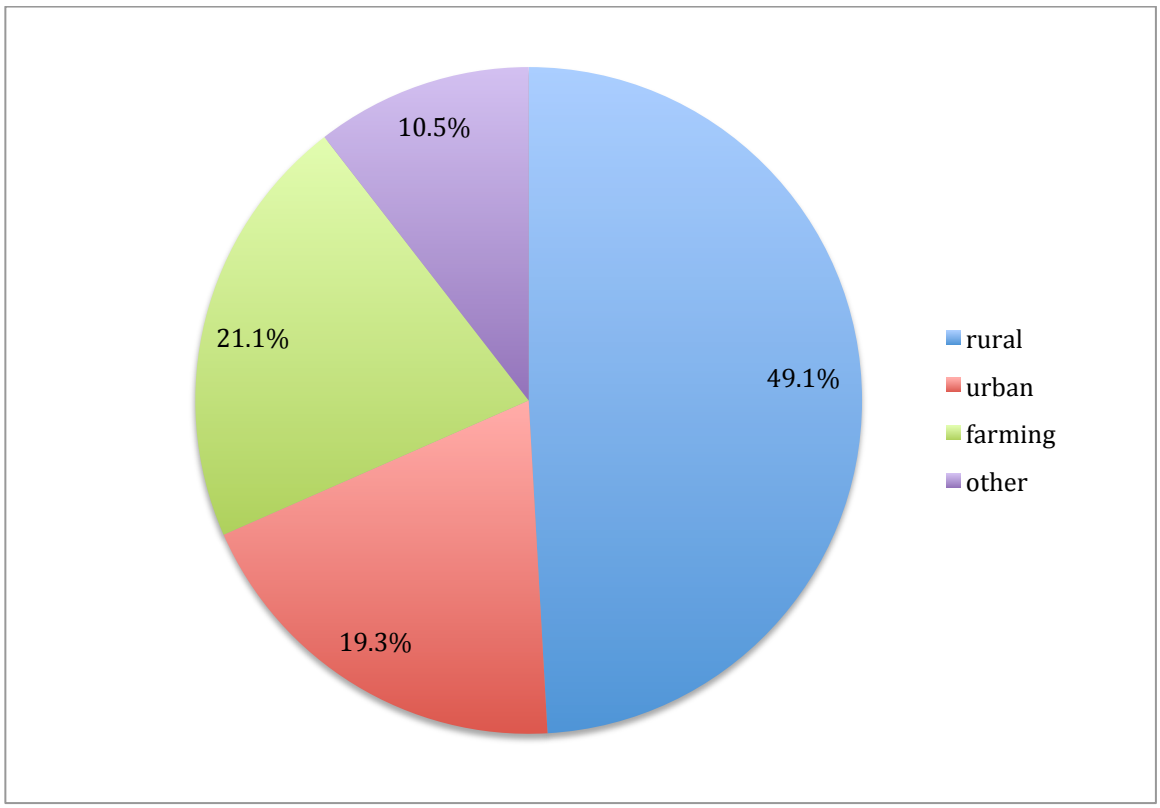

Figure 31. Childhood homes (up to age 18) of rancher respondent (n=54).

Most respondents were at least a third generation rancher and one was a tenth generation rancher.

When asked how many livestock they believed they had lost within the past year due to wolf depredation 68% said *1-3* (Figure 32).

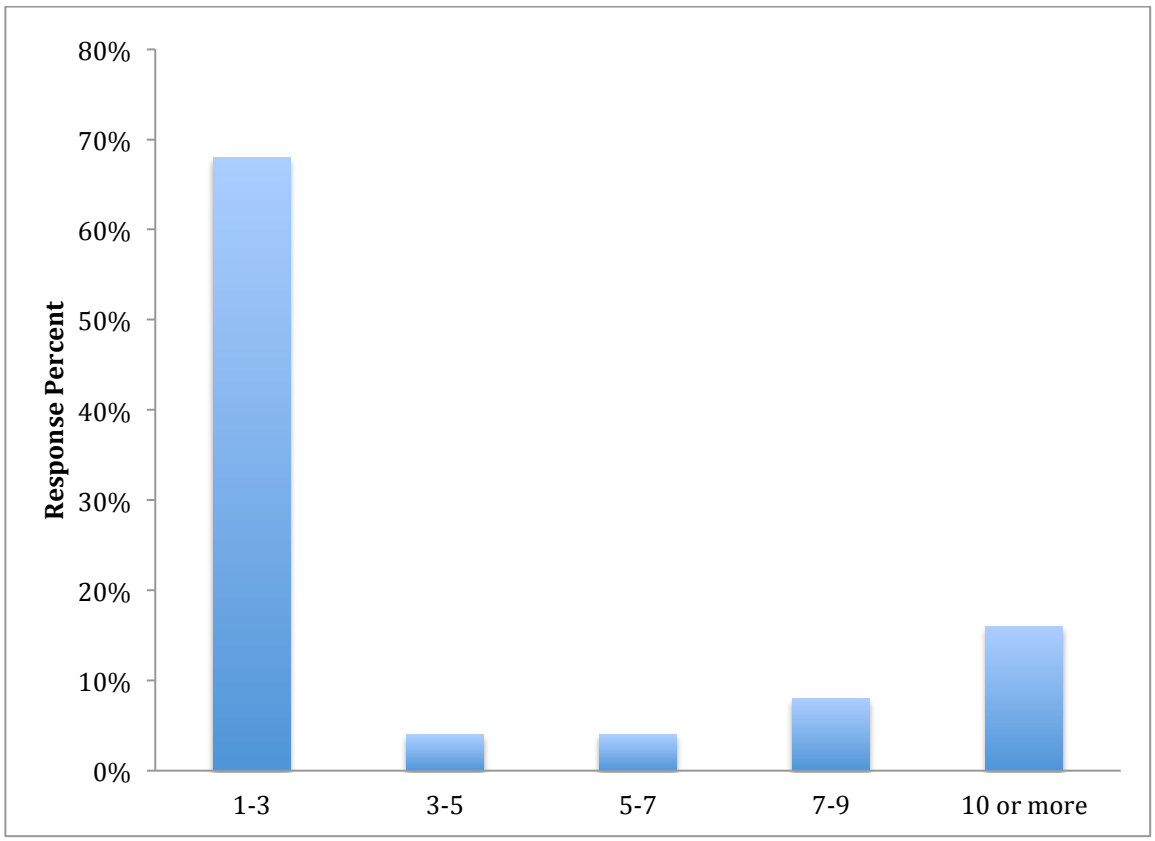

Figure 32. The estimated number of livestock lost in the past year due to wolf depredation (n=54). This bar graph shows the estimated number of livestock lost within the past year of ranchers dealing with the northern gray wolf and ranchers dealing with the Mexican gray wolf combined.

However, when I split the ranchers into two groups, those dealing with Mexican versus those dealing with the gray wolves, I found that 91% of ranchers in the gray wolf region estimated they lost between *1-3* livestock while 44.4% of ranchers in the Mexican wolf region estimated they lost *10 or more* livestock (Figure 33).

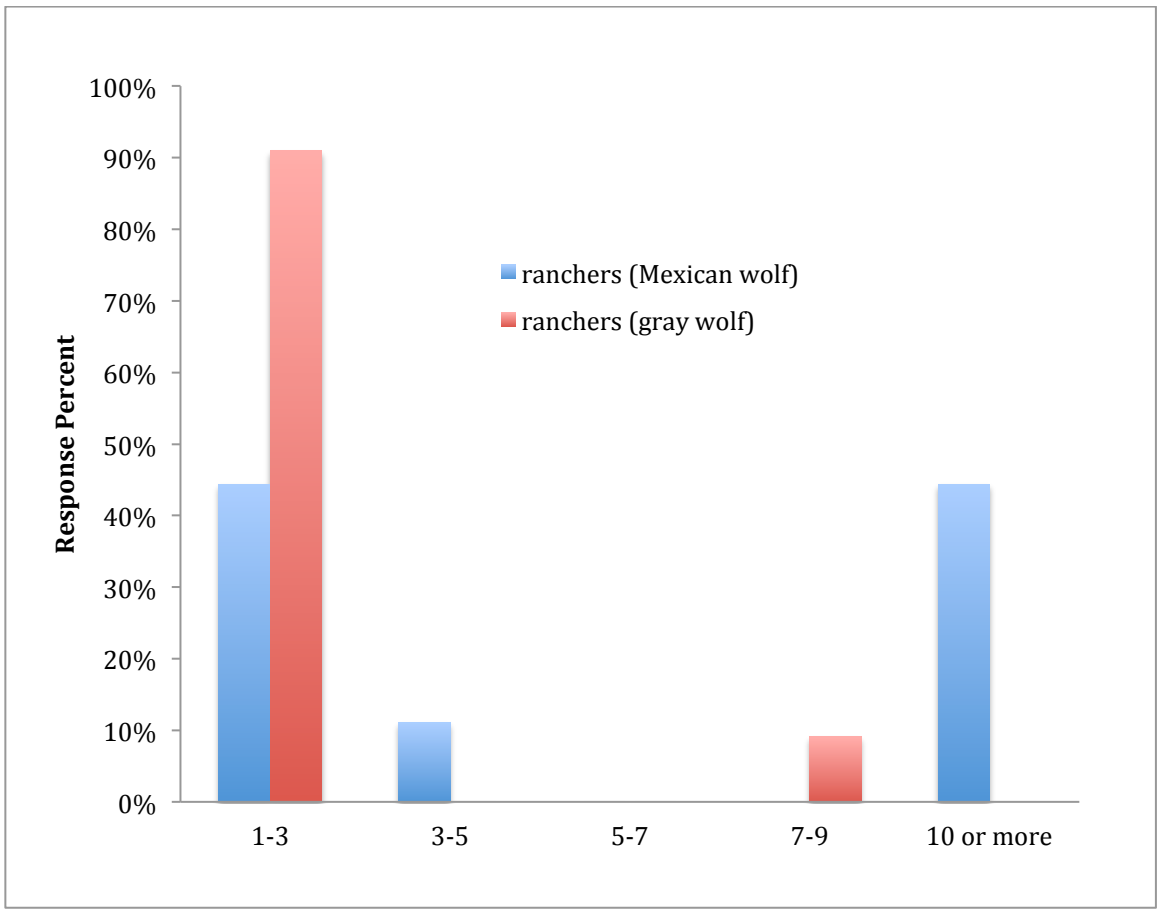

Figure 33. Estimated livestock lost due to wolf depredation within the past year from ranchers affected by Mexican wolves (n=23) vs. ranchers affected by gray wolves (n=31).

While neither rancher group supports wolf recovery, ranchers affected by Mexican wolves believe that they lose more livestock than ranchers affected by gray wolves. Moreover, 75% of the ranchers affected by Mexican wolves *strongly do not support wolf recovery* while only 45% of ranchers affected by gray wolves *strongly do not support wolf recovery* (Figure 34).

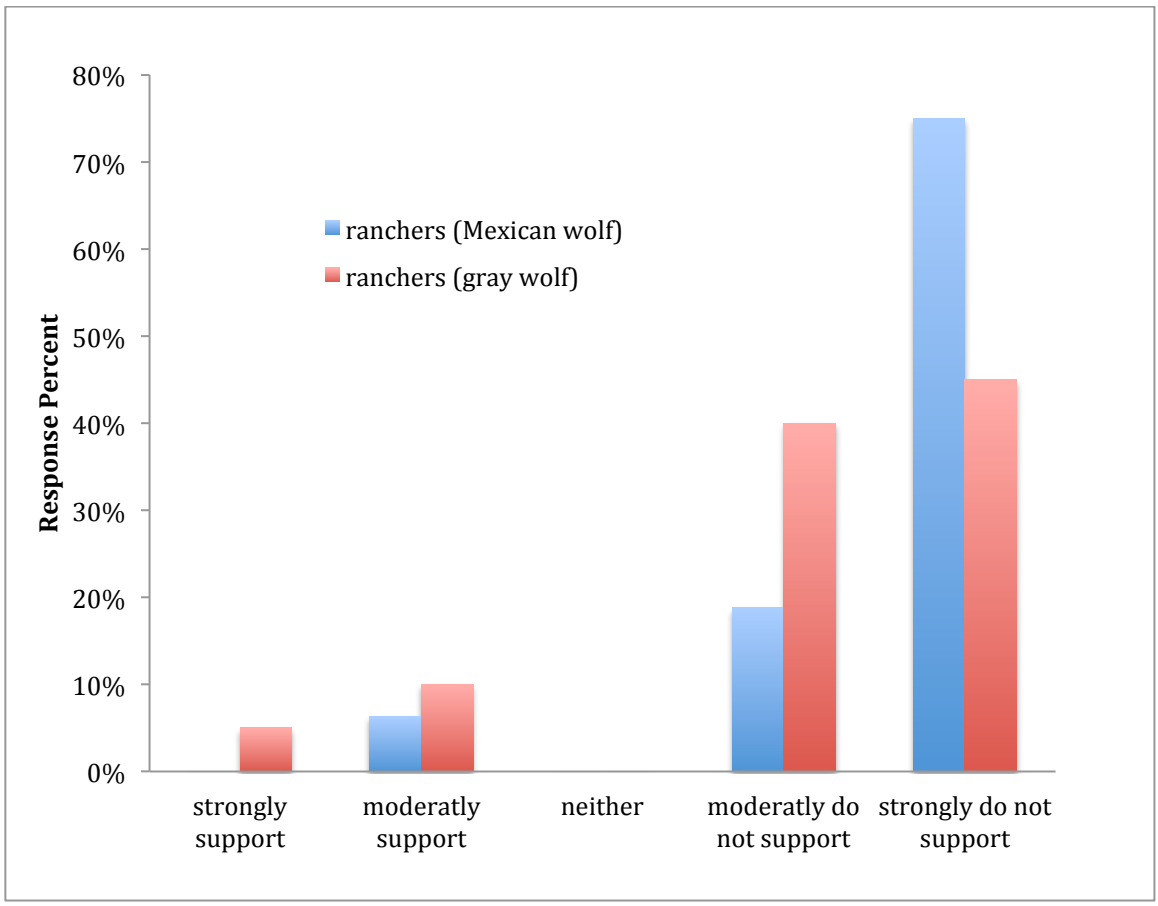

Figure 34. Level of support from rancher respondents towards wolf recovery. This figure shows differences in support for wolf recovery between ranchers affected by Mexican wolves (n=23) vs. ranchers affected by gray wolves (n=31).

A similar question was asked about wolf reintroduction with similar results. Of respondents, 87.5% of ranchers affected by Mexican wolves and 61.9% of ranchers affected by gray wolves *strongly do not support wolf reintroduction*, respectively (Figure 35).

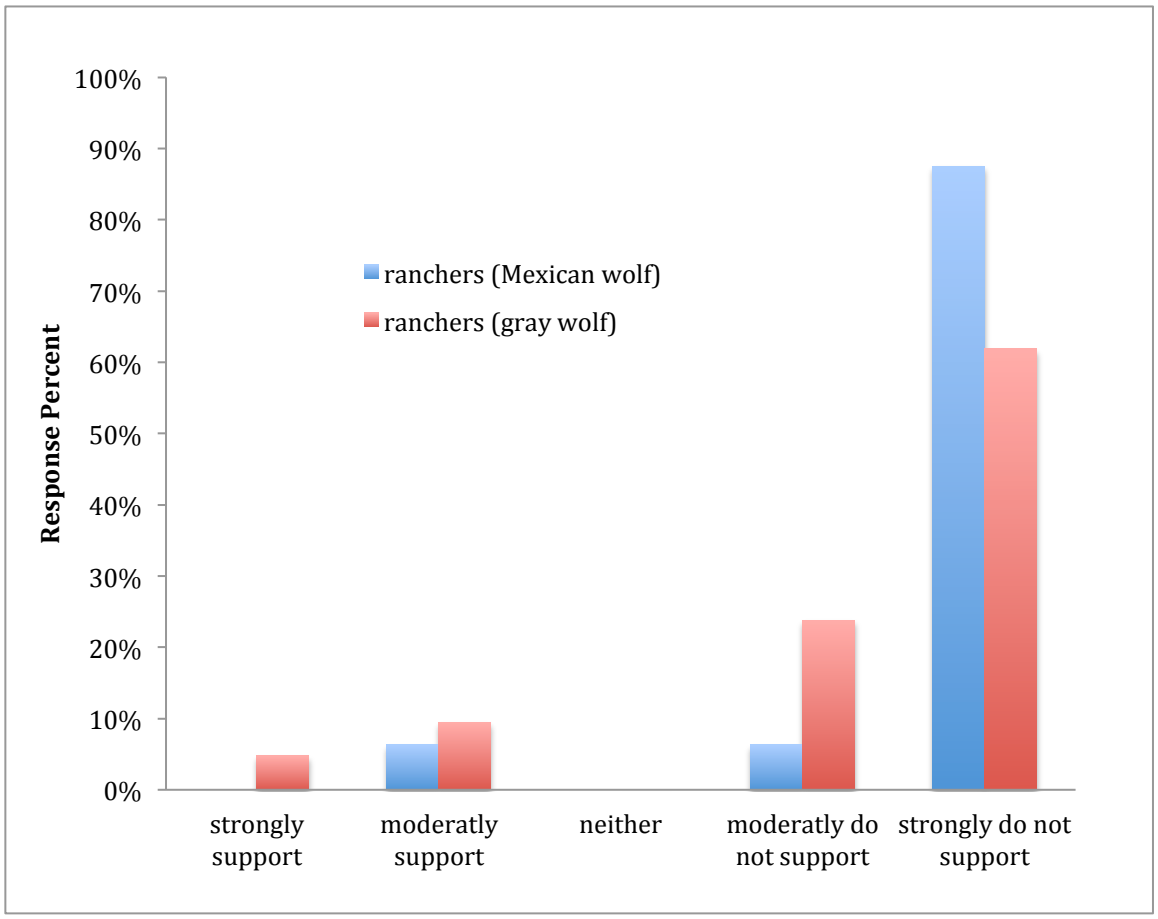

Figure 35. Level of support from rancher respondents towards wolf reintroduction. This figure shows the difference of support for wolf reintroduction between ranchers affected by Mexican wolves (n=23) vs. ranchers affected by gray wolves (n=31).

Similar to the biologists many ranchers (46.8%) believe that current compensation programs for wolf depredation on livestock are not working. However, where biologists believed that current compensation programs were fair, the plurality of ranchers (45.8%) did not believe they were fair (Figure 36).

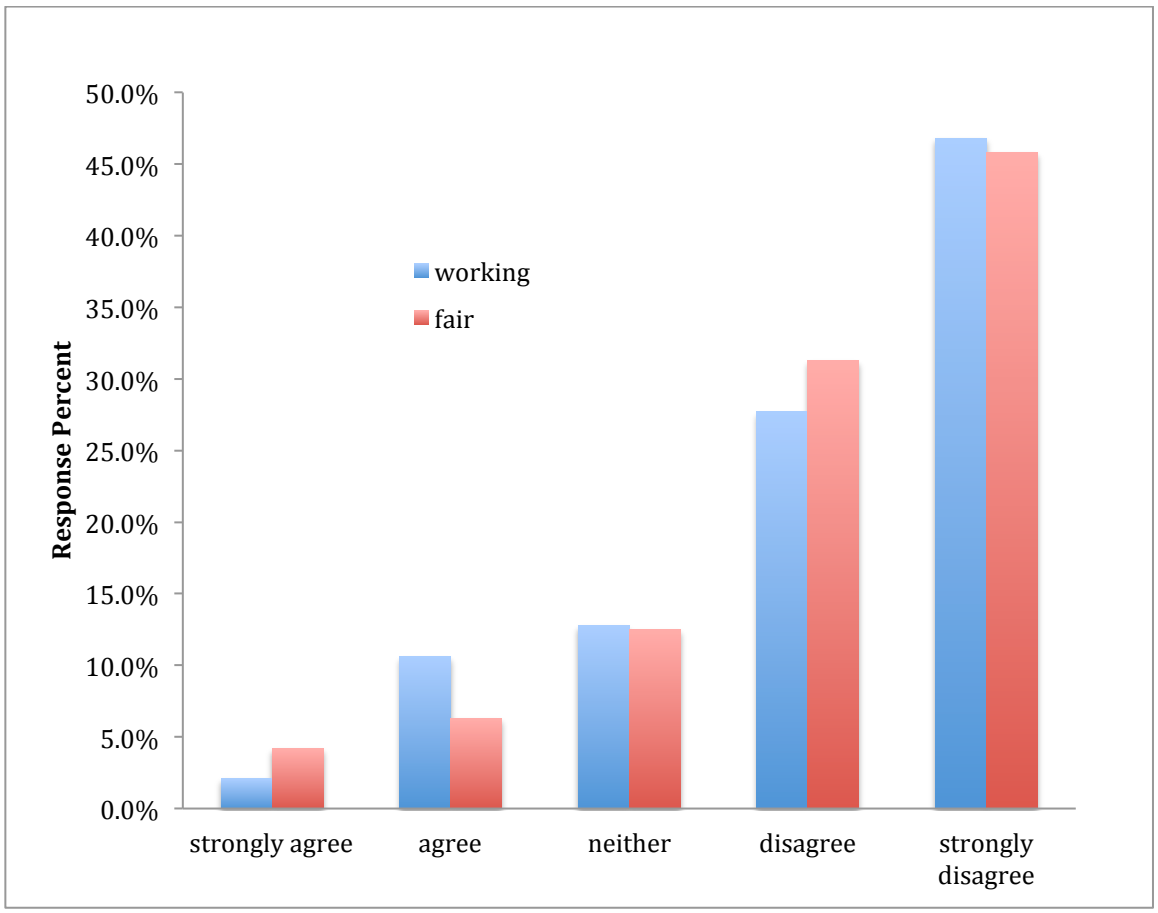

Figure 36. Level of support from rancher respondents towards compensation programs (n=54). This figure shows whether ranchers believe compensation is working vs. whether they believe it is fair.

Perhaps not surprisingly the majority of ranchers (75.6%) felt they were not included in decisions about wolf reintroduction (Figure 37), a pattern that was consistent across recovery regions.

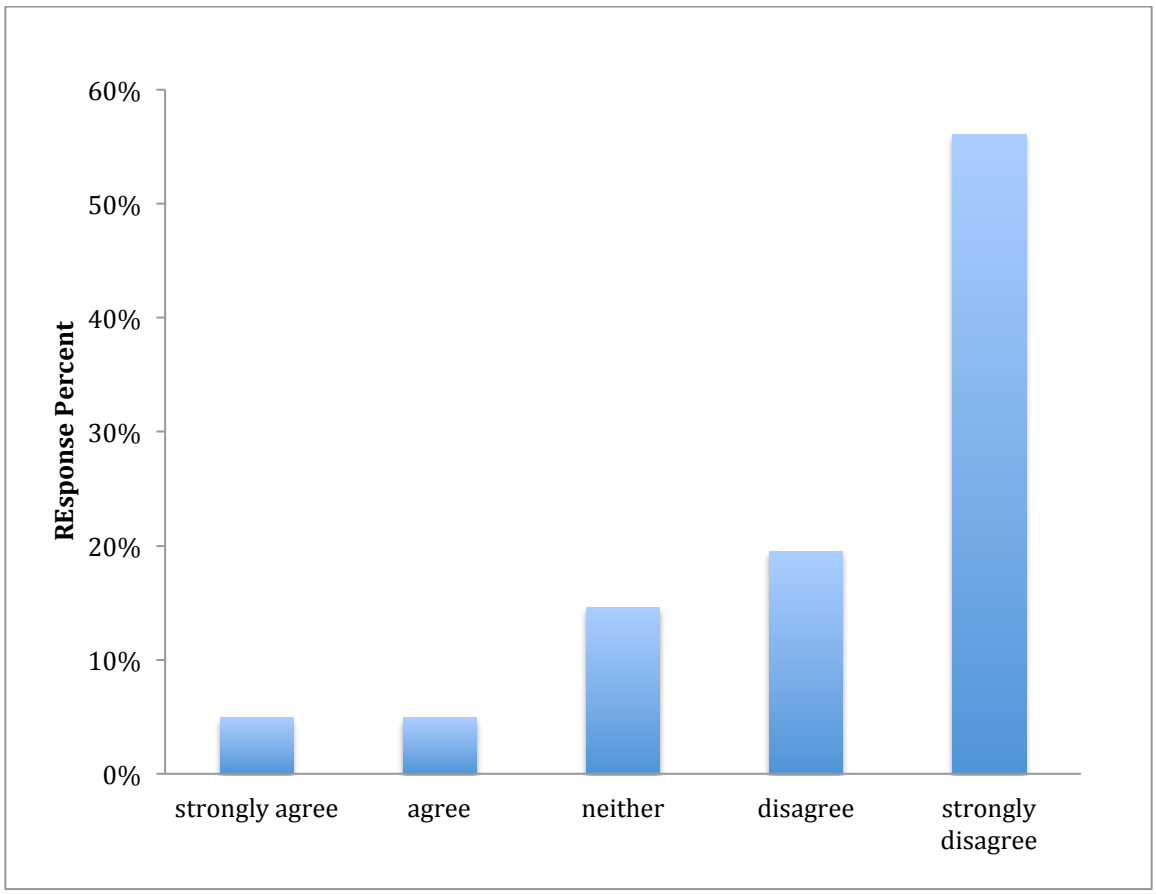

Figure 37. Ranchers' response to the question: *Do you feel you are included in decisions about wolf reintroduction?* (n=54).

Although both groups of ranchers did not like the idea of wolves on their land, 45% of ranchers affected by Mexican wolves categorized them as being a *huge threat* while only 31.6% of ranchers affected by gray wolves characterized them in this way. Another 36% of ranchers affected by Mexican wolves thought wolves were *invading their land* compared to 5.3% of ranchers affected by gray wolves (Figure 38). Nine respondents wrote comments in the 'other' category so I created two new categories entitled *"They are gradually becoming more of a threat"* and *"They do not occur on my land"* that I thought best described what respondents had submitted.

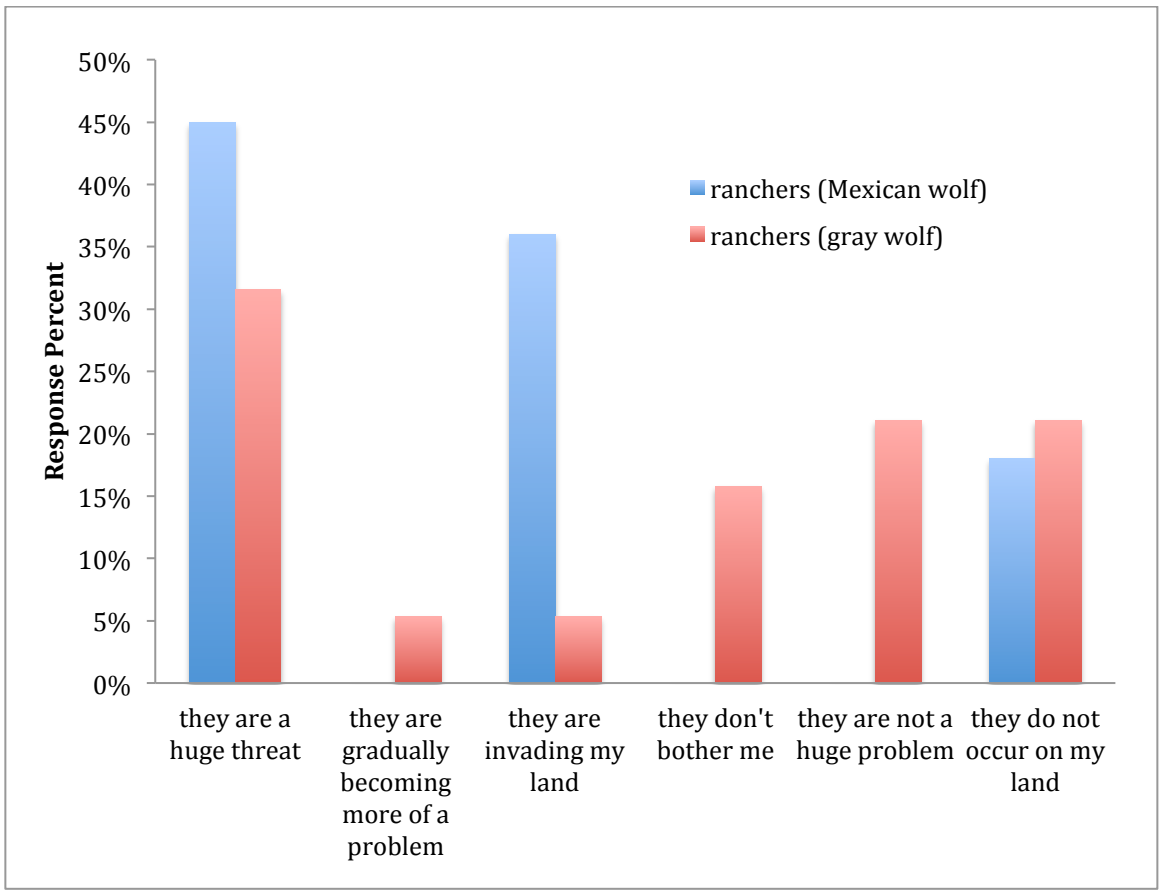

Figure 38. Ranchers' response to the question: *How do you feel about wolves on your land?* This figure shows the difference between ranchers' feelings towards wolves on their land. It splits the ranchers into those affected by Mexican wolves (n=23) vs. those affected by gray wolves (n=31).

Similar to the biologists' responses, ranchers believed that wolf recovery efforts tend to divide the affected communities into biologists (generally supportive) and ranchers (generally not supportive). Ranchers were asked to characterize the relationships between biologists and ranchers in the recent past. Though both groups of ranchers thought the relationship was poor, they characterized the nature of the relationship differently. The majority (50%) of ranchers affected by Mexican wolves said *there* is *less cooperation* between the two groups through time while the majority (57.9%) of ranchers affected by gray wolves indicated that the relationship was *not changing* (Figure 39).

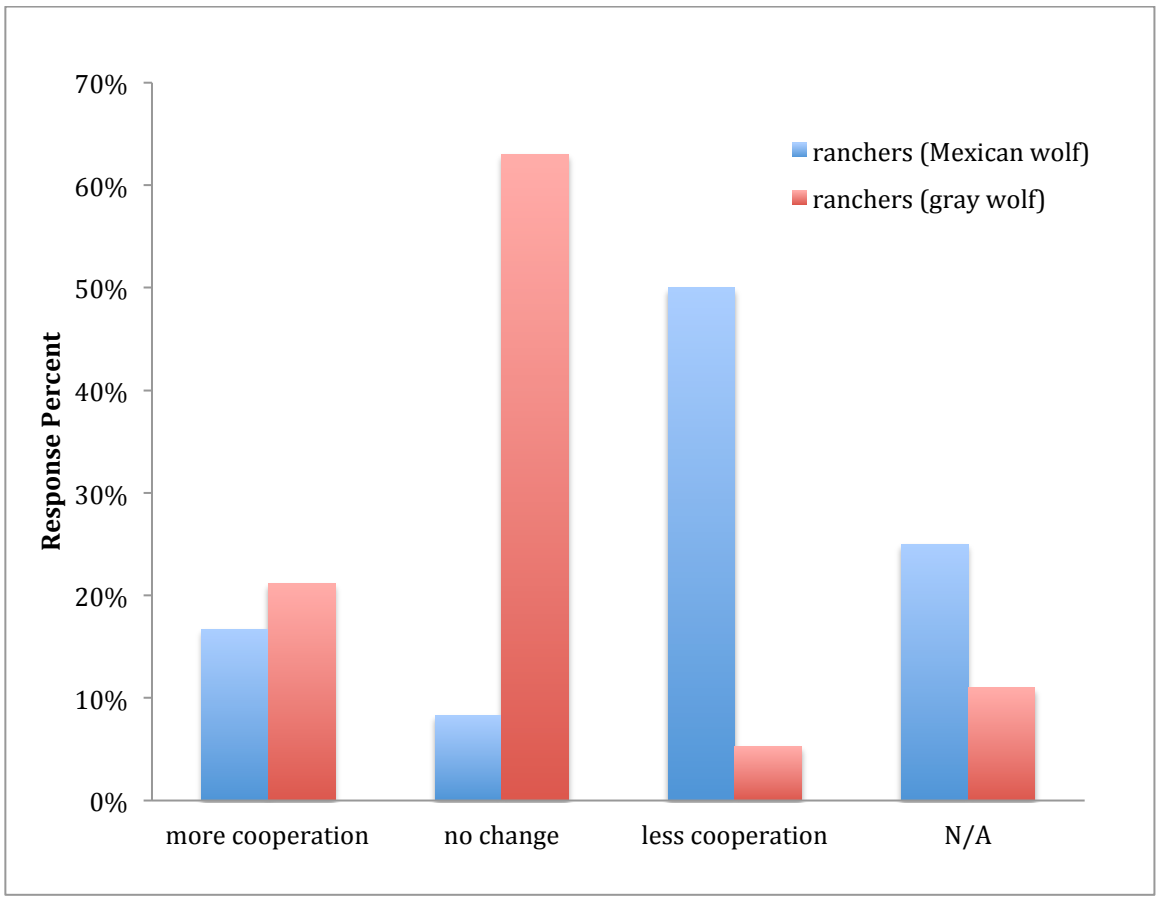

Figure 39. How rancher respondents characterize the relationship between biologists and ranchers through time. This figure shows how the two different groups of ranchers (those affected by Mexican wolves (n=23) vs. those affected by gray wolves (n=31)) characterize the relationship between biologists and ranchers through time.

Of rancher respondents, 56.8% stated that they *agreed or strongly agreed* with the idea that wolves occupying the same land they ranched would result in them having to give up their land (Figure 40).

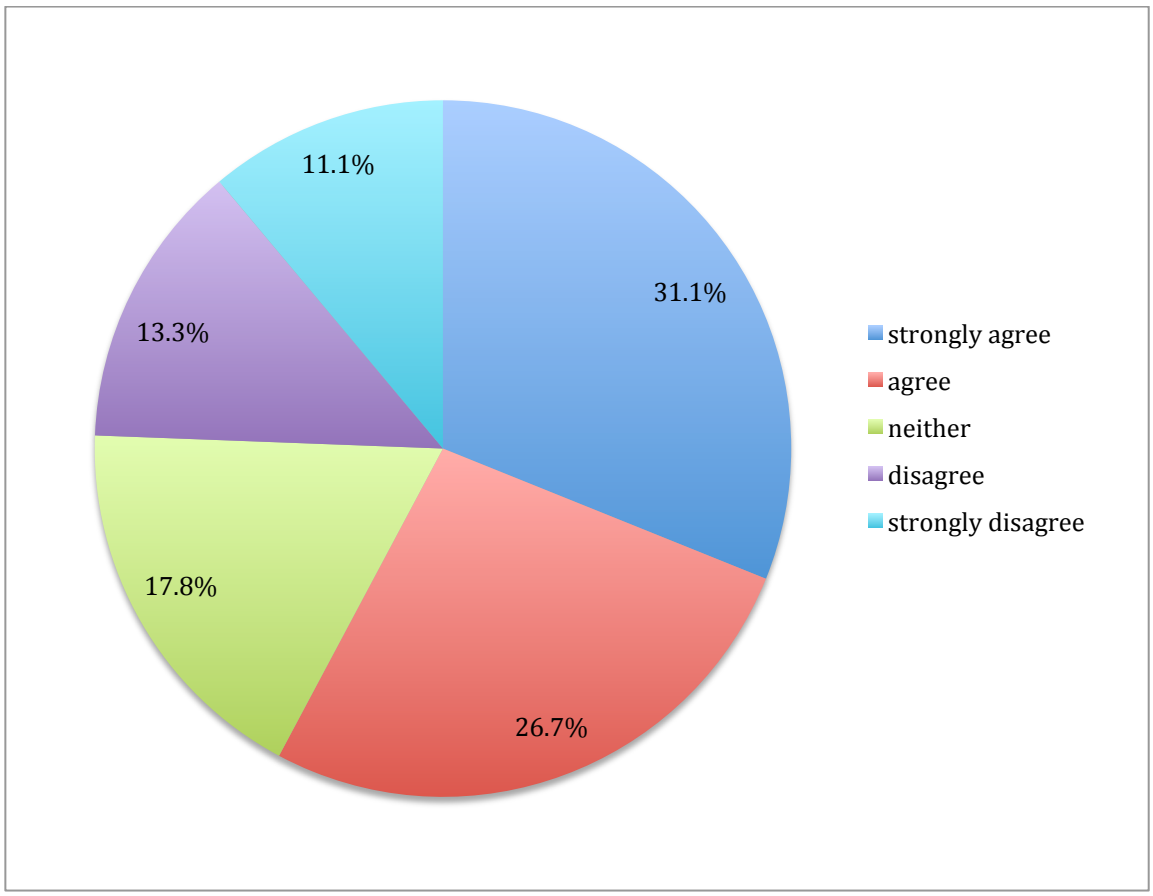

Figure 40. Ranchers' response to the statement: *Wolves occupying the same land that you ranch will result in you having to give up your land for ranching* (n=54).

A plurality of ranchers (42.6%) was largely against wolves and livestock sharing the same range area even if they were given compensation for wolf depredation and tools (lethal and non-lethal) for dealing with problem wolves. However, 23.4% of ranchers said they would be *willing* to share the range with wolves (Figure 41).

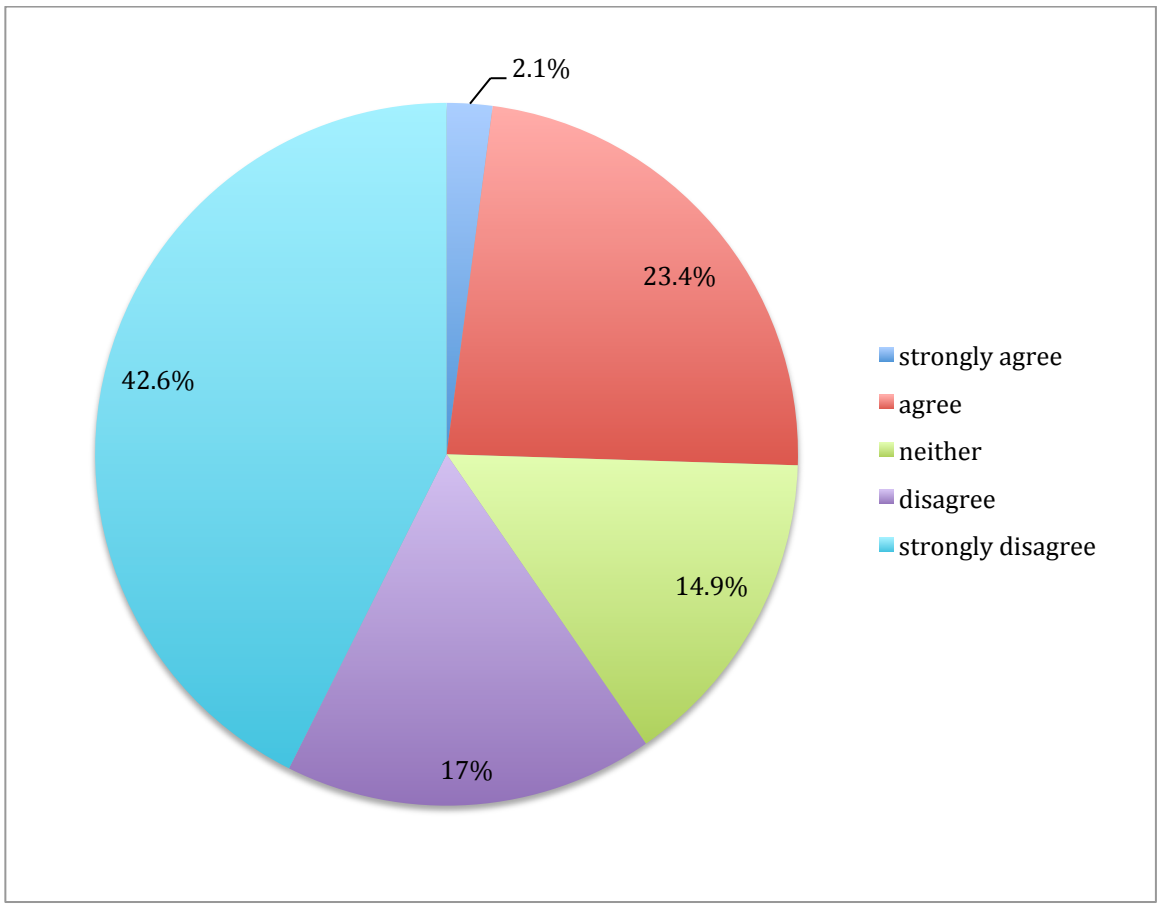

Figure 41. Level of support by rancher respondents for ranching with wolves (wolves occupying the same land as the rancher's livestock) if provided with certain compensation or tools (n=54).

Many ranchers, 93.6% and 93.5%, believe they were *very or somewhat knowledgeable* about wolves and wolf recovery (Figures 42 and 43).

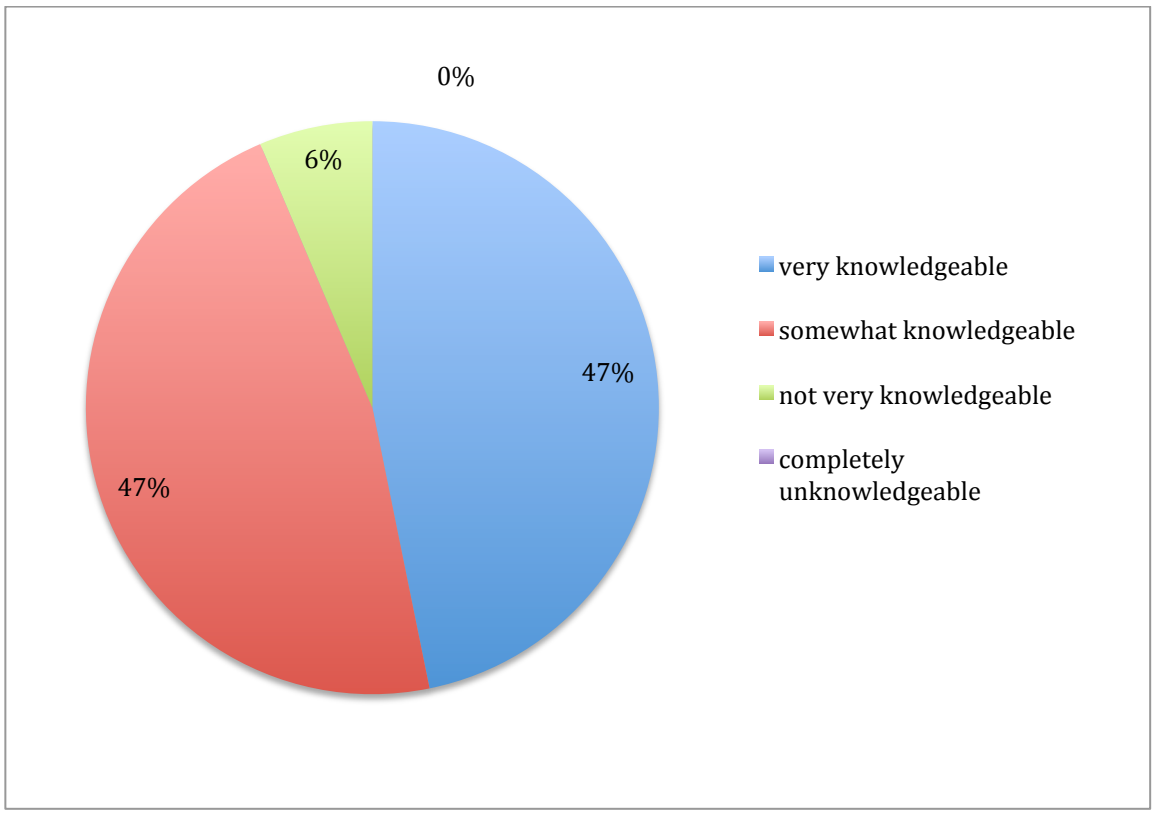

Figure 42. How rancher respondents characterize their knowledge of wolves (n=54). The 0% represents 'completely unknowledgeable'.

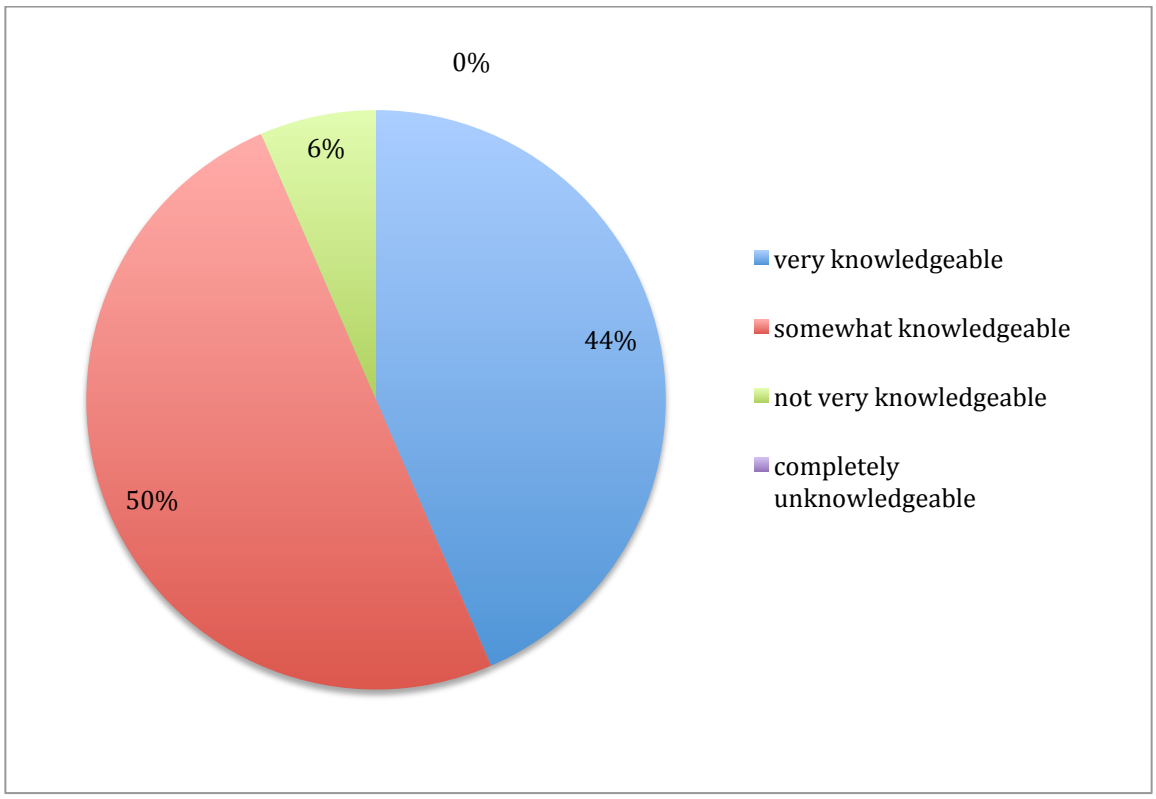

Figure 43. How rancher respondents characterize their knowledge of wolf recovery (n=54). The 0% represents 'completely unknowledgeable'.

Despite the differences between ranchers and biologists many ranchers would be willing to learn more about wolves if given the chance, that is, 44.4% and 19.4% stated they would be *willing* or *very willing* to learn more about wolves, respectively (Figure 44). Many ranchers also stated they would be willing to learn more about wolf recovery as well, that is, 54.1% of ranchers affected by gray wolves and 16.2% of ranchers affected by Mexican wolves, respectively, stated they would be *willing* or *very willing* to learn more about wolf recovery (Figure 45).

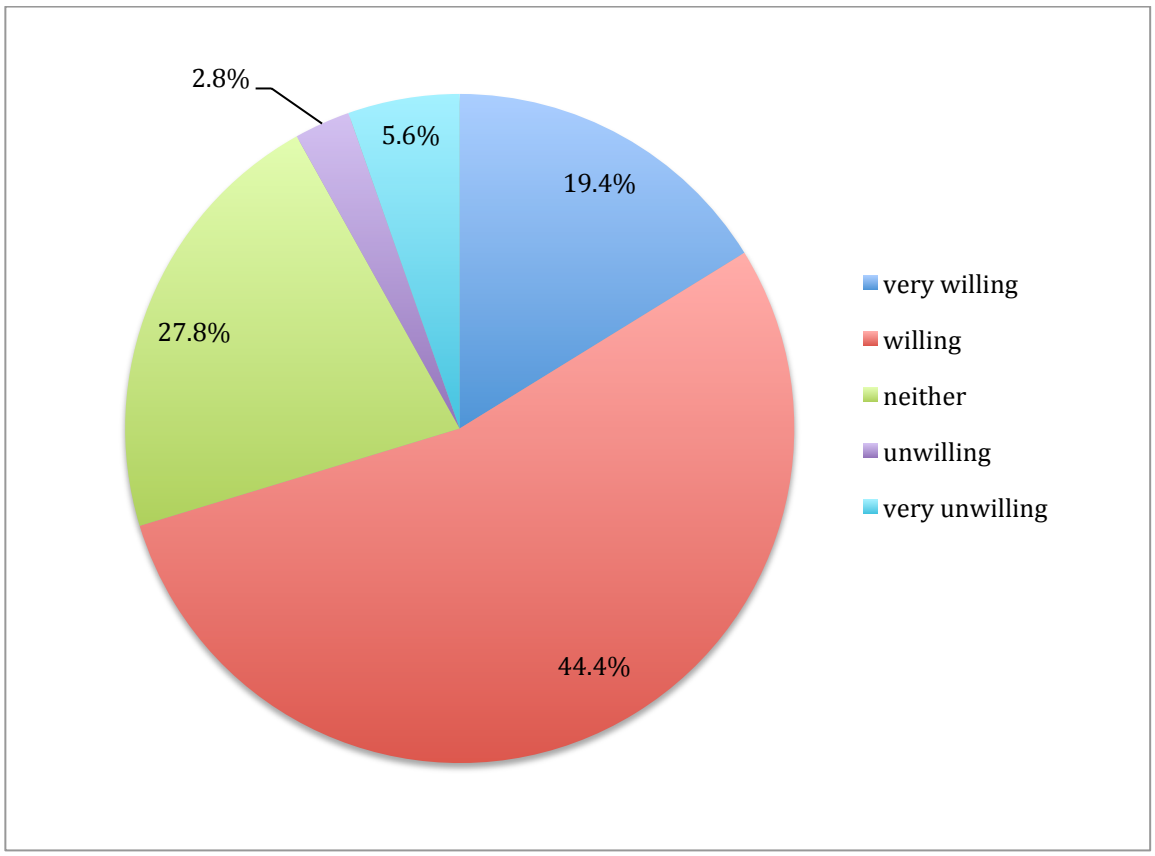

Figure 44. Level of support from rancher respondents in learning more about wolves (n=54).

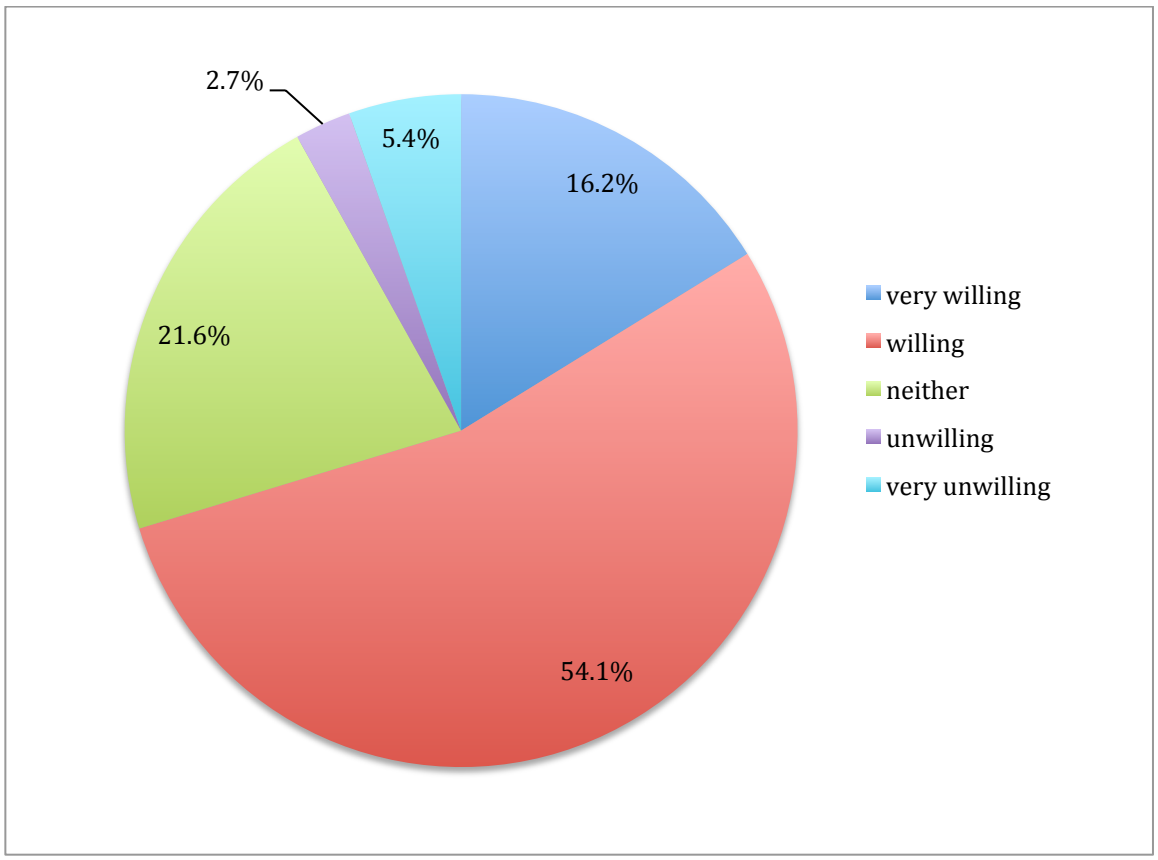

Figure 45. Level of support from rancher respondents in learning more about wolf recovery (n=54).

Many ranchers (42.1%) said they would be *willing* to learn how to humanely manage wolves while 23.7% said they would be *very willing* (Figure 46).

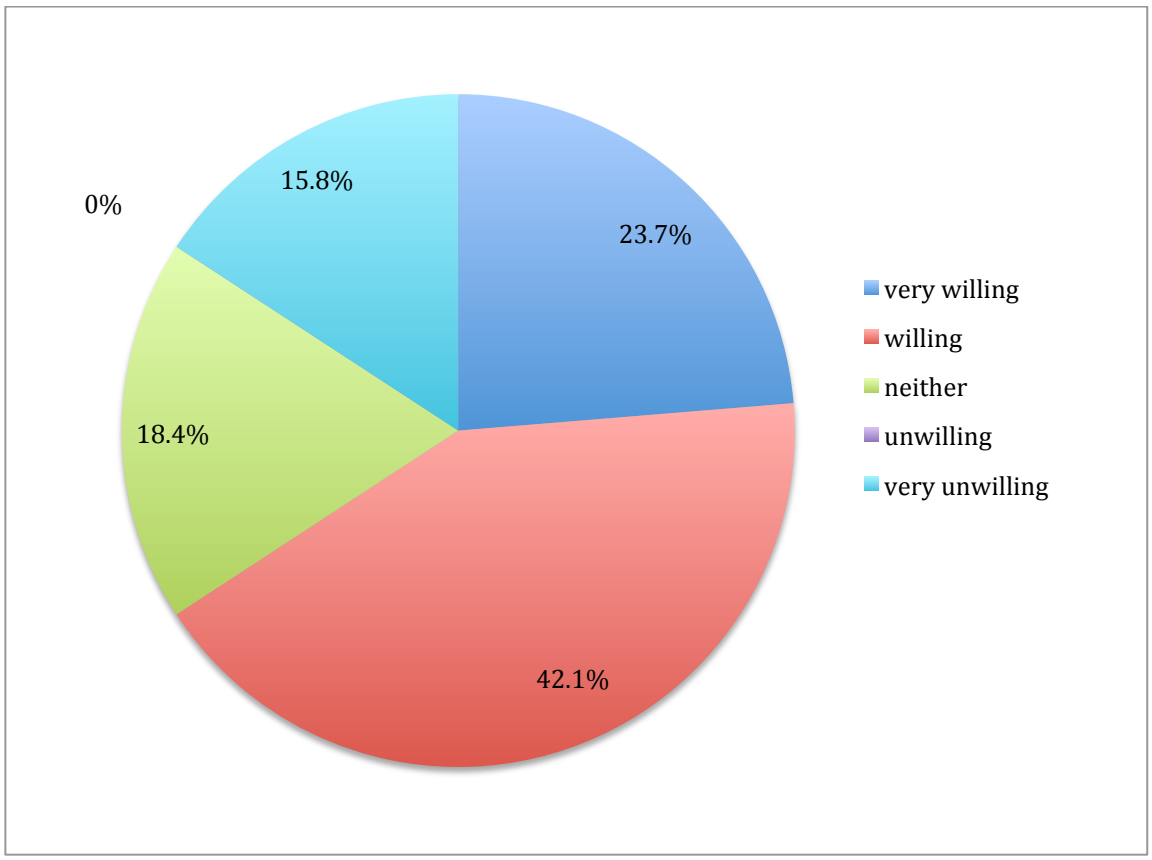

Figure 46. Level of support from rancher respondents to learn how to humanly manage wolves from staying off ranchers' land (n=54). No respondents said they would be *unwilling*.

The majority of ranchers (52.8%) said they had never used nonlethal tools to reduce wolf predation on their land (Figure 47).

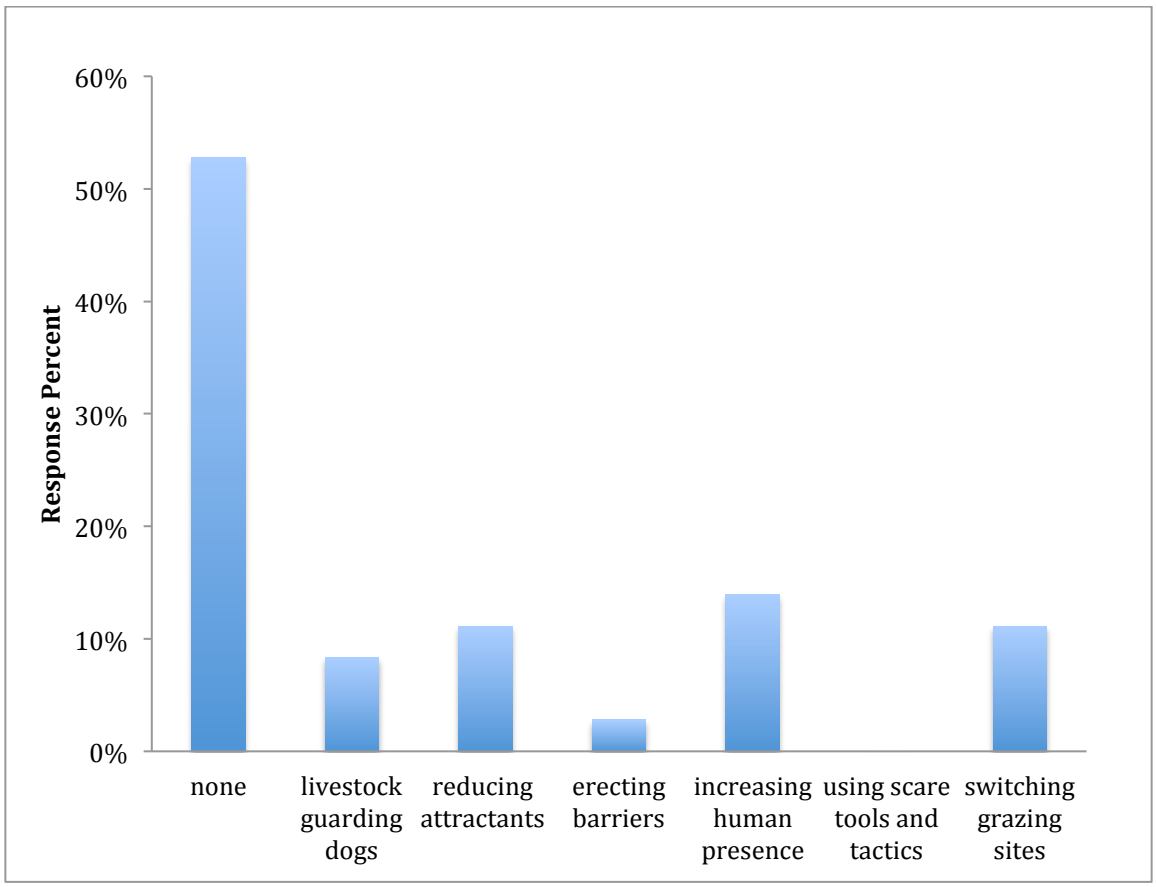

Figure 47. Types of nonlethal tools and methods ranchers have used in order to reduce conflicts with wolves (n=54).

CHAPTER FIVE

DISCUSSION AND CONCLUSION

DISCUSSION

Biologists tended to believe that issues related to wolf ecology were less important to the success of reintroduction programs than social issues. This finding was similar to Beeland's (2008) study that found the largest impediment (according to government employees) with reintroduction programs was peoples' attitudes or beliefs towards wolves and wolf recovery. My study suggested that avoiding human/wolf conflicts may be the most important component needed to ensure the success of a wolf recovery plan both in the short (10 years) and long term (>10 years). Most biologists surveyed in this study believed that gray wolf reintroduction has been successful because the public has come to accept the idea of wolves reoccupying some of their historic range.

One of the most important goals of these surveys was to identify possible variables that influenced attitudes about wolves and success of wolf recovery. Reasons the Mexican wolf plan has been unsuccessful were divided into the two categories of biological and social, with social seeming to be the more important of the two.

BIOLOGICAL ISSUES

Mexican wolves come from a very small founder population, and two big hurdles the recovery effort has had to overcome are establishing a successful captive breeding program and developing a wild population from a captive source. These particular

challenges were unique to the Mexican wolf recovery and may have contributed to the fact that the Mexican wolf program has been less successful than the gray wolf program.

The biologists I surveyed believed that habitat quantity was very important to success of wolf recovery. All wolves including the Mexican wolf are wide ranging animals. However, Mexican wolves are limited to the recovery area boundaries whereas this was not the case for the gray wolf whose population could expand outside of Yellowstone. A number of sources (Beeland, 2008; Dougherty, 2007; Parsons, 1998; Povilitis et al., 2006) suggested that recovery area's size may reduce the chances for successful reintroduction as defined by meeting the goal of 100 wild animals.

The 1982 Mexican Wolf Recovery Plan did not address the key question, i.e., *what are the downlisting and delisting criteria?* All the biologists could imagine was a population of 100 wolves in an area a little over 10,000 km^2, and acknowledged that this number did not represent recovery because it was too small. The plan has not been revised since it was implemented. However revising the plan (developing recovery actions to achieve recovery criteria) may not increase the possibility of recovery unless all other problems are looked at as well.

SOCIAL ISSUES

When asked about compensation programs both biologists and ranchers believed that current compensation programs were not working. Beeland (2008, p. 89) found that government employees believed existing compensation programs had flaws and were not a "complete solution for removing the economic burden" wolves create for ranchers. However, biologists surveyed in this study mostly believed compensation programs to be

fair in contrast to ranchers who thought them to be unfair. Naughton-Treves et al. (2003) found that ranchers consider compensation payments inadequate especially given the years invested in the livestock. These findings are consistent with this and other studies (see Muhly & Musiani, 2009; Vynne, 2009). A number of ranchers responding to my survey commented that while compensation pays for depredation of livestock indirect losses are not often considered. For example, stressed livestock may graze less and put on less weight or suffer from decreased reproductive success. Furthermore compensation does not account for the financial loss of important breeding animals (Muhly & Musiani, 2009). Moreover, ranchers often have the burden of proof in that they must demonstrate to some standard that their livestock were indeed killed by wolves (Ashcroft, Mathis, Smallidge, Fowler, & Baker, 2009). This is a problem since often times there is disagreement on what constitutes a wolf kill and many times livestock will go missing with no evidence as to what happened. Ranchers also commented on the lag time between a livestock loss and the compensation. One rancher commented that it took him one year to get paid and the price was below what he felt was fair market value. Indeed, according to Ashcroft et al. (2009) compensation often takes 3 to 6 months to receive after the documented depredation and compensation is paid at the current market value which underestimates the real economic value of the animal. When a program takes a long time to reimburse producers, that program can create the impression that the agencies providing compensation do not take the problem seriously (Muhly & Musiani, 2009). Ranchers' underlying mistrust towards the government's program for restoring wolves to the wild could increase due to these difficulties. I also found that many of the ranchers had been on the land for at least three or four generations and sometimes more, which I believe will make implementing wolf recovery particularly difficult. Ranchers

may not want to cooperate with wolf recovery if they feel like they are being kicked off land that has been in the family for many generations.

I found that ranchers associated with the Mexican wolf had stronger negative attitudes towards wolf recovery than ranchers associated with the gray wolf. Reasons for these findings could be related to a variety of issues including habituation of wolves to humans, year-round land use by livestock owners, and differences in perceptions of depredation of livestock.

There is a possibility that Mexican wolves may be more habituated and thus less afraid of humans, at least according to one rancher I talked to (email interview). Williams, Ericsson, & Heberlein (2002) did a study to better understand how support for wolves may be related to familiarity with wolves and found that people who had the most experience with wolves had the most negative attitudes. A similar study done by Huston et al., (2010) found that experience with wolves along with living near wolf territories negatively impacted peoples' attitudes towards the predator: "one negative event (whether direct or indirect) could substantially impact these individuals' attitudes" (p.391). If Mexican wolves are more habituated to humans, then these interactions could conceivably lead to greater fear of Mexican wolves (although they are much smaller then gray wolves) and thus a more negative attitude.

Another issue associated with wolf recovery is related to how much wolves range overlaps with livestock grazing areas, and how overlap translates into conflict rates between wolves and livestock. The Mexican wolf program includes a relatively small recovery area compared to the gray wolf program. For example the gray wolf program includes larger core wilderness and park areas. In addition gray wolf areas have cattle that are grazed on a seasonal basis versus year-round in the Mexican recovery area.

Potentially it would seem that the more wolves that can live away from livestock areas the better chance they will have at survival.

When wolves and livestock co-inhabit the same area, there will likely be livestock depredation. However, between the two different groups of ranchers there were strong differences in perceptions of the rate of depredation of livestock. I found that 91% of ranchers in the gray wolf region estimated they lost between 1-3 livestock while 44.4% of ranchers in the Mexican wolf region estimated they lost 10 or more livestock (see Figure 33). The fact that lands in the Southwest are grazed year-round along with the lack of livestock free core area could explain why Mexican wolves seem to kill more livestock per year than gray wolves. Wolf habituation to humans might also explain why ranchers in the Mexican wolf area claim to have lost many more livestock (10 or more) to wolf depredation within the past year compared to ranchers in the gray wolf area (1-3).

Many ranchers feel their concerns about wolf reintroduction have been ignored, which in turn seemed to cause distrust and less cooperation. One rancher stated, "…The program has been forced upon us. We have been lied to…" Another rancher said, "We were listened to only enough to have promises made that were broken and [were] manipulated into thinking our interests were considered." While many ranchers are completely opposed to wolves and wolf reintroduction there are a few who would seem to be willing to cooperate and learn how to coexist. Some rancher suggestions for improvement included: direct community involvement along with landowner input and predator control. One rancher suggested that they should receive a minimum payment for living near wolves and then compensation payments on top of that for depredations. Arguing to do otherwise would require ranchers bear the entire burden of supporting wolves. Another approach would be for compensation programs to provide ranchers with

nonlethal tools and methods to reduce conflicts with wolves. Those who stated they had never used nonlethal tools to prevent livestock depredation may have never had this opportunity or were unaware of what tools might be available to them.

My study suggests that attitudes towards recovery continue to be one of the biggest factors affecting success of wolf recovery programs. When compensation programs may not be working as designed, ranchers do not believe they are included in compensation planning to the point of considering compensation unfair. Ultimately, this perception of being unfair results in a lack of rancher trust for biologists.

While it may be impossible to completely satisfy all those involved in wolf recovery the process should be seen as fair by all. As stated by one rancher respondent: "Most people will tolerate wolves if you gain their respect as someone working to fairly balance these complex and competing objectives". Nie (2003) suggested that it is difficult for states to manage wolves when politics and politicians continually cater to one side or the other. Wolf management is often based on fear and misinformation rather than science, especially in today's Internet age where people are continually exposed to more misinformation than facts (Nie, 2003).

Although my study did not look into the role of education in dealing with wolves and wolf recovery, I found many studies suggesting education could positively affect peoples' attitudes towards wolves (Willard, 2008; Williams et al., 2002). Moreover, Williams et al., (2002) found that those with higher levels of education had more positive attitudes and hypothesized that, as the public gained more education attitudes towards wolves would become more favorable. How this would translate into success of wolf recovery programs likely depends on public outreach and stakeholder cooperation.

METHODOLOGICAL CAVEATS

Survey questions are created and answered as part of a questionnaire and/or interview. The content of the questionnaire can have major impacts on how individuals interpret and answer survey questions. In any survey, there is risk of two types of errors being made: "poor measurement of cases that are surveyed (errors of observation) and omission of cases that should be surveyed (errors of non-observation)" (Check & Schutt, 2012, p.161). Errors of observation stem from how questions are written, the types of respondents who answer questions, how questions are presented, and types of people asking the questions (Check & Schutt, 2012). There are three sources of errors of non-observation. These are inadequate coverage of the population due to a poor sampling frame, sampling error due to process of random sampling, and nonresponse of individuals to the survey or specific questions (Check & Schutt, 2012).

While the questionnaire I prepared was relatively easy to design, given additional resources I would have liked to have done interviews and meet with participants in person. The return rate in my biologist questionnaire was quite low. This could have been due to errors of observation, i.e., problems occurring with how I worded my questions. One Montana biologist responded to me by saying that he felt the survey had some discrepancies in this area. For example, in a question asking biologists if they were working on or with their state's wolf recovery plan there was a small percent that said no. It is possible that respondents who answered that they were not working on the recovery plan did so because their wolf related work is not related to recovery per se but rather more related to general wolf management. I said wolf recovery plan when I should have stated wolf recovery or wolf management plan. The same Montana biologist mentioned above pointed out to me that his state has a wolf management plan (they manage the

wolves already in the state) but that plan is not referred to as a wolf recovery plan, which would suggest that wolves are endangered in Montana. Wyoming and Idaho have similar situations. Responses to another question about why biologists thought the Mexican wolf plan has been unsuccessful in the past were quite variable (see Figure 19). For this question biologists were allowed to choose more than one answer. The options of *inadequate habitat range* and *human conflict* tied for most popular answer. A possible reason for this tie may be that biologists might have seen *inadequate habitat range* and *high conflict* as similar answers. A larger sample size may have resolved this ambiguity.

It would be useful to better understand how biologists interpreted my questions and a pilot study with a small group of biologists would have been useful in this regard. One question asked biologists how they would rate the success of gray wolf reintroduction. However, it was clear from respondents that not everyone understood the question. One scientist stated that she thought Mexican wolf reintroduction had been mildly successful demonstrating that she answered the question in terms of Mexican wolves instead of gray wolves. A larger participant pool would have improved results as well. Recall that I received only 13 completed questionnaires from biologists and was unable to work directly with biologists during the survey process. Biologists also seemed to be more reserved than ranchers in their responses to questions. An interview might have allowed them to be more nuanced in their answer and thus more willing to answering my questions. Importantly I had to contact ranchers through trade organizations in order to acquire participants for the survey, which may have resulted in a lack of randomization.

FUTURE STUDY AND SUGGESTED IMPROVEMENTS

Further research should be considered in several areas of this study. A reasonable next study might determine how attitudes towards wolves differ across boarders, for example gray wolves in Canada vs. gray wolves in the U.S. and Mexican wolves in Mexico vs. those in the U.S. as well as a study that looks into binational collaboration and how recovery efforts differ. This may provide insight into how to best approach certain groups of people about wolf recovery which could in turn increase positive attitudes towards wolves. According to Stoopen (2004) representatives of Mexico and the U.S. are focused on their own national agendas in achieving recovery goals. Looking at their difference in wolf plans could bring insight into how best to work together and combine recovery efforts to increase success of recovery plans.

Many studies have been done looking at peoples' attitudes towards wolves especially ranchers (Muhly & Musiani, 2009; Naughton-Treves et al., 2003). These studies tend to support one of the overarching findings in this study, that is, most ranchers are opposed to wolves sharing range with their livestock. However, it would be interesting to see if these attitudes stem from deep-seated negative feelings towards the animal itself or if they arise more directly from the fact that wolves threaten their livestock and way of life. Likewise it would be important to better understand how compensation is related to negative attitudes about wolf recovery. If compensation was fair and complete from the perspectives of ranchers, would ranchers still be opposed to wolf recovery efforts? Many ranchers are wary of programs supporting wolves and distrust those involved. Biologists are going to have to work more with ranchers in order to help dispel some of this wariness. I found no studies looking at how wolves may affect other non-ranching rural residents. How do non-ranchers who have lost pets or

other animals such as horses, donkeys, and hunting dogs regard wolf recovery efforts? Is this segment of the population affecting attitudes in other groups, which will make recovery more difficult? One concerned citizen said her neighbor breeds hunting dogs and has lost some on several occasions from wolf predation but has never been compensated.

Similar to Wagner, Schmidt, & Conover (1997), I found compensation programs could be improved. It might be helpful to create a program to help provide ranchers with the education and tools to humanly manage wolves from staying off their land. More education about wolves in general and on recovery plans in particular should be extremely helpful.

From a biological perspective, the likelihood of success of the Mexican wolf plan would increase with a revision of the original plan. The new plan should include delisting criteria as well as a new goal. The release site should be expanded and perhaps some other states should be included in the recovery area. This is a key time to define what recovery is across a broader landscape and with respect to best available science. Empowering livestock producers to deal directly with problem Mexican wolves may also help to improve cooperation between rancher and scientist groups.

CONCLUSION

Obstacles to the Mexican wolf recovery plan seem to include both biological and social issues in a synergistic way. It is often difficult to separate the biological from the social. The fact that Mexican wolves are restricted to a smaller habitat range and share the land with livestock year-round adds to the possibility of wolves becoming increasingly habituated. This in turn could add to ranchers' negative attitudes towards

wolves. Closer proximity of wolves to livestock can also cause greater livestock depredation. Greater rates of depredation mean more compensation and increased animosity from ranchers towards the wolf program especially if ranchers believe the compensation is unfair. Aside from further studies regarding the Mexican wolf plan, the most crucial recommendation for improvement and success of wolf recovery programs is to create more cooperation between biologists and affected stakeholders. "The key is not for acceptance of wolf reintroduction but rather a willingness to work together" (anonymous rancher). The greatest threat and challenge to the success of wolf recovery plans are addressing human/wolf conflicts. Wolf reintroduction is a social issue above all else and according to Dougherty (2007) "the overarching battle is for control of the public land" (p. 16). More collaboration between biologists and more science-based management is also important. One biologist in Montana stated that most people working with the Mexican wolf are fully aware of what is going on with the gray wolf but those working on the gray wolf may not be as familiar with what is going on with the Mexican wolf. These divisions between ranchers and environmentalists as well as lack of collaboration between biologists in different states are important to overcome. If it was just a matter of biology wolves could make it in the wild (Dougherty, 2007). The real question comes down to our values. "What values do we as individuals in society place on wolves and how much are we willing to tolerate them on the landscape?" (Dougherty, 2007, p. 3). The greatest determinant of wolf success in the future is how we choose to live or not live with wolves (Nie, 2003) because as Aldo Leopold stated "only the mountain has lived long enough to listen objectively to the howl of a wolf" (Brown & Carmony, 1990).

REFERENCES

Ashcroft, N. K., Mathis, C. P., Smallidge, S. T., Fowler, J. M., & Baker, T. T. (2009). *Reestablishment of the Mexican gray wolf: The economics of depredation.* (Range Improvement Task Force Report No. 8). Las Cruces, NM: New Mexico State University.

Barrett, S. (2012). Mexican wolf recovery: Moving forward through collaboration. *International Wolf , 22* (3), 9-12.

Beeland, T. D. (2008). *Information sources, beliefs and values of key stakeholder groups in Mexican gray wolf reintroduction.* (Master's Thesis), University of Florida.

Brown, D. E., & Carmony, N. B. (Eds.). (1990). *Aldo Leopold's Southwest.* Stapole Books.

Browne-Nunez, C., & Taylor, J. G. (2002). *Americans' attitudes toward wolves and wolf reintroduction: An annotated biblography.* USGS/BRD/ITR-2002-0002. Denver, CO: U.S. Government Printing Office.

Carnes, R. (2011). *Mexican wolf recovery: Habitat suitability and dispersal potential.* (Master's Thesis), The Nicholas School of the Environment of Duke University, Environmental Management, Durham, North Carolina.

Check, J., & Schutt, R. K. (2012). Survey research. In *Research methods in education* (pp. 159-185). Los Angeles, CA: SAGE Publications, Inc.

Cribb, S. (1998). Endangered Species Act, Section 10(J): Special rules to reestablish the Mexican wolf to its historic range in the American Southwest. *Environs , 21* (2), 49-55.

Defenders of Wildlife. (2008). *Livestock and wolves: A guide to nonlethal tools and methods to reduce conflicts.* Retrieved September 16, 2012, from Defenders of Wildlife: http://www.defenders.org/sites/default/files/publications/livestock_and_wolves.pdf

Defenders of Wildlife. (2009). *Wolf Compensation Trust.* Retrieved September 16, 2012, from Defenders of Wildlife: http://www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/solutions/full_list_of_payments_in_the_northern_rockies_and_southwest.pdf

Dougherty, J. (2007, December 24). Last chance for the lobo: Mexican wolves caught in the crossfire of the battle over public lands. *High Country News* , pp. 10-17.
Endangered Species Act of 1973 . (1973, December 28). *PL 93-205* . United States Congress.

Fitzgerald, E. A. (2006). Lobo returns from limbo: New Mexico Cattle Growers Ass'n v. U.S. Fish & Wildlife Service. *Natural Resources Journal , 46* (9), 9-64.

Fritts, S. H., Bangs, E. E., Fontaine, J. A., Johnson, M. R., Phillips, M. K., Koch, E. D., et al. (1997). Planning and implementing a reintroduction of wolves to Yellowstone National Park and central Idaho. *Restoration Ecology , 5* (1), 7-27.

Gerfin, A. (2006, June 12). Mexican wolves face a rocky road to recovery. *High Country News* , 1. Panioa, CO. Retrieved August 8, 2012, from www.hcn.org/issues/324/16357/print_view

Grant, J. W. (2002). *Ranches with wolves: How straight talk is the salvation of open range in the Northern Rockies.* (Master's Thesis), The University of Montana, Missoula.

Hedrick, P. W., & Fredrickson, R. J. (2008). Captive breeding and the reintroduction of Mexican and red wolves. *Molecular Ecology , 17*, 344-350.

Houston, M. J., Bruskotter, J. T., & Fan, D. (2010). Attitudes toward wolves in the United States and Canada: A content analysis of the Print News Media, 1999-2008. *Human Dimensions of Wildlife , 15*, 389-403.

Jimenez, M., Smith, D., Becker, S., Stahler, D., Stahler, E., Metz, M., et al. (2012). *Wyoming wolf recovery 2011 annual report.* Pages WY-1 to WY-25 in U.S. Fish and Wildlife Service Rocky Mountaian Wolf Program 2011 Annual Report, USFWS, Ecological Services, Helena, Montana.

Kellert, S. R., Black, M., Rush, C. R., & Bath, A. J. (1996). Human culture and large carnivore conservation in North America. *Conservation Biology , 10* (4), 977-990.

Lister, & McDaniel. (2006, April 17). *The wolves of Yellowstone.* Retrieved July 1, 2012, from www.bioinfo.rpi.edu/bystrc/pub/artWolves.pdf

McCann, K. (2004). *Demonizing the wolf*. (Polar Publishing) Retrieved 9 16, 2012, from Polar Worlds: website.lineone.net/~polar.publishing/demonizingthewolf.htm

Muhly, T. B., & Musiani, M. (2009). Livestock depredation by wolves and the rancheing economy in the Northwestern U.S. *Ecological Economics , 68*, 2439-2450.

Naughton-Treves, L., Grossberg, R., & Treves, A. (2003). Paying for tolerance: Rural citizens' attitudes toward wolf depredation and compensation. *Concervation Biology , 17* (6), 1500-1511.

Nie, M. A. (2003). *Beyond wolves: The politics of wolf recovery and management.* Minneapolis, MN: University of Minnesota Press.

Paquet, P. C., & Carbyn, L. N. (2003). Gray wolf. In G. A. Feldhamer, B. C. Thomson, & J. A. Chapman, *Wild mammals of North America: Biology, management, and conservation* (Second Edition ed., pp. 482-510). Baltimore, Maryland: The John Hopkins University Press.

Parsons, D. R. (1998). "Green fire" returns to the Southwest: Reintroduction of the Mexican wolf. *Wildlife Society Bulletin , 26* (4), pp. 799-807.

Parsons, D. R. (1996). Case study: The Mexican wolf. (E. A. Herrera, & L. F. Huenneke, Eds.) *New Mexico Journal of Science , 36*, 101-1223.

Povilitis, A., Parsons, D. R., Robinson, M. J., & Becjer, C. D. (2006). The bureaucratically imperiled Mexican wolf. *Conservation Biology , 20* (4), 942-945.

Ramler, J. P. (2009). *The economic impacts of wolves on calf production on western Montana cattle ranches beyond direct depredation.* Masters Thesis, The University of Montana, Missoula.

Ripple, W. J., & Beschta, R. L. (2003). Wolf reintroduction, predation risk, and cottonwood recovery in Yellowstone National Park. *Forest Ecology and Management , 184*, 299-313.

Robinson, M. J. (2004, March 29). Petition for rule-making to enhance prospects for recovery of the Mexican gray wolf experimental population, in accordance with scientific findings.

Smith, D. W., Peterson, R. O., & Houston, D. B. (2003). Yellowstone after wolves. *BioScience , 53* (4), 330-340.

Stoopen, J. F. (2004). *Binational collaboration in recovery of endangered species: The Mexican wolf as a case study.* (Dissertation), Texas A&M University, Office of Graduate Studies.

Sullivan, W. (2012). *The wolf subspecies*. (Wolf Anti-Defamation League) Retrieved September 16, 2012, from The wolf: wolfsubspecies.blogspot.com/2011/10/wolf_subspecies.html

The Wildlife Society. (2011, October). *Northern Rocky Mountian Gray Wolf.* Retrieved July 1, 2012, from The Wildlife Society: joomla.wildlife.org/documents/policy/gray.wolf.pdf

Tukua, A. (2005). *A curriculum study on the gray wolf.* University of Minnesota, Moorhead.

U.S. Congressional Research Service. (2010, August 10). Gray wolves under the Endangered Species Act (ESA): Distinct population segments and experimental populations. (K. Alexander, & M. L. Corn, Eds.) Washington DC: Library of Congress.

U.S. Congressional Rresearch Service. (2011, July 27). The gray wolf and the Endangered Species Act (ESA): A brief legal history. *R41730* . (K. Alexander, Ed.) Washington DC: Library of Congress.

U.S. Department of Agriculture. (2002, April). *Final Environmental Assessment: Management of wolf-livestock conflicts and control of depredating wolves in the state of Minnesota.* Retrieved September 5, 2012, from www.aphis.usda.gov/regulations/pdfs/nepa/MNwolfEA.pdf

U.S. Fish and Wildlife Service. (2011, February 23). Fish and Wildlife convenes Mexican wolf recovery plan team. [Press Release]. Albuquerque, NM. Retrieved October 12, 2012, from us.vocuspr.com/Newsroom/Query.aspx/SiteName=fws&Entity=PRAsset&SF_PRAsset_PRAssetID_EQ=113122&XSL=PressRelease&Cache=

U.S. Fish and Wildlife Service. (2010). *Mexican wolf conservation assessment.* Region 2, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. (1982). *Mexican wolf recovery plan.* U.S. Fish and Wildlife Service, Albuquerque, NM.

U.S. Fish and Wildlife Service. (1987). *Northern Rocky Mountian wolf recovery plan.* U.S. Fish and Wildlife Service, Denver, Colorado.

U.S. Fish and Wildlife Service. (1996). *Reintroduction of the Mexican wolf within its historic range in the Southwestern United States.* Final Environmental Impact Statement. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. (2000, April). Wolves in North America. U.S. Fish and Wildlife Service. Retrieved June 3, 2012, from library.fws.gov/pubs3/wolves00.pdf

Vynne, S. J. (2009). Livestock compensation for the Mexican gray wolf: Improving tolerance or increasing tension? *Human Dimensions of Wildlife , 14*, 456-457.

Wagner, K. K., Schmidt, R. H., & Conover, M. R. (1997). Compensation programs for wildlife damage in North America. *Wildlife Society Bulletin , 25* (2), 312-319.

White, A. B. (2011). *Wolves of the world*. Retrieved August 13, 2012, from Gray wolf compensation: http://www.graywolfconservation.com/Information/world_wolves.htm

Wiles, G. J., Allen, H. L., & Hayes, G. E. (2011). *Wolf conservation and management plan for Washington.* Washington Department of Fish and Wildlife, Olympia, WA.

Willard, A. L. (2008). *Presenting wolves as wolves: Educational outreach in the debate about wolf management in the west.* (Master's Thesis), Washington State University, School of Earth and Environmental Sciences, Pullman.

Williams, C. K., Ericsson, G., & Heberlein, T. A. (2002). A quantitative summary of attitudes toward wolves and their reintroduction. *Wildlife Society Bulletin , 30* (2), 575-584.

APPENDIX A: HUMAN SUBJECTS REVIEW

HUMAN SUBJECTS REVIEW
REVIEW FORM
The Evergreen State College

☐ Exempt ☑ Expedited ☐ Board Review

Name of Applicant: **Kari Schoenberg** Assurance#: **1112241** Date Submitted: **7/27/2012 (revisions of 7/24/2012)**

Project Title: **Wolf Reintroduction and Recovery: Improving the Mexican Gray Wolf Recovery Plan through Analysis of the Successful Reintroduction of Gray Wolves in the Northern United States**

Faculty Sponsor: **Tim Quinn**

☑ HSR application approved

Reviewer's Comments:

Thank you for your revisions. Best wishes with the project.

☐ HSR application will be approved if the following changes are made:

☐ Need to Re-review ☐ No Need to Re-review

☐ HSR application is denied because of the following:

Date Reviewed: **07/27/2012**

1. How would you summarize, in the form of an abstract, the nature and purpose of your research project?

   Wolves once roamed freely throughout the lower 48 states. Centuries of misconception and hostility along with habitat loss effectively extirpated the species from most of the country during the 20th century. Wolves have always invoked strong emotions for many people making it difficult to craft legislation regarding wolf management in the wild. One of the most significant gray wolf policies over the past century was the decision to reintroduce gray wolves into Yellowstone National Park and Idaho. The reintroduction was extremely successful and has even been called the "greatest wildlife experiment in North America" (Grant, 2010, p.1). Today the wild wolf population in the US has grown from less than 300 in the 1930s to over 4,000. This is just for the gray wolf (*Canis lupus*) however. While the gray wolf was being eliminated in the northern United States, the Mexican wolf was also being eliminated across most of its historic range. The Mexican gray wolf (*Canis lupus baileyi*) is the smallest subspecies of gray wolf and the most genetically distinct form of existing gray wolves in North America. In 1976 the Mexican gray wolf was listed under the Endangered Species Act. Soon after being listed a Mexican Wolf Recovery Team was created and in 1982 the Team completed the Mexican Wolf Recovery Plan. The plan was suppose to reestablish a population of at least 100 Mexican wolves in the wild by 2006. It is now 2012 and the number of Mexican wolves in the wild has never risen above 60. For this thesis I would like to determine whether the Mexican Wolf Recovery Plan could be improved through analysis of the successful reintroduction of gray wolves into Yellowstone National Park.

2. What are the procedures to which humans will be subjected, i.e., questionnaires, interviews, audio or video recordings, etc.? When, where, and how will these procedures be carried out?

   Participants will be sent questionnaires using the online site SurveyMonkey. The questionnaire will be emailed to the participants in mid-July. Identity of participants will be confidential. Subjects will be able to answer the questions at their convenience and can return questionnaires through email.

3. How will the recruitment of human subjects for your proposed project be carried out? Include your recruitment criteria and procedures.

   The questionnaire is geared towards biologists. Since this thesis is looking at improving the Mexican Wolf Recovery Plan biologist working on the plan will be sent the questionnaire. Those working on the wolves in Yellowstone will be sent questionnaires as well.

4. What are the possible risks to the human subjects? Specify possible kinds and degrees of risks, e.g., minimal, emotional risks in the form of distress or embarrassment. Outline the precautions that will be taken to minimize these risks, including methods of ensuring confidentiality or obtaining a release to use collected material and information.

Risks to human subjects are minimal. Possible risks include time management or lost time and possible identification. Precautions that will be taken to minimize these risks are an easy to follow questionnaire. The questionnaire will be emailed using the respected site Surveymonkey. The vast majority of questions are close-ended questions and the questionnaire should not take more than about 15 minutes of the subject's time. The subjects will not be asked to provide their names and all questionnaires will be anonyms. No particular piece of data is in itself identifying. Nevertheless, due to a potentially small participant pool combinations of data could lead to inadvertent identification. To avoid this problem only aggregated information, not individual responses, will be presented to the public.

5. What are the specific, anticipated benefits to be gained by completing the project? These may be at an individual, institutional, or societal level.

   Anticipated benefits for completing the project include a better understanding of why the Mexican Wolf Reintroduction Plan has not succeeded at well as biologists had hoped. The project should provide insight into reasons for the success of the reintroduction of gray wolves into Yellowstone National Park and whether reasons for that success could be transferred and used to improve the Mexican Wolf Recovery Plan. I will also benefit from completion of the project. Through completion of this project I will finish the MES program at Evergreen and will receive my Masters in Environmental Studies.

6. How will the information derived from this activity be used? To whom will the information be distributed, and if made, how will the promise of confidentiality be kept or carried out in the final project?

   The information derived from this project will hopefully be used to help improve the Mexican Wolf Recovery Plan and provide insight into why it was not as successful as wolf recovery in the northern United States. The information will be distributed to The Evergreen State College as well as the interviewees if requested. Confidentiality will be kept in the final project through keeping the answered questionnaires anonyms throughout the process. Once the project is completed I may try to publish the results in peer-reviewed literature.

APPENDIX B: LETTER FOR BIOLOGIST PARTICIPANTS

Dear Participant:

I am a student at The Evergreen State College. As part of my work for my Masters in Environmental Studies (MES) I will be conducting a research project titled "Improving the Mexican Gray Wolf Recovery Plan Through the Analysis of the Successful Reintroduction of Gray Wolves in the Northern United States." The purpose of the project is to gather information about successful wolf recovery and whether the Mexican Wolf Recovery Plan can be improved by looking at reasons why wolf reintroduction in Yellowstone and the Northern United States have been (relatively) successful.

I request only a few minuets of your time. My estimates for completing the form are about 15 minutes.

The only people to see individual responses to surveys will be my faculty sponsor, Dr. Tim Quinn and myself; all information presented publicly will be reported in aggregate to avoid inadvertent identification of participants. Your identity and your comments will be kept strictly confidential

The final paper is to be distributed to The Evergreen State College. Once the project is completed I may try to publish the results in peer-reviewed literature. At your request, I will provide you with a copy of the final paper.

If you have any questions about this project or your participation in it, you can call me at 505.412.2848. My email address is karischoen@aol.com. If you would like to talk to the MES program lead you may contact Dr. Martha Henderson at The Evergreen State College, Lab 1 Rm 3018, Olympia, WA 98505; Phone 360.867.6794.

The person to contact if you experience problems as a result of your participation in this project is John McLain, Academic Grants Manager at The Evergreen State College, Library 3821, Olympia, WA 98505; Phone 360.867.6045.

By submitting this online survey, you indicate that you have read the above information and agree to participate in this research project.

Thank you for your participation and assistance!

Sincerely,
Kari Schoenberg

APPENDIX C: LETTER FOR RANCHER PARTICIPANTS

Dear Participant:

I am a student at The Evergreen State College in Olympia, WA. As part of my work for my Masters in Environmental Studies (MES) I will be conducting a research project titled "Improving the Mexican Gray Wolf Recovery Plan Through the Analysis of the Successful Reintroduction of Gray Wolves in the Northern United States." The purpose of the project is to gather information about successful wolf recovery and whether the Mexican Wolf Recovery Plan can be improved by looking at reasons why wolf reintroduction in Yellowstone and the Northern United States have been (relatively) successful. I would like to acquire an insight into how ranchers and farmers feel about wolf recovery and reintroduction in their area and whether they feel that their concerns are being meet and their voices heard.

I request only a few minuets of your time. My estimates for completing the form are about 15 minutes. I will include it at the bottom of the email as well. I would like to have surveys back within two weeks of receiving the survey. If you know of anyone else who would be willing to participate in my survey please forward him or her my information and I can send him or her the survey as well if they contact me.

The only people to see individual responses to surveys will be my faculty sponsor, Dr. Tim Quinn and myself; all information presented publicly will be reported in aggregate to avoid inadvertent identification of participants. Your identity and your comments will be kept strictly confidential.

The final paper is to be distributed to The Evergreen State College. Once the project is completed I may try to publish the results in peer-reviewed literature. At your request, I will provide you with a copy of the final paper.

If you have any questions about this project or your participation in it, you can call me at 505.412.2848. My email address is karischoen@aol.com. If you would like to talk to the MES program lead you may contact Dr. Martha Henderson at The Evergreen State College, Lab 1 Rm 3018, Olympia, WA 98505; Phone 360.867.6794.

The person to contact if you experience problems as a result of your participation in this project is John McLain, Academic Grants Manager at The Evergreen State College, Library 3821, Olympia, WA 98505; Phone 360.867.6045.

By submitting this online survey, you indicate that you have read the above information and agree to participate in this research project.

Thank you for your participation and assistance!

Sincerely,
Kari Schoenberg

APPENDIX D: SURVEY FOR BIOLOGISTS

Date of participation: / /

Name of your company/employer:

What is your gender? Circle one

- Male
- Female

What is your age? Circle one

- 18-29
- 30-49
- 50-64
- 65 years and over

What is the highest level of education you have completed? Circle one

- Some high school
- High school graduate
- Some college
- Trade/technical/vocational training
- College graduate
- Some postgraduate work

- Post graduate degree

What is your employment status? Circle one

- Full time
- Part time
- Not employed
- Retired

How would you describe your political views? Circle one

- Very conservative
- Conservative
- Moderate
- Liberal
- Very liberal

Please circle up to two of the best descriptions of the education field in which you are qualified:

- Wildlife management
- Wildlife biology
- Forestry
- Conservation biology
- Natural resources conservation and management
- Environmental studies/science

- Natural resources policy
- Fisheries science and management
- Other: _____

Current salary: Circle one

- NA
- <$25,000
- $25-50k
- $50-100k
- $100k-200k
- >$200k

Characterize the place where you spent most of your childhood up to age 18: Circle one

- Rural
- Urban
- Farming
- Other: _____

Write the name of the state where you reside

Do you work with or on your state's wolf recovery plan? Circle one

Yes No

In what capacity or in what aspect do you work on the state's wolf recovery plan? Circle as many as apply.

a. NA
b. With wolf ecology
c. With land owners and ranchers
d. Captive management
e. Outreach and education with public excluding affected landowner and ranchers
f. Other, explain:

1. Rank in order of importance (by placing a number 1-5 next to each item, 1 being the least and 5 being the most) the biological component(s) needed to ensure **short term** (10 years) success of the wolf recovery in an area.
    a. Sufficient habitat **quality** for ensuring a range that matches a wolf's natural needs for migration/reproduction/feeding
    b. Sufficient habitat **quantity** for ensuring a range that matches a wolf's natural needs for migration/reproduction/feeding
    c. Having a population size that ensures adequate genetic diversity
    d. Adequate gene flow assumption from other source populations.
    e. Figuring out how to avoid human conflicts

2. Rank in order of importance (by placing a number 1-5 next to each item, 1 being the least and 5 being the most) the biological component(s) needed to ensure **long term** (> 10 years) success of the wolf recovery in an area.
    a. Sufficient habitat **quality** for ensuring a range that matches a wolf's natural needs for migration/reproduction/feeding
    b. Sufficient habitat **quantity** for ensuring a range that matches a wolf's natural needs for migration/reproduction/feeding
    c. Having a population size that ensures adequate genetic diversity
    d. Adequate gene flow assumption from other source populations.
    e. Figuring out how to avoid human conflicts

3. How important do you think habitat **quality** is to the success of wolf recovery plans? Circle one
    a. Very important
    b. Important
    c. Neither
    d. Unimportant
    e. Very unimportant

4. How important do you think habitat **quantity** is to the success of wolf recovery plans? Circle one
    a. Very important
    b. Important
    c. Neither

d. Unimportant

e. Very unimportant

5. How important do you think wolf genetic diversity is to success of wolf recovery plans? Circle one

    a. Very important

    b. Important

    c. Neither

    d. Unimportant

    e. Very unimportant

6. How would you rate the success of Timber wolf reintroduction? Circle one

    a. Very successful

    b. Moderately successful

    c. Neither

    d. Moderately unsuccessful

    e. Very unsuccessful

7. Explain why you answered question 6 the way you did by circling up to 3 of the most appropriate topics you considered.

    a. Habitat/range- Having access to large, designated wilderness areas

    b. Little or no risk of having contact with people

    c. Genetic diversity- having a large enough gene pool as to have diversity

    d. Better or improved policy and understanding

e. Public acceptance

f. Prey availability

g. All the above

h. Other, explain:

_____

8. Based on your answer(s) to question 7 above; describe your level of agreement to the following statement: Wolf recovery plans will benefit from the approach followed in the timber wolf recovery plan. Circle one

   a. Strongly agree

   b. Agree

   c. Neither

   d. Disagree

   e. Strongly disagree

9. If you could have full ecological information about the wolf prior to writing a recovery or reintroduction plan what would it be? (Write a number from 1-5 next to topic areas below, where 1 is the least important and 5 is the most important)

   a. Demographic data (birth, death)

   b. Movement data (immigration, emigration)

   c. Habitat use information

   d. Diet information

   e. Behavior related to farm animal predation

f. Behavior related to human disturbance (roads, houses, hunting, forestry, etc.)

g. Other, please describe:

---

10. If you placed something in the **"other"** category for question 9, what if any information did you use instead to craft a recovery or reintroduction plan? Circle the single best answer. If not go to question 11

    a. We used information from other wolf populations of the same species

    b. We used information from similar wolf subspecies populations

    c. We used information from closely related but non-wolf species

    d. We did not consider demographic data directly

    e. Other, please explain:

11. If you did not have **demographic data** from the source population of wolves that will be used for introduction what if any information did you use instead to craft a recovery or reintroduction plan? Circle the best answer

    a. We used information from other wolf populations of the same species

    b. We used information from similar wolf subspecies populations

    c. We used information from closely related but non-wolf species

    d. We did not consider demographic data directly

    e. Other, please explain:

12. If you did not have wolf **movement** information crafting a recovery or reintroduction plan, what if any information did you use instead to craft a recovery or reintroduction plan? Circle the best answer
    a. We used information from other wolf populations of the same species
    b. We used information from similar wolf subspecies populations
    c. We used information from closely related but non-wolf species
    d. We did not consider movement data directly
    e. Other, please explain:

13. If you did not have **habitat use** information what if any information did you use instead to craft a recovery or reintroduction plan? Circle the best answer
    a. We used information from other wolf populations of the same species
    b. We used information from similar wolf subspecies populations
    c. We used information from closely related but non-wolf species
    d. We did not consider habitat use data directly
    e. Other, please explain:

14. If you did not have **diet** information what if any information did you use instead to craft a recovery or reintroduction plan? Circle the best answer
    a. We used information from other wolf populations of the same species
    b. We used information from similar wolf subspecies populations
    c. We used information from closely related but non-wolf species
    d. We did not consider diet data directly
    e. Other, please explain:

15. If you did not have **behavior information related to farm animal predation** what if any information did you use instead to craft a recovery or reintroduction plan? Circle the best answer

    a. We used information from other wolf populations of the same species
    b. We used information from similar wolf subspecies populations
    c. We used information from closely related but non-wolf species
    d. We did not consider behavior information related to farm animal predation data directly
    e. Other, please explain:

16. If you did not have **behavior information related to human disturbance** (roads, houses, hunting, forestry, etc.) what if any information did you use instead to craft a recovery or reintroduction plan? Circle the best answer

    a. We used information from other wolf populations of the same species
    b. We used information from similar wolf subspecies populations
    c. We used information from closely related but non-wolf species
    d. We did not consider behavior information related to human disturbance data directly
    e. Other, please explain:

17. What is the single best kind of information necessary to create a successful wolf recovery plan? Circle one answer

    a. Habitat quality and quantity information- geographic area appropriate for recovery efforts
    b. Demographic data (birth, death)
    c. Movement data (immigration, emigration)
    d. Life history- ecology and habitat characteristics
    e. Behavior related to farm animal predation
    f. Behavior related to human disturbance (roads, houses, hunting, forestry, etc.)
    g. Abundance of prey species
    h. Genetic diversity
    i. Gene flow assumptions
    j. Other, explain:

    _____

18. What obstacles or information gaps with wolf/human interactions have you encountered in the planning process for wolf reintroductions? (Rank from 1 to 6 where 1 is least important and 6 is most important).

    a. Conflicts with farmers/ranchers and the livestock industry
    b. Conflicts with hunters
    c. Competition over land use
    d. Public views of wolves and wolf reintroduction

e. Illegal killing of wolves

f. Other, explain:

---

19. If you placed something in the **"other"** category for question 18, how did you or your agency address this conflict? (If not go to question 20) Circle the single best answer

    a. Literature review

    b. Used information from other wolf recovery plans

    c. Used information from public meetings

    d. Used information from private meetings

    e. Used nothing

    f. Other, explain:

20. If you or your agency experienced conflicts with the **farmers/ranchers**, how did you address these conflicts? Circle the single best answer

    a. Literature review

    b. Used information from other wolf recovery plans

    c. Used information from public meetings

    d. Used information from private meetings

    e. Used nothing

    f. Other, explain:

21. If you or your agency experienced conflicts with the **hunting community** how did you address these conflicts? Circle the single best answer

    a. Literature review

    b. Used information from other wolf recovery plans

    c. Used information from public meetings

    d. Used information from private meetings

    e. Used nothing

    f. Other, explain:

22. If you or your agency experienced conflicts with competition over **land use** how did you address these conflicts? Circle the single best answer

    a. Literature review

    b. Used information from other wolf recovery plans

    c. Used information from public meetings

    d. Used information from private meetings

    e. Used nothing

    f. Other, explain:

23. If you or your agency experienced conflicts with the **public at large** of wolves and wolf reintroduction how did you address these conflicts? Circle the single best answer

    a. Literature review

    b. Used information from other wolf recovery plans

    c. Used information from public meetings

d. Used information from private meetings

e. Used nothing

f. Other, explain:

24. If you or your agency experienced problems/conflicts with **illegal shootings** of wolves how did you address these issues? Circle the single best answer

a. Literature review

b. Used information from other wolf recovery plans

c. Used information from public meetings

d. Used information from private meetings

e. Used nothing

f. Other, explain:

25. Rank your familiarity with the Mexican wolf recovery plan from 1 very unfamiliar to 5 very familiar. Circle one

1 2 3 4 5

26. How important was the Mexican wolf recovery plan in developing your own wolf recovery plan? (Was the Mexican wolf recovery plan used at all to aid and guide in the development of your own wolf recovery plan?) Circle one answer

a. Very important

b. Important

c. Neither

d. Unimportant

e. Very unimportant

27. To what degree do you agree that listing the Mexican gray wolf as a "nonessential experimental population" helped with the reintroduction of the Mexican wolf? Circle one answer

    a. Strongly agree
    b. Agree
    c. Neither
    d. Disagree
    e. Strongly disagree

28. Explain why you chose the answer you did to question 27 by circling the answer that best describes your thinking.

    a. The listing increases the flexibility in managing the reintroduction of the wolf
    b. The listing allows reintroduced wolves to be killed for livestock depredation
    c. The listing creates a better cooperation between biologists and livestock owners.
    d. There will be more illegal killings of wolves
    e. Less protection will be given to the wolf populations
    f. The Mexican wolf will go extinct
    g. Other, explain:

29. To what degree do you believe the Mexican wolf recovery program has been unsuccessful in the past? Circle one answer

    a. Strongly agree
    b. Agree
    c. Neither
    d. Disagree
    e. Strongly disagree

30. If you believe the Mexican wolf recovery program has been unsuccessful in any way in the past, what are the main reason(s) for those beliefs? (Circle as many as apply)

    a. Inadequate habitat range
    b. Low genetic diversity
    c. Low population of prey species
    d. Illegal killings
    e. Inbreeding due to low genetic population
    f. Other. Please explain in a few words:

    _____

31. To what degree do you believe that stronger restrictions placed on land and grazing activities would increase Mexican wolf populations? Circle one answer

    a. Strongly agree
    b. Agree

c. Neither

d. Disagree

e. Strongly disagree

32. To what degree do you believe that new revisions on the Mexican wolf recovery plan will help improve the likelihood of the species maintaining self-sustaining populations? Circle one answer

    a. Strongly agree

    b. Agree

    c. Neither

    d. Disagree

    e. Strongly disagree

33. What single comment below best describes your belief about Mexican wolf recovery in the future? (Circle one)

    a. Mexican wolf populations will increase significantly

    b. There will be no change

    c. Mexican wolf populations will decrease

    d. The Mexican wolf will become extinct in the wild

    e. Other, explain:

34. What is the single most important benefit that Mexican wolves will likely have on the Southwest ecosystem? Circle one

    a. They could reduce forage competition between livestock and other ungulates
    b. They could provide more food for scavengers (e.g., coyotes, ravens, foxes, weasels, etc.)
    c. Providing another food source for scavengers could reduce predation on livestock by other predators
    d. They could help increase diversity in plants and animals in the environment
    e. By providing food for scavengers as well as helping to increase diversity in plants and animals, they could provide buffer effects towards climate change.
    f. Other, explain:

    _____

35. To what degree do you believe that the greatest obstacle for wolf recovery in the US is the degree to which land/livestock owners affected by wolves cooperate with the recovery efforts? Circle one

    a. Strongly agree
    b. Agree
    c. Neither
    d. Disagree

e. Strongly disagree

36. To what degree do you believe that cooperation with land/livestock owners is difficult to achieve. Circle one

    a. Strongly agree
    b. Agree
    c. Neither
    d. Disagree
    e. Strongly disagree

37. To what degree do you believe that current compensation for wolf depredation on livestock is working? Circle one

    a. Strongly agree
    b. Agree
    c. Neither
    d. Disagree
    e. Strongly disagree

38. To what degree do you believe that current compensation for wolf depredation on livestock is fair? Circle one

    a. Strongly agree
    b. Agree
    c. Neither
    d. Disagree

e. Strongly disagree

39. To what degree do you believe that successful wolf management relies on the use of the following factors (rank items from 1 (least important) to 5 (most important))?

    a. Science
    b. Politics
    c. Opinion
    d. Religion
    e. Other, explain:

    _____

40. How do you think the delisting of wolves as threatened or endangered from the Endangered Species Act will affect their recovery in terms of population size? Circle one

    a. Wolf populations will stay roughly the same
    b. Wolf populations will increase in size
    c. Wolf populations will decrease in size
    d. Other, explain:

41. How do you think the delisting of wolves as threatened or endangered from the Endangered Species Act will affect wolf recovery in terms of cooperation between recovery agencies and ranchers/farmers?

a. There will be better cooperation among biologists and farmers/ranchers
b. These relationships will remain mostly the same
c. There will be less cooperation among biologists and farmers/ranchers
d. Other, explain:

42. How do you think the delisting of wolves as threatened or endangered from the Endangered Species Act will affect wolf recovery in terms of recovery planning?
    a. Wolf recovery planning will increase
    b. Wolf recovery planning will remain at roughly the same level
    c. Wolf recovery planning will decrease
    d. Wolf recovery planning will stop
    e. Other, explain:

---

43. What do you believe is the most likely scenario for wolf populations once state management plans are implemented? Circle one
    a. They will remain in a recovered state
    b. They will increase
    c. They will decrease slightly but not to the point of becoming threatened or endangered once again
    d. Wolf populations will remain roughly the same
    e. They will decrease to the point of becoming relisted as threatened or endangered

f. They will go extinct

g. Other, explain:

44. Rank you familiarity with gray wolf recovery plans in the Northern United States (ex. Northern Rocky Mountain gray wolf and wolves reintroduced into Yellowstone) from 1-5, 1 being very unfamiliar and 5 being very familiar by circling one number.

    1 2 3 4 5

45. To what degree do you believe that existing gray wolf recovery plans were important in developing your own wolf recovery plan? (Was the gray wolf recovery plan used at all to aid and guide in the development of your own wolf recovery plan?) Circle one

    a. Very important

    b. Important

    c. Neither

    d. Unimportant

    e. Very unimportant

46. To what degree do you believe that wolf recovery efforts tend to divide the affected communities into biologists (generally supportive) and ranchers/famers (generally not supportive)?

    a. Strongly agree

    b. Agree

c. Neither

d. Disagree

e. Strongly disagree

47. What do you believe the fate of this divided community will be through time? Circle one

    a. There is more cooperation

    b. Cooperation levels remain mostly the same

    c. There is less cooperation

    d. Other, explain:

48. We are interested in improving the acceptance of wolf reintroduction by rancher/farmers and hunters. In your opinion, how would you or your agency improve the acceptance of wolf reintroductions by these stakeholders?

49. What aspect of creating a wolf recovery plan could you offer biologists from other states in order to ensure success?

50. What parts of the wolf recovery plan are most troubling to you?

51. What would you like to see changed in the recovery planning process, the recovery plan itself, and in how the plan is implemented?

52. On the social side of human- wolf interactions, what needs to be done in your opinion in order to ensure the success of a wolf recovery plan?

53. What advice could you offer to biologists from other states on creating a successful wolf recovery plan?

APPENDIX E: SURVEY FOR RANCHERS

Date of participation: / /

Name of your company/employer:

What is your gender? Circle one

- Male
- Female

What is your age? Circle one

- 18-29
- 30-49
- 50-64
- 65 years and over

What is the highest level of education you have completed? Circle one

- Some high school
- High school graduate
- Some college
- Trade/technical/vocational training
- College graduate
- Some postgraduate work

- Post graduate degree

What is your employment status? Circle one

- Full time
- Part time
- Not employed
- Retired

How would you describe your political views? Circle one

- Very conservative
- Conservative
- Moderate
- Liberal
- Very liberal

Current salary: Circle one

- <25,000
- 25-50k
- 50-100k
- 100k-200k
- >200k

Characterize the place where you spent most of your childhood up to age 18: Circle one

- Rural
- Urban
- Farming
- Other: _____

Write the name of the state where you reside

What generation rancher/farmer are you?

How many years have you been a rancher/farmer?

1. Rank your familiarity with the Mexican wolf recovery plan from 1-5, 1 being very unfamiliar and 5 being very familiar. Circle one

   1 2 3 4 5

2. Rank your familiarity with the timber (gray) wolf recovery plan from 1-5, 1 being very unfamiliar and 5 being very familiar. Circle one

   1 2 3 4 5

3. Rank your familiarity with current compensation programs for wolf depredation on livestock in your state from 1-5, 1 being very unfamiliar and 5 being very familiar. Circle one

   1 2 3 4 5

4. Do you agree that current compensation for wolf depredation on livestock is working? Circle one
   a. Strongly agree
   b. Agree
   c. Neither
   d. Disagree
   e. Strongly disagree

5. For question 4 above why did you choose the answer you did? Circle one
   a. I get compensated fairly for what the wolf kills
   b. Wolf predation on livestock is minimal
   c. Compensation does not take into account that prices for livestock are always going up
   d. It takes too long to receive the compensation
   e. Other, explain:

6. Do you agree that current compensation for wolf depredation on livestock is fair? Circle one
   a. Strongly agree

b. Agree

c. Neither

d. Disagree

e. Strongly disagree

7. For question 6 above why did you choose the answer you did? Circle one

    a. I get compensated fairly for what the wolf kills

    b. Wolf predation on livestock is minimal

    c. Compensation does not take into account that prices for livestock are always going up

    d. It takes to long to receive the compensation

    e. Other, explain:

8. How many livestock do you believe you have lost in the past year to wolf depredation? Circle one

    a. 1-3

    b. 3-5

    c. 5-7

    d. 7-9

    e. 10 or more

9. What are your feelings towards wolf recovery? Circle one

    a. Strongly support

    b. Moderately support

c. Do not care

d. Moderately do not support

e. Strongly do not support

10. What are your feelings towards wolf reintroduction? Circle one

    a. Strongly support

    b. Moderately support

    c. Do not care

    d. Moderately do not support

    e. Strongly do not support

11. Wolves occupying the same land that I ranch will result in me having to give up my land for ranching. Circle one

    a. Strongly agree

    b. Agree

    c. Neither

    d. Disagree

    e. Strongly disagree

12. I would be willing to ranch with wolves (wolves occupying the same ranch as my livestock) if provided with certain compensation or certain tools. Circle one

    a. Strongly agree

    b. Agree

    c. Neither

d. Disagree

e. Strongly disagree

13. Characterize you knowledge of wolves. Circle one

a. Very knowledgeable

b. Somewhat knowledgeable

c. Not very knowledgeable

d. Completely unknowledgeable

14. Characterize your knowledge of wolf recovery. Circle one

a. Very knowledgeable

b. Somewhat knowledgeable

c. Not very knowledgeable

d. Completely unknowledgeable

15. If you are unfamiliar with wolves how willing would you be to learn? Circle one

a. Very willing

b. Willing

c. Neither

d. Unwilling

e. Very unwilling

16. If you are unfamiliar with wolf recovery how willing would you be to learn? Circle one

    a. Very willing
    b. Willing
    c. Neither
    d. Unwilling
    e. Very unwilling

17. Characterize your willingness to learn how ranchers and wolves can coexist. Circle one

    a. Very willing
    b. Willing
    c. Neither
    d. Unwilling
    e. Very unwilling

18. How would you feel about learning how to humanly manage wolves from staying off your land? Circle one

    a. Very willing
    b. Willing
    c. Neither
    d. Unwilling
    e. Very unwilling

19. What is your preference towards the management of "problem" wolves (defined as wolves that threaten farmers livestock)? Circle one

    a. Compensation payments
    b. Lethal control
    c. Translocation: when an animal is captured and released elsewhere
    d. Returned to captivity
    e. Nonlethal tools and methods to reduce conflicts
    f. Other, explain:

20. If you have used any nonlethal tools and methods to reduce conflicts with wolves what have you used? Circle one

    a. Livestock guarding dogs
    b. Reducing attractants (removing any type of dead, diseased, or dying animal as well as those ready to give birth)
    c. Erecting barriers: fencing, fladry (perimeter rope of vertical flagging), and penning
    d. Increasing human presence (range riders, herders)
    e. Using scare tools and tactics (alarms, shock collars, nonlethal ammunition)
    f. Switching grazing sites
    g. None
    h. Other, explain:

21. Do you feel you are included in decisions about wolf reintroduction? Circle one

    a. Strongly agree
    b. Agree
    c. Neither
    d. Disagree
    e. Strongly disagree

22. How do you feel about wolves on your land? Circle one

    a. They are a huge threat
    b. They are invading my land
    c. They don't bother me
    d. They are not a huge problem
    e. Other, explain

23. How willing would you be to forfeit your grazing permits on public land and permanently remove your cattle if the federal government paid you? Circle one

    a. Very willing
    b. Willing
    c. Neither
    d. Unwilling
    e. Very unwilling

24. How willing would you be to allow a certain amount of wolves on your property if the Fish and Wildlife Service paid you to do that? Circle one
    a. Very willing
    b. Willing
    c. Neither
    d. Unwilling
    e. Very unwilling

25. How would you characterize the relationships between biologists and rancher/farmers over the years? Circle one
    a. There is more cooperation between the two groups
    b. Nothing has changed
    c. There is less cooperation between the two groups
    d. Other, explain:

26. We are interested in improving the process of wolf reintroduction in ways that make it more acceptable to you as stakeholders. In the space below please provide some details on how this could happen from your perspective.

27. Do you feel you were listened to and your concerns were taken into account with the creation of the wolf recovery plan in your area?

28. What could have made the wolf recovery plan better?

29. What would you like to see changed?

30. Describe briefly how much confidence you have in scientists describing the nature of the predators and the damage to farmers/ranchers?