

RANCHER ADAPTATIONS TO WOLF DEPREDATION IN WESTERN
MONTANA

By

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ABSTRACT

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With the recovery of gray wolves (*Canis lupus*) to the Northern Rocky Mountains, wolf depredations on domestic cattle are an ongoing concern for all stakeholders in wolf management. Because these events can occur in clusters, one ranch or a group of ranches may experience disproportionately high levels of depredation. Thus, reducing depredation risks on ranches that have experienced repeated depredation events may greatly reduce depredation in the long term. This research examined what management tools ranchers who have experienced repeated losses to wolves are utilizing to reduce the risk of further depredations, how they evaluate the efficacy of management tools, and why they choose certain management tools over others. All 18 ranchers interviewed were utilizing some combination of lethal and non-lethal tools to prevent further depredations. Ranchers were in agreement that eliminating problem wolves as soon as possible was critical for addressing both the imminent and future threats. Of non-lethal tools, the majority of ranchers spent more time with range cattle (either personally or with a hired range rider), removed livestock carcasses that could attract wolves, and paid more attention to wolf and other wildlife activity on the landscape. In descending order of significance, biological effectiveness, economic and temporal efficiency, and

cultural acceptability were the three main lenses that ranchers used to evaluate the overall efficacy of risk abatement tools. Ranchers who perceived an available tool as effective were more likely to be already implementing that tool or express interest in implementing it in the future. Conversely, ranchers who perceived an available tool as ineffective were less likely to be implementing it. Range riding was the only exception to this general rule as ranchers implemented it broadly, but perceived it as largely ineffective at deterring wolves from preying on cattle. The reasons why ranchers perceive certain management tools as more effective than others are sourced in historical forces, individual experiences with depredation, and differences in their individual histories and personalities. It was beyond the scope of this research to adequately analyze the latter. However, this research suggests that managers and funders should focus their resources on research and development of risk abatement tools that ranchers perceive as effective and are therefore more likely to implement on a broad scale.

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JULY 10TH, 2014

When I see wolves, I start shaking. I forget to breathe. And I stop thinking. How this manifests depends on the situation, where I am. Twice, I have been a voyeur from within my house – the first in November of 2013 when the alpha male of our local pack threw me from my bed with his booming howl and then trotted by my kitchen window, paused, and looked inside to where I stood dumb and frozen. He had been hunting a badger. The second in July of 2014 when I sat reading a book on backcountry recipes in my library and through the corner of my eye out the window caught the flash of a white-tailed deer take off through the meadow flagging. In the tall grasses sat a wolf, nose to the air, winding for fawns. I dumbly whisper-yelled through my house for my partner, to tell him there was a wolf outside, and could barely tear myself from the library window, which was really not the best view. When I finally found my partner, outside, by his truck, to say that *there was a wolf right there*, I scrambled immediately back to the same library window to watch, dumbly and frozen again, the wolf trot north across our driveway, past a hidden fawn, and out of sight. There were much better windows. Or I could have stayed outside. Both times it has taken me so long to gather my wits back up and carry on with the day that I begin to wonder what the problem is. I leave the stove on, put the cat in the refrigerator, keep my car in drive when I park it to get out. I become dangerous. And then I remember: I saw a wolf today.

When I see wolves in the woods it is quite different. The shaking, no breathing, and no thinking is the same. But I don't freeze, unless that's what they tell me to do. I

listen. They send signals over the air. They must be quite good at this, being social beings, at throwing their intentions at another animal so effectively that those intentions are felt. Their voices help too. Barks, howls, growls, huffs, whines. I'm usually in a situation where it wouldn't be difficult to interpret their behavior anyway, near a den or in a rendezvous site, where they are likely to be upset by my presence, but they communicate that upset directly. *To* me. It's a subtle difference. But something happens in me, some instinct takes over and I am so wholly and completely focused on that wolf that everything else fades away. When I am in the woods with them, I can react to what they tell me when that is all my brain can do. But when I am watching from my house, that communication line opens when the wolf isn't even aware of me and I am rendered dumb and useless usually for the rest of the day. I have dreams about them all the time. And many, *many* nightmares.

I am not a wolf freak, not a lover or a hater. I have nothing against any of that, we all have a right to feel what we feel, but I don't hold wolves as gods. Or demons. Or anything other than simply magnificent animals. But I don't deny that magnificence either, and I do feel they have some power over me in those moments that we occupy the same space. Whether that's just me, or some innate human instinct that developed in conjunction with living alongside and competing with "the beast" throughout our early human history, or whether it's something about them being social apex land predators and us being social apex land predators and my awe in that *similarity* in the yellow-eyed face and form of all the obvious, toothy, four-legged differences, I don't know. But whatever it is, for me it's more profound than if they were earth spirits, or symbols of the

wild, or the devil's walking form, because it's something real that happened sometime, somewhere, to me, or to someone in my blood, or to all of us, perhaps just once, maybe twice, maybe always.

For me, that is true. For the people I talked to for this project, it may not be. I don't know, I didn't ask them, directly at least, but maybe I would like to someday. I know their experiences with wolves have been utterly different than mine, and somehow also similar. But I want, I *need* everyone who reads this or knows me to hear me say: if any person on this earth's truth about wolves is different than mine, *that truth is also true*. To do *right* by this wolf issue, and by each other, because that's what this all is really about, we need to own that. And hold it. And nurture it. And respect it. And that is really hard to do.

That is what I have learned.

INTRODUCTION

The recovery of gray wolves (*Canis lupus*) in the Northern Rockies has been a biological success story. However, social acceptability of wolves within the rural, resource-dependent communities of Wyoming, Idaho, and Montana continues to be controversial. Wolf predation on cattle (depredation) is an ongoing social, economic, and political issue. Furthermore, as wolf distribution expands outside of protected, designated wilderness areas or national parks, wolves increasingly utilize available habitat on private lands for foraging, reproduction, and dispersal. Mixed use lands composed of both private and public ownership may therefore play an important role in supporting the long-term, life history needs of this species. Wolf depredation of domestic livestock is a major source of wolf mortality in Montana because wolves that demonstrate this behavior are removed from the population either by USDA Wildlife Services or ranchers that are authorized through kill permits (Bradley, et al. 2014). Furthermore, depredations tend to occur in clusters, disproportionately affecting the ranchers that experience such conflicts (Breck and Meier 2004, Muhly and Musiani 2009). This presents a challenge whereby a proportionally small population of ranchers bears substantial costs of wolf restoration and conservation (Muhly and Musiani 2009).

Historically, the ranching industry and the federal government considered wolves and livestock incompatible, and wolves were eradicated from the lower 48 states through an industry and government supported effort (Mech 1970, Lopez 1978). Wolves were largely absent from the west from the 1930's until the mid-1990's, when the U.S. Fish

and Wildlife Service (USFWS) initiated a federal recovery effort in the Northern Rockies of Montana, Idaho, and Wyoming (USFWS et al. 2014). Further, the Endangered Species Act and subsequent state level management have compelled ranchers to accept the presence of wolves since the 1970s. A continuing aversion to wolves is embedded in today's ranching communities (Mech 1970, Lopez 1978). This situation has agitated ranchers who suffer economic losses, polarized ranching community and urban environmental interests, and led to political conflict over wolves' delisting from the Federal List of Endangered and Threatened Wildlife. Beneath the umbrella of these larger conflicts, ranchers must continually interact with the environments that they, and their livestock, depend upon to survive. Until the mid-1990s, before wolves re-colonized, several generations of ranchers ran cattle without the threat of wolf depredation. The carnivore's renewed presence therefore represents a new challenge for today's ranching communities.

Certain regions of western Montana appear to show consistent patterns of livestock depredation by wolves, where high levels of confirmed cattle losses and wolf removals involve few producers that often suffer repeated depredations either on private land or public grazing allotments (Muhly and Musiani 2009). With the element of wolf depredation back on the landscape, these ranchers are responding with various tools to manage the risk of wolf depredation. However, little is known about how ranchers who have repeatedly lost cattle to wolves are responding, the potential value of their adaptations on a larger scale, or the individual and societal influences on the choices they make. Because wolf populations have recovered and expanded, and both wolf managers

and control authorities are spread thin in their ability to respond to depredations, prioritizing the areas with the highest number of incidents to gather information that could help reduce depredation may result in the most private and public benefit.

A primary stated goal of the federal wolf recovery and state wolf management efforts has been to reduce negative impacts to ranchers from wolves (USFWS 1987, Montana Fish, Wildlife & Parks 2002). Understanding how and why ranchers react a certain way to wolves is vital for mitigating conflicts and tolerating wolf populations across the working landscapes of the Northern Rockies in the long term. The purpose of this research was to investigate how ranchers may be adjusting their behaviors after experiencing repeated confirmed losses to wolves in order to manage the risk of further depredation. I focused on whether ranchers are adopting management strategies that they believe help reduce depredation risk, as well as how they evaluate management strategies that they are not utilizing. Ranchers' evaluations of management strategies' efficacy can help prioritize tools for further research and improve management plans, because ranchers may be most likely to apply tools that they perceive as effective. On a theoretical level, this study utilized a modified human dimensions of wildlife (HDW) framework to explore why ranchers are adapting in certain ways by elucidating the personal and interactive processes that influence their decisions and actions in response to wolf depredation. This inquiry will be useful to the stakeholders engaged in wolf conservation and management by identifying practical areas for further research into approaches to mitigating wolf-livestock conflicts.

Background and Scope

As European settlers colonized the United States, they eradicated the gray wolf from nearly all of its historic range (Young & Goldman 1944). In the 19th and early 20th Centuries, wolves presented a threat to the burgeoning livestock industry in the western United States because they preyed on livestock, so the federal government authorized hunters, trappers, and ranchers to systematically remove them (Young & Goldman 1944, Lopez 1978). The eradication effort was successful and wolves were considered functionally extinct in the lower 48 states by the 1930s, although some very small isolated fragments remained (Mech 1970). By the 1960s and 1970s, new perspectives on wolves began to emerge with the scientific suggestion that wolves play important biological roles in ecosystems (Mech 1970). When Congress passed the Endangered Species Act in 1973, wolves were listed as endangered and the U.S. Fish and Wildlife Service (USFWS) implemented a recovery plan for the species in the Northern Rockies (USFWS 1987). In 1995, the federal government authorized wolf reintroductions to facilitate the recovery effort. In 1995 and 1996, 66 wolves were trapped in Alberta, Canada and released in Yellowstone National Park and central Idaho (USFWS et al. 2011, Breck & Meier 2004). Wolves also recolonized northwest Montana naturally from Canada (USFWS et al. 2011).

Nearly two decades later, these recovering wolf populations have expanded beyond the boundaries of protected areas and across the ranching landscapes of Montana, Idaho, and Wyoming where they occasionally prey upon cattle. How and when wolves

kill livestock depends on a complex suite of ecological and management factors (Bradley & Pletscher 2005, Musiani et al. 2005, Breck & Meier 2004, Treves et al. 2004). The gray wolf was removed from the Federal List of Endangered and Threatened Wildlife in May of 2011 and is now managed by the states as a recovered species (Ashe 2011). The ongoing management challenge from the time that wolves naturally recolonized, or were federally reintroduced, has been how to balance ranchers' economic concerns with wolf conservation.

There are several documented approaches to mitigating cattle depredation by wolves that generally fall into two categories: reactive/lethal or proactive/non-lethal. Reactive and incremental removals of wolves or packs and/or providing monetary compensation to the rancher are important management measures used to reduce effects of cattle losses (Bangs et al. 2009). However, new wolves or packs may fill the empty territory in subsequent seasons and also kill livestock (Musiani et al. 2005, Bangs et al. 2006, Bangs et al. 2009), and ranchers may suffer uncompensated cattle losses that cannot be confirmed as wolf kills (Muhly & Musiani 2009, Steele et al. 2013). Other approaches to managing wolf depredation are non-lethal and intend to minimize both rancher economic losses and wolf removals (Stone et al. 2011, Muhly et al. 2010, Bangs et al. 2006, Shivik 2006, Breck & Meier 2004). Non-lethal strategies that ranchers and managers generally employ in the Northern Rockies include: removing attractants like cattle carcasses from rangelands and pastures, using livestock protection dogs (LPD), increasing human presence on the range, erecting permanent or temporary barriers such as electric fencing or fladry, moving cattle to new grazing sites more often, and using

deterrents like alarms and rubber bullets to scare wolves away from cattle (Stone et al. 2011, Muhly et al. 2010, Shivik 2006). Non-lethal methods that are direct deterrents against wolves (alarms and rubber bullets) offer temporary relief at best, while non-lethal methods that are directed toward other sources of depredation conflict (carcass disposal, human presence, altered husbandry patterns) may reduce attractants and reduce livestock vulnerability to depredation in the long term (Bangs et al. 2009).

Objectives

The purpose of this research was to explore how and why cow-calf ranchers in western Montana are managing risk in response to wolves repeatedly killing their cattle. The research objective was to obtain a baseline of practical understanding of how these ranchers are managing depredation risk and a baseline of theoretical understanding of why they are managing in certain ways. The guiding questions were:

- 1) What management strategies are ranchers adopting that suffer repeated losses to wolves?
- 2) How are ranchers evaluating available strategies?
- 3) What influences ranchers' decisions to adopt certain tools in response to depredations?

The results of this research may help the broader public and wildlife managers understand the plight of ranchers that experience repeated depredations and prioritize methods that may reduce depredation risk in those areas where it matters most.

REVIEW OF LITERATURE

The goal of this research was to explore how cow-calf ranchers who experienced repeated depredations responded with management tools to prevent further depredations, as well as why they adopted certain management tools. Since rancher reactions to wolves likely has deep cultural and generational roots in historical processes, this chapter begins with a brief history of wolves and European Americans in the West. To address the research questions of how and why ranchers respond to wolf depredation directly, the second half of this chapter reviews depredation patterns in Montana, tools for reducing depredation, and theoretical frameworks for determining producers' choices to adopt certain tools.

Part I: A Brief History of Wolves and Humans in the Western United States

To understand the contemporary relationships between ranchers and wolves, this literature review must first account for the rich history of wolf-human interaction in the Rocky Mountain West. This chapter will detail this history from the time of initial American westward expansion to the present day, paying close attention to the shifting eras of governmental policies and associated social, economic, and environmental influences and repercussions. These ongoing processes constitute the dynamic environment within which contemporary wolf-rancher conflicts are situated, and are an essential foundation for understanding ranchers' perspectives on wolves and subsequent

actions in response to their presence. This historical account is separated into three historical eras that characterize the human-wolf relationship in the western U.S. over the past 150 years: the eras of eradication, recovery, and contemporary conflict.

The era of eradication

The wolf is the arch type of ravin, the beast of waste and desolation. It is still found scattered thinly throughout all the wilder portions of the United States, but has everywhere retreated from the advance of civilization.

- Theodore Roosevelt, 1902

With the United States' acquisition of the Louisiana Territory, nearly a century before Roosevelt penned his famous line, came the birth of American westward expansion. The Louisiana Purchase, signed as a treaty between the United States and France in 1803, essentially doubled the size of the United States by adding nearly 530 million acres for \$15 million (Library of Congress 2011). Spreading west from the Mississippi to the Rocky Mountains was a vast swathe of land largely empty of western European peoples, of "civilization", and brimming with seemingly limitless natural treasures and wildlife. These lands were also occupied widely by native peoples, but it is beyond the scope of this project to adequately address the damage caused to indigenous American peoples and their cultures during this time period and beyond, and the complex social and psychological processes that directed it. However, it is important to acknowledge here that the colonial spirit of Manifest Destiny caused widespread displacement of indigenous Americans, the legacy of which continues to be a source of

deep social, political, environmental, and human injustice today. Much of United States policy over the next 100 years was designed to settle, utilize, and civilize the west's wild bounty and the wolf (also the mountain lion, coyote, and grizzly bear) presented an irreconcilable nuisance to this objective. The wolf by its very nature came to symbolize all that resisted civilization in the west, thus "the beast of waste and desolation," according to Theodore Roosevelt (Lopez 1978, Nie 2003). Wolf eradication therefore became a fixture in United States policy and culture throughout the 19th and early 20th Centuries.

Much of the popular literature and opinion about wolves condemns and dismisses wolf eradication as the result of human greed and ecological misunderstanding. This analysis, while holding some merit, fails to account for the complex forces in the national climate of the time that legitimized wolf eradication. Instead of dismissing wolf eradication, it is more useful to cultivate an understanding of why killing all of the country's wolves was deemed legitimate. This section will therefore discuss three facets of westward expansion that contributed to wolf eradication, moving generally from opportunistic to targeted take: the furbearing industry, the settlement process and the livestock industry, and the symbolism associated with Manifest Destiny and other cultural constructs.

Furbearers

The 19th Century hosted an industry for fur, worldwide. Eastern trappers quickly headed west following the Louisiana Purchase in 1803, mostly in search of highly

lucrative beaver, into a landscape that supported thousands of wolves. Estimates of the wolf population at the peak of the bison hunts, which provided plentiful carrion on the landscape, range broadly (Wise 2013). Wolves would often beat trappers to animals caught on their trap lines, consuming the meat and destroying the valuable pelt in the process. At first, therefore, wolves were killed opportunistically to keep them off the trap lines (Lopez 1978). As trappers depleted the supply of highly prized beavers for their pelts, an economy for wolf pelts developed by the 1830s, and by 1850 a wolf pelt was worth \$2.00, as trappers turned to wolves to supplement their incomes by providing for the Russian and European demand for wolf coats (Lopez 1978, Wise 2013).

True “wolfers”, hunters that targeted wolves, didn’t emerge until after 1850. As beaver were mostly trapped out of the West and trappers turned also to bison for their pelts, which created additional opportunities to take wolves. Bison hunters killed at least 75 million bison by 1880 and so provided a plethora of carrion in their wakes (USFWS 1987, Lopez 1978, Wise 2013). Wolves took to following bison hunters for the meat they left behind, and hunters would shoot them also for their pelts. Wolfing was further cemented as an occupation as the West became more settled with the mid-century gold rushes and more men moved west in search of jobs related to the mineral and furbearing industries. Bison were difficult to kill, especially in winter when it was most difficult for men to find other means of subsistence, so more and more people turned to wolfing for prime winter pelts (USFWS 1987). Later on wolves were shot from the air and the ground and trapped in foot snares, but the primary mode of killing them was with poison (Musiani and Paquet 2004). Reflecting on the counterintuitive information that wolves

were easier to kill than bison, Lopez (1978) states, “All a wolfer had to do was set out strychnine and gather in the dead at two dollars a hide,” (178). However, poisoning may have taken a long time to kill an individual wolf, depending on how much was ingested, and trappers may not have always found the wolves they had killed.

Bounty programs issued by federal and state government agencies also paid wolfers to kill wolves. Bounties began in the eastern United States in the 17th Century (Mech 1970, Lopez 1978), and were established in the West, for example, as late as 1883 in Montana (Curnow 1969 via. Riley et al. 2004, Lopez 1978). However, these bounties and an increase in the practice of poisoning were driven by broader forces than the furbearing industry, as western settlement and the emergence of the livestock industry became the West’s primary economic driver (Lopez 1978).

Settlement and livestock

In 1862, the United States passed the Homestead Act, which issued ownership of 160-acre parcels to settlers who lived on the land and worked it for a period of 5 years, to encourage people to move west (Library of Congress 2010). Alternatively, settlers who lived on the land for six months could buy land from the federal government for \$1.25 an acre, greatly facilitating the emergence of ranching establishments throughout the previous Louisiana Territory (Library of Congress 2010, Wyckoff and Hansen 1991, Lopez 1978). In the ensuing decades, new ranches were increasingly linked to broader economies as demands for livestock products grew on larger regional and national scales to provide for the increasingly industrialized eastern seaboard and mining camps

associated with the western gold rush (Wyckoff and Hansen 1991). In 1880, the railroad lines that connected the Northern Rockies to Utah, the Midwest, and the Northeast were completed, resulting in the livestock industry's full incorporation into the expanding and mobile United States economy (Wyckoff and Hansen 1991, Lopez 1978). Livestock production by 1880 was arguably the most important economic activity in the West (Lopez 1978, Wise 2013).

As mentioned above, bison hunters had killed over 75 million bison by 1880. The wolf population exploded as a result of greatly increased protein from carcasses, despite the furbearing industry's pressure (Wise 2013). As bison populations decreased between the 1850s and 1880, domestic livestock numbers increased on the western landscape. Bison were the primary prey species for wolves historically and, as the bison disappeared and wolf populations were at an all-time high, wolves turned to livestock for prey en masse (Musiani and Paquet 2004, Lopez 1978, Mech 1970, Young and Goldman 1944, Wise 2013). Because this coincided with the livestock industry's emergence into the national market as an important economic and cultural component, regional governments, as well as cattlemen themselves, began systematically offering bounties for dead wolves (Musiani and Paquet 2004, Lopez 1978, Mech 1970, Young and Goldman 1944). Whereas trappers and hunters had previously taken wolves opportunistically and out of convenience, now professional wolfers pursued them unrelentingly. After 1870, wolfing became a government-sanctioned profession in defense of the western United States' ranching economy, and a highly lucrative one (Wise 2013). Their numbers plummeted, and wolfers even began raising captive wolves to kill and sell for bounty (Wise 2013).

However, economics alone cannot explain why the wolfers did not stop killing wild wolves when their numbers had declined to a point when their removal became neither profitable nor as a response to a substantial threat to livestock. Only an analysis of human symbolism can explain why almost every single gray wolf in the lower 48 was killed by 1940.

Manifest Destiny and other symbolisms

Beginning around 1880, wolves were targeted because they threatened livestock, but the wolfing sentiment evolved to target wolves because they existed. Barry Lopez, in *Of Wolves and Men* (1978) provides a detailed synthesis of the literature, supplemented by personal interviews, regarding humans' stark historic hatred of wolves in the western United States. Lopez begins by discussing Roderick Nash's scholarship on wilderness, and humans' drive to tame or overcome it:

In the Bible, wilderness is defined as the place without God—a sere and barren desert. This twinned sense of wilderness as a place innately dangerous and godless was something that attached itself, inevitably, to the wolf—the most feared denizen of the gloomy wilderness. As civilized man matured and came to measure his own progress by his subjugation of the wilderness...the act of killing wolves became a symbolic act, a way to lash out at that enormous, inchoate obstacle: wilderness (Lopez 1978, 141).

The wolf as a symbol of wilderness came to represent primitive man, the opposite of civilization, and therefore had to be erased from the western mind and the western land. The wolf stood as an irreconcilable symbolic affront to the face of Manifest Destiny, the national sentiment that understood the nation's westward expansion as

fulfilling Americans' duty to civilize and reap benefit from the western bounty. The livestock industry itself was a large contributor to the realization of Manifest Destiny (Lopez 1978, Wise 2013). Furthermore, at a time when the livestock industry was attempting to prove its value to the national economy in the face of widespread dispossession of native peoples' lands, it was essential for it to produce beef and dollars (Wise 2013). Any affront to this measure of success became an intolerable threat. Therefore, the physical act of a wolf killing a domestic animal came to be seen as an evil attempt to thwart Americans' right to the land, as well as a threat to the newly emerging institution of private property rights (USFWS 1987, Lopez 1978). Furthermore, the wolf was conceptualized as "a deliberate murderer," that enjoyed the act of killing helpless livestock. This perception was specifically rooted in how utterly defenseless domestic sheep were to wolves. The federal bounty laws and widespread strychnine campaigns were justified symbolically as retributive justice against a deliberately cruel, evil predator (USFWS 1987, Lopez 1978). In summary, Lopez (1978) states:

It was against the backdrop of these broad strokes—taming wilderness, the law of vengeance, protection of property, an inalienable right to decide the fate of all animals without incurring moral responsibility, and the strongly American conception of man as the protector of defenseless creatures—that the wolf became the enemy (148).

By 1910, wolf bounties were up to \$150 per head, paid by the federal government, and the wolves that were left were extremely adept at avoiding human pursuit (Lopez 1978). The last wolves in the west were classified as outlaws and became

known individually on the national public arena (Curnow 1969). The last of the outlaw wolves are listed in Lopez' book, and some of their names and locations include:

Lobo, King of Currumpaw, northern New Mexico;
Big Foot, Lane County, Colorado;
Queen Wolf, Unaweep Canyon, Colorado;
Snowdrift Wolf, Judith Basin, Montana;
Rags the Digger, Cathedral Bluffs, Colorado; and
Ghost Wolf of the Little Rockies, north-central Montana (193).

The stories told of these wolves' personalities, livestock terrorization, and trap evasion resemble mythologies, and the men who finally caught them were hailed as heroes. These men are described broadly in the literature as wolf-like themselves, as it took knowing the wolves so well and following them relentlessly for long periods of time through remote country to finally kill them (Wise 2013). By the 1940s, Theodore Roosevelt's idiom that "the beast of waste and desolation" fled before civilization had been enacted fully on the western landscape. But for a few remnants along the border between Canada and Montana, and in the upper Midwest on Isle Royale, America's wolves were gone.

The era of recovery

The terms "conserve", "conserving", and "conservation" mean to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary.

Endangered Species Act of 1973

In the decades between the federal bounties on the last outlaw wolves of the 1930s and the command and control environmental legislation of the 1970s, the American public generally experienced a profound shift in its attitudes toward the environment, including the growing perception that human development and exploitation had driven several once abundant species to extinction. Other species, such as the grizzly bear and the gray wolf, were nearly extinct. The United States passed a wave of environmental legislation in the early 1970s, including the Endangered Species Act of 1973.

The Endangered Species Act makes it illegal for any individual, corporation, or government agency to kill or degrade the habitat of any animal listed on the Federal List of Endangered and Threatened Wildlife (Endangered Species Act of 1973). Furthermore, upon listing a species, the U.S. Fish & Wildlife Service must develop and implement a recovery plan for that species with the goal of recovering its populations to the point where protection under the Act is “no longer necessary,” (Endangered Species Act of 1973). Therefore, it is important to note that the objective of the Endangered Species Act is to recover species, not protect them in perpetuity. “Endangered” or “threatened” status is meant to be temporary.

The USFWS identified the Northern Rocky Mountain region of Montana, Wyoming, and Idaho as a region that represented a portion of wolves’ historic range and was both appropriate and feasible for wolf recovery in the United States (USFWS 1987). The Northern Rocky Mountain gray wolf was classified as Endangered under the ESA in 1974, and the USFWS completed its mandated recovery plan in 1987 (USFWS 1974,

USFWS 1987). The Northern Rocky Mountain Gray Wolf distinct population segment (DPS) is made up of three core recovery areas: northwest Montana, central Idaho, and the Greater Yellowstone Area (USFWS 1987). The details of how the federal government and the national public supported and implemented wolf recovery are essential for understanding ranchers' perspectives on wolves and wolf management. Therefore, this section will describe the state of wolf populations in the region by the 1980s, summarize the 1987 USFWS Northern Rocky Mountain Wolf Recovery Plan, and outline the plan's implementation through the year 2002.

Canadian dispersers

Despite being functionally hunted to extinction in the lower 48 by the 1940s, wolves were (and are) still abundant in Canada, although heavily persecuted (Musiani and Paquet 2004, Paquet and Carbyn 2003). Southwestern Canada's predator regulations fluctuated between 1930 and 1970. In the 1930s, Alberta relaxed predator control in combination with implementing heavier regulations on big game hunting, which led to a spike in wolf populations followed by heavy wolf culling through the 1950s (Paquet and Carbyn 2003, Montana Fish, Wildlife & Parks 2002). In the 1960s, however, Alberta once more restricted wolf control and populations increased over the next decade, resulting in a higher wolf density and proportion of dispersing individuals by the time the United States passed the ESA in 1973 (Paquet and Carbyn 2003, Montana Fish, Wildlife & Parks 2002, Ream and Mattson 1982).

The USFWS uses the presence of breeding pairs as the indicator for wolf establishment in an area, because breeding pairs represent a successfully reproducing population. Although there were no breeding pairs documented in northwest Montana throughout the 1970s, Alberta's relaxation of wolf control likely increased the number of dispersing wolves that traveled south across the border into northwest Montana's Glacier National Park throughout the decade (Montana Fish, Wildlife & Parks 2002). The first case of wolf reproduction in the Northern Rockies in half a century was observed in Glacier National Park in 1986 (Montana Fish, Wildlife & Parks 2002, Bangs 1994, Ream et al. 1989). Wolves continued to naturally re-colonize the northwest Montana recovery area throughout the early 1990s, and an estimated 5-7 breeding pairs were present by 1995 (Montana Fish, Wildlife & Parks 2002). The central Idaho and the Greater Yellowstone recovery areas did not contain wolves during the same period (Montana Fish, Wildlife & Parks 2002).

Northern Rocky Mountain Wolf Recovery Plan

The Northern Rocky Mountain Wolf Recovery Plan ("the Plan") identifies its primary goal as the biological recovery and subsequent removal of the Northern Rocky Mountain wolf from the List of Endangered and Threatened Wildlife (USFWS 1987). The USFWS (1987) established that successful biological recovery would be met when a minimum of ten breeding pairs of wolves were present in each of the recovery areas for three consecutive years. Each of the three recovery areas is separated into three wolf management zones:

“Zone I is the area where wolf recovery will be promoted due to the low potential for conflict with other land uses. Zone III (all land area outside the recovery area) is the area where wolf recovery will not be promoted due to the high potential for conflict with existing land uses. Zone II represents a buffer between Zone I and Zone III,” (USFWS 1987, V).

The Plan states that it would rely on natural recolonization from Canada as much as possible, noting that the northwest Montana and central Idaho recovery areas were more likely to experience successful natural recolonization than the Greater Yellowstone Area because it is substantially more geographically isolated from the source Canadian wolf population than the other two recovery areas (USFWS 1987). To repopulate the Greater Yellowstone Area with wolves, the Plan states that the USFWS would likely be required to artificially translocate them from Canada following the National Environmental Policy Act (NEPA) process requiring a full public comment period (USFWS 1987). Furthermore, if two breeding pairs were not established in both northwest Montana and central Idaho in 5 years (by 1992), the Plan states that wolf reintroductions would be considered there as well (USFWS 1987).

The reintroduced wolves to the Greater Yellowstone Area would be classified as a “nonessential experimental population” (USFWS 1987). The nonessential experimental designation (sometimes termed the “10(j)” rule) is a clause under the Exceptions Section of the Endangered Species Act that: 1) authorizes the USFWS to artificially translocate populations from outside a designated recovery area if necessary for species recovery within the recovery area and 2) allows the USFWS greater flexibility in managing

artificially translocated populations to mitigate conflict with humans (Endangered Species Act of 1973, USFWS 1987).

To address the risk of increased livestock depredations, the USFWS (1987) outlined the following protocol for response:

“The goal of the control program is to reduce and prevent livestock losses to wolves while removing the minimum number of wolves necessary to resolve the conflict yet still progress toward recovery. Control will include live-capturing and relocating, holding in captivity, or killing the offending animal(s). If initial efforts to trap a problem wolf are unsuccessful and depredation continues, or if transplanted wolves return, lethal control using approved methods may be used,” (V, 25-26).

In this section, the Plan also develops detailed criteria for determining problem wolves (item 371), evaluating the disposition of problem wolves (item 372), techniques and expertise in conducting wolf control (item 373), identifying potential release sites in Zone I management areas in case of the need for relocation from Zone III management areas (item 374), implementing wolf control (item 375), and approving compensation for livestock losses (item 376) (USFWS 1987, 26-27, Appendix A).

The Plan emphasizes the integration of the public to the recovery process through education and cooperation, acknowledging that some interest groups are substantially against wolf recovery (USFWS 1987). It highlights that “Opposition can be reduced, however, by pointing out the Plan’s objectives which are aimed at coordinating wolf management and recovery with other multiple use interests (livestock industry, timber industry, etc.)” (USFWS 1987, 31).

The above is a mere sketch of the Northern Rocky Mountain Wolf Recovery Plan, as it was adopted by the USFWS in 1987. To understand the scope of this recovery effort, it is necessary to now examine what happened when it was put into place on the ground.

Implementation of wolf recovery

By 1991, the progress goal of at least 2 breeding pairs of wolves was exceeded in northwest Montana due to colonization from Canada, but was not met in central Idaho. Congress subsequently authorized the USFWS to complete an Environmental Impact Statement (EIS) to evaluate the impacts of alternatives on wolf reintroductions to the central Idaho and Greater Yellowstone recovery areas, as mandated by the National Environmental Policy Act (Bangs 1994). The Draft EIS public comment period ran from July 1 to November 26 of 1993, and elicited 160,200 comments in total (Bangs 1994). The five alternatives were: “(1) Reintroduction of Experimental Wolves, (2) Natural Recovery (No action), (3) No Wolves, (4) Wolf Management Committee Recommendations, and (5) Reintroduction of Nonexperimental Wolves,” (Bangs 1994). The first alternative, Reintroduction of Experimental Wolves, was selected as the USFWS proposed action and the Secretary of the Interior signed the Record of Decision in June of 1994 (Bangs 1994). Ed Bangs wrote in his summary of the Final Rule in the Federal Register that, “This gray wolf reintroduction does not conflict with existing or anticipated Federal agency actions or traditional public uses of park lands, wilderness areas, or surrounding lands,” (Bangs 1994).

In 1995 and 1996, 66 gray wolves were trapped in British Columbia and Alberta by an interagency team representing both Canadian and United States agencies. Thirty-one of these wolves were released in Yellowstone National Park and the other 35 were released in the wilderness of central Idaho (USFWS et al. 2011, Breck and Meier 2004). The goal of establishing at least 30 breeding pairs across the entire Rocky Mountain recovery area was first met in 2000 (USFWS et al. 2003). The Rocky Mountain Wolf Recovery 2002 Annual Report states that by the end of 2002 at least 633 individual wolves and 43 breeding pairs were documented, marking the third consecutive year that 30 or more breeding pairs of wolves had been observed in the Rocky Mountain West. Wolves met the criteria for delisting from the Federal List of Endangered and Threatened Wildlife by 2002, only 7 years after the Recovery Plan was put into action (USFWS et al. 2003). This was also the first year that no wolves were relocated as a result of livestock depredations because the populations had grown to such a point that previous Zone I release site areas all supported resident packs. Instead, 46 problem wolves were killed in response to 165 confirmed livestock depredations across all three recovery areas (USFWS et al. 2003).

The report states, “As new packs are formed between the original core recovery/release areas, the three populations increasingly resemble and function as a single, large population,” (USFWS et al. 2003). The USFWS (2003) anticipated at this time that the process of delisting the Northern Rocky Mountain wolf could begin as early as 2003, as soon as the states of Wyoming, Idaho, and Montana completed wolf

management plans that would maintain wolf populations in the long term across the region.

The era of contemporary conflict

“The State of Montana recognizes the gray wolf as a native species and will integrate wolves as a valuable part of our wildlife heritage.”

Draft Montana Wolf Conservation Management and Planning Document, prepared in response to the Wolf Advisory Council Recommendations, 2002, i.

The USFWS anticipated that the process of delisting the Northern Rocky Mountain gray wolf would be fraught with conflict and litigation on a national scale, but stated optimistically that wolves could be delisted as soon as 2004 (USFWS et al. 2003). However, biological recovery was not sufficient to convince many stakeholders that delisting wolves would not result in their extinction. On the other hand, other stakeholders fully supported the transfer to state management and greater flexibility with controlling wolves that delisting them would allow. These perspectives became (and continue to be) polarized, and looking closely at them reveals that wolves are not merely wolves in political and societal discussions. Wolves are symbols. They represent a range of human worldviews that are often irreconcilable and the politics of wolf recovery therefore extends far “beyond wolves” themselves (Nie 2003). The Endangered Species Act itself is also symbolic because it not only drives species management, but land management, policy, and economies on both public and private lands (Nie 2003). The

story of the delisting process surrounding wolves in the Northern Rockies, which exemplifies how this range of worldviews affects national policy through the Endangered Species Act, follows. An overview of the symbolic associations surrounding wolves in the Rocky Mountain West follows in Part II of this literature review.

Delisting and litigation

By the end of 2003, Montana, Idaho, and Wyoming had submitted their state management plans to the USFWS for independent peer review (USFWS et al. 2004). The Montana and Idaho plans were each approved as adequate to conserve wolves in each state in the future. However, Wyoming's proposed plan was not approved by the USFWS. Since wolves in the northern Rockies were considered one population under the Endangered Species Act, they could not be delisted in any state if one failed to produce an adequate management plan. Wolves, therefore, remained listed as endangered in all three states, but the USFWS transferred management authority to Montana and Idaho under their state management plans while maintaining federal funding (USFWS et al. 2006).

The legacy of wolf delisting litigation began in late 2007, when a revised Wyoming plan was approved by the USFWS, and all wolves in the Northern Rocky Mountain distinct population segment were removed from the List of Endangered and Threatened Wildlife in February of 2008 (Sime et al. 2011). The delisting rule had received nearly 300,000 public comments from people all around the country during its 90-day public comment period. In April 2008, twelve environmental organizations filed

suit against delisting on the grounds that Wyoming's management plan was actually insufficient to maintain wolf populations (Sime et al. 2011). The plaintiffs' requested injunction was granted on July 18, 2008, and the USFWS revised the delisting rule to delist wolves across the Northern Rocky Mountain Wolf Distinct Population Segment (DPS), except in Wyoming, where endangered nonessential-experimental status would remain in effect until the state could draft an acceptable management plan. The revised delisting status took effect in May of 2009, but was again challenged in court by the same 12 environmental organizations, this time on the grounds that delisting only a portion of the DPS violated the ESA (Sime et al. 2011, *Defenders of Wildlife v. Salazar* 2010). During the period of this litigation, Montana and Idaho held wolf hunts in the fall of 2009 under a state management objective to stabilize the population's growth, but the court ruled in August of 2010 that it was indeed a violation of the ESA to delist wolves in all states but Wyoming. Wolves were subsequently reclassified as endangered under the ESA in the entire Northern Rocky Mountain DPS (Sime et al. 2011).

In April of 2011, Senators John Tester (Democrat, Montana) and Representative Mike Simpson (Republican, Idaho) attached a rider to the must pass Appropriations Act of 2011 to reinstate the May of 2009 rule to delist all wolves in the Northern Rocky Mountain DPS except those in the state of Wyoming (Ashe 2011). President Obama signed the Appropriations Act on April 15 2011, to take effect on May 5, 2011 (Ashe 2011). Since this delisting decision, wolves have been classified in Montana as a species in need of management (Bradley et al. 2014).

This historical and political context of wolf-livestock conflicts in western Montana is necessary for understanding how and why ranchers that experience repeated conflicts may react. Part II of this literature review will further contextualize these conflicts in the process and culture of cow-calf ranching in Montana as it relates to wolves and wolf depredation on cattle.

Part II: Review of Depredations in Montana, Management Tools to Reduce Depredation, and Theories Explaining Why Ranchers May Utilize Certain Tools

This section will first contextualize this project within the annual cow-calf production cycle in Montana, with specific attention to when and where cattle may be more vulnerable to wolves. Then, it will review the literature on the efficacy of management tools to prevent wolf depredations on livestock. Then, it will review existing theories about the national socio-political context that may explain ranchers' symbolic associations with wolves, as well as the human dimensions of wildlife framework that may explain why ranchers respond in certain ways to conflicts with wolves. It will conclude with an identification of gaps in the literature and an explanation of how this research contributes to the body of knowledge addressing wolf depredation on domestic cattle in the West.

Management tools for addressing wolf depredations on cattle

Management tools to address wolf depredations on cattle fall into two categories in the literature: lethal and non-lethal (Bangs et al. 2006).

Lethal control of problem wolves is widely accepted as critical for wolf management because it maintains social tolerance for the species over the long term and may reduce illegal killing (Shvik 2006, Bangs et al. 2006, 2009, Sime et al. 2007). Non-discriminate lethal management of wolves (i.e. regulated public hunting seasons) is also considered important to maintain social tolerance, although some research suggests that it may have unintended consequences that could increase livestock depredations by destabilizing wolf pack social dynamics (Treves 2009, Wielgus and Peebles 2014).

Lethal management of problem wolves was initiated by the USFWS upon wolf reintroduction to Central Idaho and Yellowstone National Park, with the goal of balancing wolf restoration objectives with minimizing damages to producers (USFWS 1987, Sime et al. 2007, Bangs et al. 2009). In the early years following reintroduction, wolves that preyed on domestic livestock were initially collared and released or relocated; if they depredated again, a few wolves were removed from the pack. Only if a pack was found responsible for livestock deaths multiple times was the whole pack removed (USFWS 1987, Bangs et al. 2009). Over time as wolf populations increased, the USFWS transferred authority for deciding how to implement lethal control to the states and tribes, and liberalized livestock producers' ability to remove problem wolves (Sime et al. 2007, Bangs et al. 2009). As of 2014 under Montana Senate Bill 200, Montana

livestock producers are authorized to kill up to 100 wolves per year on private land that they believe are threatening their livestock (Montana State Senate 2013).

Wolves' probability for preying on cattle is likely determined by a combination of environmental variables such as elk presence, vegetation cover (that may increase wolves' hiding capacity), terrain, and cattle distance from human development or activity as well as variations in individual wolf and wolf pack behavior (Bradley and Pletscher 2005, Muhly et al. 2010). The literature about lethal control largely suggests that removing problem wolves can reduce depredations in the short term but may not adequately address long term losses (Bradley 2004, Bradley and Pletscher 2005, Musiani et al. 2005). For example, if a depredating pack is removed, a new pack may colonize the open territory and begin killing cattle as soon as the next season. The converse may also occur: if a depredating pack is removed a new pack may colonize the open territory and never prey on cattle. However, the literature suggests a cycle of depredation, wolf removal, wolf colonization, and depredation may occur if producers and managers solely rely on lethal control of problem wolves (Bangs et al. 2006, Bradley 2004, Musiani et al. 2005, Muhly et al. 2010). This situation represents a worst case scenario amongst the diverse stakeholders of wolf conservation, whereby livestock producers continually suffer economic losses and wolves are continually killed (Bangs et al. 2006).

Because lethal control is expensive, time consuming, and may or may not be an effective long-term solution, the literature broadly recommends a combination of lethal and non-lethal methods to prevent wolf depredations on cattle (Bangs et al. 2006, Shvik 2006, Sime et al. 2007, Wielgus and Peebles 2014). Non-lethal methods have varied over

the course of wolf recovery from wolf-behavior focused methods to livestock and producer focused methods. As the wolf population has expanded, methods that focus on changing wolf behavior have waned due to the sheer number of wolves on the landscape and the inherent unpredictability of their behavior. Therefore, for the purposes of this project, producer-focused non-lethal methods are most relevant as they can be controlled by managers and producers, while wolf behavior cannot. I limit this discussion to those non-lethal methods that the ranchers I interviewed were utilizing or critiquing. It should be noted that each non-lethal method discussed here was utilized or recommended by the USFWS during the period of wolf recovery to help ranchers deter wolves from preying on cattle (Bangs et al. 2006). There are numerous cost-share programs throughout the Northern Rockies to help ranchers offset the costs of implementing non-lethal tools if they are interested in doing so.

Fencing

Bangs et al. (2006) describe the clear benefit of fencing. Especially if electrified, fencing prevents wolves from accessing cattle and contains cattle in an area where they can be better protected. However, electric fences that successfully deter wolves are expensive to purchase and require expertise to install correctly and routine maintenance to ensure continued functioning. Furthermore, a permanent electric fence can only be constructed around a relatively small area such as a calving yard and therefore is not a feasible solution to rangeland depredations (Bangs et al. 2006). Keeping cattle confined

for longer periods to protect them from wolves can also increase disease incidence and fatalities (Bangs et al. 2006).

Fladry

Fladry is a single strand wire, often electrified, strung with bright flags that frighten wolves. While it is no substitute for a permanent electric fence, wolves' fear of it may render it as effective for excluding them as a permanent fence for a period of time (Bangs et al. 2006, Musiani et al. 2003). However, wolves become habituated to it within 60 days and it is no longer effective because they can easily pass over or under the wire (Bangs et al. 2006, Shvik 2006). The literature broadly suggests that fladry is beneficial to managers and producers because it is easy to erect and portable, allowing a quick response to protect cattle during depredation cycles (Bangs et al. 2006, Stone 2011). However, it is not recommended as a permanent solution due to its temporary effect on wolves and need for constant maintenance (Bangs et al. 2006).

Livestock protection dogs (LPDs)

LPDs are most broadly used to protect sheep from wolves in the Northern Rockies, and were imported from European stock by an organized program in the 1970s for this purpose (Bangs et al. 2006, Shvik 2006, Urbigkit and Urbigkit 2010). The efficacy of LPDs for protecting cattle has been suggested (Andelt 2004), but needs further research. Breeds were developed in Europe over centuries specifically to protect livestock from wolves; dogs bond with livestock and instinctually guard them, chase and

fight wolves in the area, and alert producers to problems (Bangs et al. 2006). LPDs, while effective, are another animal for livestock producers to steward and they can be difficult to handle and expensive to purchase and maintain (Bangs et al. 2006, Urbigkit and Urbigkit 2010). Further, wolves may seek out and destroy LPDs (Urbigkit and Urbigkit 2010, Marlow 2012). The literature therefore recommends multiple dogs to reduce the likelihood that wolves will kill them, but this represents a higher cost of time and money for producers to maintain multiple large dogs (Bangs et al. 2006). Research is currently underway to better understand LPD interactions with wolves in order to increase their efficacy as a preventative tool (Marlow 2012, Young 2013).

Range riders

The literature broadly suggests that increased human presence, whether in calving areas or out on range, is an extremely effective deterrent of wolves because they naturally avoid humans (Musiani et al. 2010, Bangs et al. 2006). The literature therefore suggests increasing human presence, whenever possible. However, the magnitude of presence necessary to effectively prevent depredations may be higher than most producers are capable of providing due to other duties they are responsible for to keep their ranches running (Bangs et al. 2006). There have been numerous programs to externally fund range riders to increase human presence on the range, which may end up costing more than they can save a rancher because cattle are so spread out on the range that riders rarely prevent losses (Bangs et al. 2006). However, riders may be more likely to find dead livestock soon enough to have WS confirm the kill for compensation (Bangs et al.

2006). While the success of range riding is inherently difficult to measure, the literature suggests programs that integrate wolf management with increased range riding may be the most effective at actually preventing attacks. These programs utilize wolf radio telemetry information, where available, to prioritize range riding efforts in areas where wolf packs and range cattle overlap and require partnerships between agencies and livestock producers (Bangs et al. 2006, Wilson, personal communication, September 11th, 2015).

Carcass removal

While some sources suggest the relationship between wolves scavenging dead cattle and depredating on live cattle is unclear (Bradley and Pletscher 2005, Mech et al. 2000), carcasses may draw wolves into an area where they are more likely to encounter live animals. Removing carcasses removes the attractant, and has been suggested to be an effective strategy at reducing the risk of livestock loss to both wolves and grizzly bears throughout Montana and Alberta (Wilson et al. 2006, Morehouse and Boyce 2011, Chavez and Gese 2006, Northrup and Boyce 2012, Wilson et al. 2014). Several carcass removal programs have been initiated throughout the study area, with broad producer support (Wilson 2011, Wilson et al 2014).

Evaluating the efficacy of tools for preventing depredation

Shvik (2006) outlines three parameters for evaluating the effectiveness of management tools: biological efficiency, economic efficiency, and psychological assuagement. Biological efficiency addresses whether the tool actually works for preventing depredation and economic efficiency addresses whether it is actually practical for producers or managers to implement in terms of money, time, or expertise (Shvik 2006). While these two parameters are paramount to understanding objectively what works and what doesn't for protecting cattle from wolves, they are inherently difficult to quantify because of confounding variables in each depredation situation (Bangs et al. 2006). The third parameter, psychological assuagement, may be the most critical in ensuring implementation (Shvik 2006). Because human relationships with large carnivores are extremely complex, the biological and economic efficiency of any given tool must be evaluated in the context of the community's and individual's perspectives on wolves and wolf management (Shvik 2006). These perspectives, in turn, may influence livestock producers' evaluations of lethal and non-lethal management tools themselves (Shvik 2006). Producers' willingness to implement certain tools may follow from this progression of evaluations.

Martin Nie (2003), in *Beyond Wolves: The Politics of Wolf Recovery and Management*, offers a review of the historical, social, political, and economic symbolic associations and conflicts that have so classically come to embody the national wolf debate. He draws attention to the "politics of place", and the way people conceptualize

the Rocky Mountain West in terms of its historical context, to highlight that wolves have come to symbolize the competing viewpoints of those who identify with the Old West and those who identify with a New West. The Old West, and its highly symbolic ranching culture, was literally founded upon the government sanctioned eradication of wolves from the landscape, and the now government sanction restoration of wolves back to the landscape subverts the ranching industry's historical values and sense of national support (Nie 2003). On the other hand, the Intermountain West has transformed over the last half century through an increase in urban residents that generally see intrinsic value in wolves e.g. as important symbols of the untamed wild (Nie 2003). Furthermore, wolves symbolically embody the change in the political-economic context of the Intermountain West that has paralleled the change in its social makeup:

“For opponents...wolves represent yet one more nail in the coffin, symbolizing what little regard urban residents have for the people and communities that provide them their lumber, beef, and fleece jackets. Put simply, while many urban citizens in the region see the return of wolves as an asset, many rural citizens and ranchers see them as a real symbolic threat to rural communities and their economic viability...the perceived importance of resource-based industry in the area often leads these communities to assume that ecological protection and economic well-being are incompatible goals,” (Nie 2003, 132).

Rasker and Hackman (1996) conducted an economic analysis of large carnivore conservation's impact on rural economies, suggesting that the protection of wilderness and the preservation of natural resources that this entails may stimulate economic growth in some areas. Furthermore, wolf depredations on livestock are not impacting enough to put an end to the ranching industry itself (Nie 2003, Muhly and Musiani 2009). However,

Nie (2003) suggests that these types of analyses will not assuage rural concerns because their symbolic associations run deeper, as do those of the New Westerners. What is at stake is the character of western ranching economy itself, which the New Westerners increasingly conceptualize as an outdated form of extractive economy that a more progressive recreation economy should replace (Nie 2003). In other words, the ranching economy is seen as obsolete and therefore should not dictate the presence or absence of wolves in the region. The assumptive undertone here is that ranching is finished, the Old West is gone, and the return of the wolf is the symbol of its demise to both those who mourn it and those who celebrate it (Nie 2003).

Scarce (1998), in a study titled “What do wolves mean? Conflicting social constructions of *Canis lupus* in ‘bordertown,’” contributes valuable insight to the relationship between wolves and the ranching identity. Through a careful analysis of data that emerged from qualitative interviews with residents, including ranchers, of the communities immediately bordering Yellowstone National Park following the 1995 wolf reintroduction, Scarce (1998) provides a case study of the symbolism people associate with wolves. He distinguishes between what it means to “earn a living” versus “make a living” for ranching communities, a theme that continually arose during his interviews. Earning a living is simply financial support, but making a life is what ranchers do. It is creating a life. They invest more than cash in their work, they invest their whole lives and whole generations in it. Being forced to sell may make them millionaires, but they lose the life they created, or their parents or grandparents created. Oftentimes, to the rancher and his or her family, that life is worth so much more than millions of dollars (Scarce

1998). It is priceless, because it is who they are. Viewed in this context, it is understandable that wolf depredation causes such anxiety. The wolf threatens ranchers' livelihoods and lifestyles directly, through the killing event, and symbolically, through the federal reintroduction and associated interests that openly question the ranching community's right to the land. These forces cause ranchers to imbue wolves with far greater perceived power than any individual animal could wield (Scarce 1998, Nie 2003).

Scarce (1998) also distinguishes between the concepts of control/ power and self-determination/ freedom. All of his interviewees mentioned one or both of these concepts during conversations about wolves. Control/ power is something that an "other" possesses or exercises over an individual or group, and represents repression, the "other" directing the individual or group's action. Self-determination/ freedom, on the other hand, are possessed and exercised by the individual or group, and represent their ability to act of their own volition. The concepts are often relational in society, where one group exercising self-determination may exercise control over an "other", and Scarce (1998) importantly extends this conceptual spectrum to include non-humans as possible "others". So, as per his example, the Endangered Species Act creates control over human activities so that animals may exercise freedom. His interviewees expressed widespread concern about the federal impression of control over the local communities, essentially stripping communities of the freedom to defend themselves in favor of the freedom of wolves to potentially kill livestock, or roam unencumbered by human activity or resource extraction on public lands. To put it simply, "Government becomes the conniving, mythical wolf of the *Little Red Riding Hood* and *Peter and the Wolf* stories, and the

wolves that the government reintroduced are constructed as bureaucrats' vehicles to limit residents' self-determination by controlling their lifestyles and livelihoods" (Scarce 1998, 39).

It is important here to define what "ranching community" means by distinguishing between corporate ranches and family-owned ranches. Nie (2003) cites a *San Jose Mercury News* study that found large-scale corporate ranching operations to be increasingly dominating public rangelands. Much of the urban pro-wolf New West portrayal of ranchers is informed by the political actions taken by these corporate ranching interests. Therefore:

"As in farming with its chasm between the family and corporate farm, the ranching industry is undergoing the same type of economic concentration: more cows on public lands are being managed by fewer ranchers. These trends only compound the difficulties of managing wolves and endangered species on public lands throughout the West. *Imagine the challenges facing the modern-day family rancher: drought, mountains of debt, low beef prices, crashing Asian markets, finicky American consumers, and now wolves. To make matters even more frustrating, the family rancher finds himself battling perceptions of the welfare Rolex rancher, his fate (and grazing fees) lumped together with others found on the Fortune 500 list,*" (Nie 2003, 52, emphasis mine).

The United States livestock industry is increasingly undergoing both horizontal and vertical corporate consolidation. For example, family owned beef cow-calf operations with fewer than 50 reproducing cows comprise nearly 80% of cow-calf operations in the United States. However, these operations only represent 30% of the industry's total reproducing cows. The remaining 70% of reproducing cows are owned by much larger, often corporate cow-calf operations (Havstad et al. 2007). With the industry

dominated by large-scale producers, and the worldwide demand for beef on the rise, the margin for error for family owned operations is getting smaller (Havstad et al. 2007, Tilman et al. 2002). These operations are therefore increasingly stressed by environmental sources of loss to their herds, including depredation by wolves. Environmental stresses, combined with an aging producer demographic and low family succession levels, low profit margins, and other hardships may cause ranchers to sell their land on the lucrative development market (Muhly and Musiani 2009). Land conversion of rangelands is a rising threat to both biodiversity conservation and provisioning ecosystem services. In fact, loss of beneficial grazing on rangelands to development has replaced habitat degradation due to overgrazing as the primary conservation concern on rangelands in the western U. S. (Havstad et al. 2007). Muhly and Musiani (2009), among others, characterize livestock production as a positive externality for wolf conservation because it maintains open space and interconnected habitat that would otherwise be fragmented by development. Ranchers who experience repeated depredations may be more vulnerable to these stresses that push producers to sell their land.

Furthermore, corporate ranchers are largely not those whose families settled the West more than a century ago. The ranchers whose families settled the West a century ago are the family ranchers, and these ranchers collectively constitute the “ranching community”. They are negatively impacted by the consolidation of the ranching industry into corporate hands and they are misunderstood by urban environmental interests as contributing to that consolidation and its disregard for the western environment (Nie 2003). It is not difficult to see why the ranching community so opposes wolves: their

community was founded upon wolf eradication, their margin for economic error has become increasingly thinner due to capitalist corporate forces beyond their control, and wolf depredation therefore constitutes a greater and greater threat to their livelihoods. Furthermore, they perceive many environmental campaigns to consider them a disposable barrier to wolves' survival. The wolf running across the ranchers' pastures is a tangible symbol of everything pitted against them (Nie 2003).

Manfredo (2009) suggests a methodological theory within the "Human Dimensions of Wildlife" discipline that may explain how people respond to wildlife interactions by inquiring why they respond in certain ways. Human dimensions of wildlife emerged from cognitive social psychology to explain how human attitudes, norms, and values influence human behavior towards human-wildlife conflicts (Manfredo 2009). However, until recently, the role that emotions play in affecting behavior was underrepresented, mainly due to the methodological difficulties of measuring emotional response quantitatively. Manfredo (2009) has synthesized existing theories from evolutionary biology and cognitive psychology to explain how emotional and cognitive processes drive human behavior toward human-wildlife conflicts. The resulting framework posits that human decision-making processes and resulting actions are a product of: 1) an individual's initial emotive processing of a phenomenon, and 2) an individual's sustained in-depth cognitive processing of a phenomenon. The initial emotional processing affects the sustained cognitive processing to direct behavior (Manfredo 2009). Further, both intrinsic (personal) norms and values that are formed through personal history and experiences, and extrinsic (societal) norms and values

combine to influence each individual's unique emotional and cognitive processing of phenomena (Manfredo 2009). Therefore, personal experiences and cultural milieu may drive each rancher's emotional reaction to depredation events and his or her subsequent evaluations of management strategies' effectiveness. Nie (2003), Lopez (1978), and Scarce (1998), outlined above, theorize that the cultural milieu underpinning ranchers' perspectives on wolves and wolf management in the West is rooted far beyond wolves as the animals they are. Their frameworks explaining wolves as symbols of governmental control and the evolution of power in the West may significantly impact ranchers' evaluations of management strategies in the context of a changing economic climate, as Shvik (2006) suggests with his psychological assuagement parameter to determine effectiveness of tools. Combining Shvik (2006), Nie (2003), Lopez (1978), and Scarce (2006) suggests ranchers' perceptions on the available tools' effectiveness should be evaluated in the larger context of wolf symbolism that may influence cultural norms about available tools.

As wolf populations have expanded and now occupy the NRM recovery area broadly, wolf conflicts with livestock are more prevalent than at the time of the reintroduction (Sommers et al. 2010). Due to concurrent reductions in federal funding and broader demand for funding, producers must now incur the costs of protecting their cattle from wolves more than ever. Bangs et al. (2006) evaluated management tools throughout the wolf recovery period from 1995-2005 and found that the variation amongst depredations precluded any scientific analysis of how effective tools actually were. It therefore is exceedingly important to assess how producers perceive tools'

effectiveness in order to both broaden implementation and evaluate true efficacy in the future. Monetarily, the livestock industry at large does not suffer due to wolves, with wolf depredations only accounting for <0.01% of the annual gross income of ranches in Idaho, Montana, and Wyoming, but depredations are not evenly distributed amongst producers (Muhly and Musiani 2009). Depredations often occur in “hot spots”, where a small percentage of producers disproportionately bears the cost of wolf conservation in the form of cattle losses (Bangs et al. 2006, Muhly and Musiani 2009). Because these ranchers are experiencing the depredations, it is critical to understand their cognitive processes of implementation in order to prioritize measures to reduce incidents. There is no research that specifically addresses how those ranchers who have suffered the highest level of conflicts over time perceive the available tools’ efficacy. Therefore, this project assessed what tools ranchers who have had repeated depredations have adopted to prevent further depredations, as well as how they perceived tools’ efficacy based on biological effectiveness, economic efficiency, and cultural assuagement. How ranchers perceived wolves and wolf management inevitably emerged from this inquiry, allowing me to analyze how those perspectives, emerging from their individual experience and social and economic milieu, influenced ranchers’ evaluations of management tools for preventing depredations by minimizing risk.

METHODS

I sought to better understand the practical methods that ranchers in western Montana are using to adapt to wolf depredation, as well as the social, political, and economic forces that may influence why they adapt in certain ways. Adaptive management approaches included available non-lethal ranch management practices, non-lethal innovations, and various forms of lethal control to remove problem wolves. This research was therefore a case study of ranchers' reactions to losing cattle to wolves with the objective of identifying what practices ranchers perceive as effective in order to recommend practical approaches that ranchers, resource managers, and funders can take to effectively mitigate depredation.

To guide this study through its design, implementation and analysis, I chose a theoretical framework that conceptualizes both the cultural and individual processes that drive human responses to wildlife. Further, my research questions targeted not only the facts concerning how ranchers are adapting to wolf depredation, but also the value-driven and perspective-oriented reasons that they make certain decisions. To draw out the most pertinent data to inform these research questions, I chose a qualitative and inductive methodological approach with semi-structured, in depth interviews as my method. This qualitative approach allowed me to deeply explore the experiences that ranchers had with wolves and wolf depredations, and how those experiences combined with other social and economic factors to influence ranchers' perspectives on wolves and their actions to protect their cattle. This chapter first describes cow-calf operations in the study area and

discusses wolf depredation rates in the study area. Then, it develops the theoretical framework and methodological approach before describing the research methods in detail. It concludes with a brief analysis of possible outcomes according to what the current academic and popular literature suggests.

Overview of Cow-Calf and Yearling Operations in Western Montana

Ranching in western Montana, in general, follows the following annual schedule for cow-calf or yearling operations: Calving, range grazing, haying, roundup, and sale. Calving typically occurs at the home ranch, where ranchers feed cattle hay through the winter in a contained area and can regularly attend laboring cows and newborns to ensure survival. Calving generally occurs from February through April/May, depending on the operation. With winter weather often extending into the spring months, winter calves may be more vulnerable due to environmental stress. However, ranchers calve early in the year to ensure more time for calves to gain weight before sale at the end of the year. Some ranches have pushed calving back into the spring months, April – June, based on the argument that less environmental stress on the calves will result in more vigorous growth in less time. It is beyond the scope of this project to evaluate these relationships, but I point out the differences to illustrate vulnerability to depredation. Winter calves are vulnerable because they are stressed by the elements and may provide easy prey to wolves. Spring calves may also be vulnerable because their births coincide with the wolf denning season, when wolf packs experience rapid, increased energy requirements with

4-6 new, growing members of the pack (Musiani et al. 2005). Close proximity of a calving area to a wolf den may exaggerate this effect, and make younger calves out on summer range more vulnerable to wolf depredation (Oakleaf et al. 2003). Yearling operations, which hold calves over for sale the year following their births to further maximize weight gain, may calve even later into the summer. Therefore, first year calves intended for sale as yearlings are significantly smaller than other calves for the remainder of their first year and may be more vulnerable as a result.

Range grazing occurs generally from early June through late October, when cattle can utilize the year's succulent vegetation for feed. Depending on the ranch, cattle may range directly from the calving area or they may be driven or transported by trailer to an area much farther away on either private or public land. Cow-calf pairs are turned out to range together, while yearlings are weaned before being turned out to range in their second year because their mothers have often given birth to a new calf. Summer pastures are significantly larger than calving areas in order to ensure enough feed for the number of cattle, usually covering several thousand to hundreds of thousands of acres with cattle scattered throughout in small bands. Bulls are usually turned out with cows for a period of time that varies from the end of calving season to the start of the range season, depending on the operation and the goal for calving timing the following year. Yearling cattle range in yearling groups, sometimes mixed with cow-calf pairs. Despite their adult size, yearlings may be vulnerable to wolves because they are inexperienced and have been recently removed from their mothers' protection (Muhly 2009).

While the calving season brings a high percentage of cattle depredation by wolves in Montana, a second peak of depredation occurs in August-September (Bradley et al. 2014). This is the most stressful time of the year for wolves because pups are large and have high energy requirements but are still dependent on the pack unit for food (Musiani et al. 2005, Fritts et al. 2003). Further, the wolf numbers within individual packs are at an annual high and packs are still concentrated around pup rendezvous sites. Packs may therefore need to make more kills, more frequently than at other times of the year (Musiani et al. 2005). Where wolves coincide with cattle on remote summer range during this high stress period, they may be more likely to prey on cattle (Musiani et al. 2005, Oakleaf et al. 2003). Oakleaf et al. (2003) found that calves were four times more vulnerable to wolf predation out on summer grazing range for every month younger they were than their other cohorts. Muhly et al. (2010) tested environmental predictors of wolf depredations in Alberta, Canada and found that wolf depredations were more likely to occur closer to forest cover, on flatter slopes, and also closer to ranch buildings, further from roads, and in areas with higher elk density. Bradley and Pletcher (2005) also found that depredations were more likely to occur in areas with higher elk density and more vegetative cover, but in larger herds that were farther from buildings.

When cattle range on private ground, it is largely at the landowner's discretion to manage the grazing. Public grazing allotments on federal land managed by the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS), however, require ranchers to comply with grazing standards designed to minimize negative resource impacts and ensure forage sustainability. In a grazing allotment permit, ranchers are

issued site-specific measures to determine adequate range conditions, such as percent ground cover and percent riparian vegetation, and techniques for maintaining these conditions, such as resting pastures or allotments to allow for critical growth or range recovery (Bureau of Land Management 2014). Term Grazing Permits are issued for up to ten years and are renewable depending on the lessee's compliance with the terms and conditions outlined in the permit (Bureau of Land Management 2014). Because public grazing allotments can be quite large and often encompass several ranches' permitted grazing areas, ranchers are authorized to jointly manage their herds on the resource in grazing associations in order to share costs associated with range improvements and managing cattle distribution (Code of Federal Regulations 2014). While the majority of confirmed wolf depredations on cattle consistently occurs on private land, there may be significant observer bias due to the higher likelihood that depredations will be detected on private land than on remote public grazing allotments. The magnitude of undetected loss on grazing allotments has not been quantified (Bradley et al. 2014).

While ranchers take advantage of range feed as much as possible, cattle in western Montana can be dependent on hay for 6 months of the year, from November thru April. While cattle are out on summer range, ranchers typically cut and bale hay on their home ranches to prepare winter feed for their herds. If ranchers do not have access to sufficient grass to make hay to sustain the herd through winter, they must purchase winter feed from an outside source.

Ranchers in western Montana roundup their cattle to transfer them from rangeland back to the home ranch from October – November to prepare for sale. In cow-calf

operations, calves are typically weaned from their mothers during this time. Weaning times vary for calves intended to remain on the ranch through the winter as yearlings, but weaning is completed before the next calving season. Cattle are priced per pound based on “liveweights” at the time of sale. Prices are largely dictated by the relationship between supply and demand within the national beef economy, and further negotiated between a rancher and a buyer based on projected animal quality (Meyer 1997). On the sale date, calves, yearlings, and other animals designated for sale (such as unbred cows that a rancher cannot afford to feed through the winter without the payoff of a calf) are weighed and sold. The large portion of ranchers in western Montana sell their cattle to feedlot buyers in the Midwest, who fatten the cattle on grain feed before selling them to packing plants for slaughter, packing, and retail (Meyer 1997). The income gained from these November sales is the main revenue source for cow-calf and yearling producers in the state. During the course of this project, cattle prices rose from roughly 90 cents per pound in 2008 to roughly \$1.25 per pound in 2012 and have continued to rise (Trading Charts 2014).

Wolf Depredations on Cattle in Western Montana

When a rancher experiences a suspected depredation due to wolves, USDA Wildlife Services must examine the carcass and the scene to confirm the cause of death. If a WS agent confirms that wolves are responsible for the kill, the rancher is eligible for compensation through the Montana Livestock Loss Board (MLLB). The MLLB functions

under the Department of Livestock and is composed of 3 wildlife professionals and 3 livestock professionals to ensure both conservation and livestock industry concerns are represented. If a WS agent determines there is not significant evidence to confirm that wolves are responsible for the kill, the rancher is not eligible for compensation. WS confirms roughly 50% of complaints in Montana as wolf depredations (Bradley et al. 2014).

In Montana and throughout the remainder of the NRM gray wolf recovery area, depredations follow a bi-annual pulse, with the majority of depredations occurring in the spring and fall during calving and late season wolf pup rearing, respectively (Bradley et al. 2014, Musiani et al. 2005). Confirmed depredations throughout Montana peaked in 2009 and then steadily declined, with 2013 marking the lowest number of depredations in seven years (Bradley et al. 2014).

Depredation trends within the study population of ranchers who had confirmed kills and applied for compensation from the MLLB follow the statewide trends. From 2008-2012, 155 ranchers experienced a total of 396 depredations with the peak occurring in 2009 (Figure 1). On average through the five year period, these ranchers lost a total of 2.6 cattle to wolves (Figure 2).

The ranchers sampled for this project are a subset of the overall population of ranchers who had confirmed kills and applied for compensation from the MLLB. From 2008-2012, the 18 ranchers that participated in this study experienced a total of 128 confirmed wolf depredations, with a peak of 14 ranchers losing 38 cattle in 2009 (Figure 3). On average through the five year period, sampled ranchers lost a total of 7.1 cattle to

wolves, significantly higher than the total population of ranchers who had experienced any level of depredation (Figure 4). Figure 5 depicts the total number of losses for each rancher in the study.

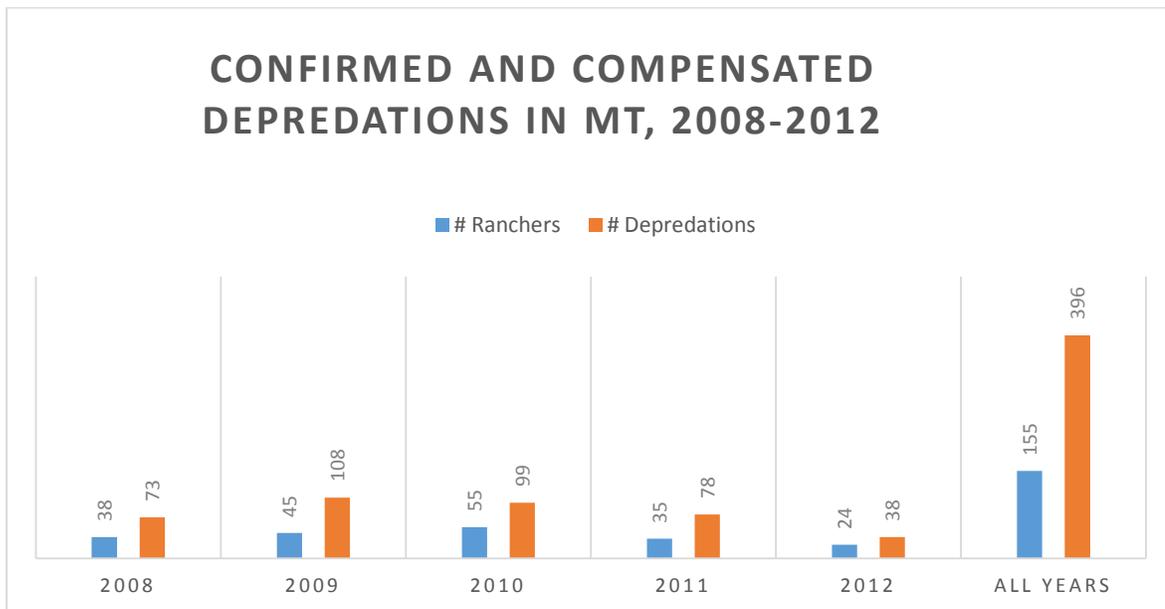


Figure 1: Confirmed and Compensated Depredations in Montana from 2008-2012.

Source: Montana Livestock Loss Board Database of Confirmed Losses.

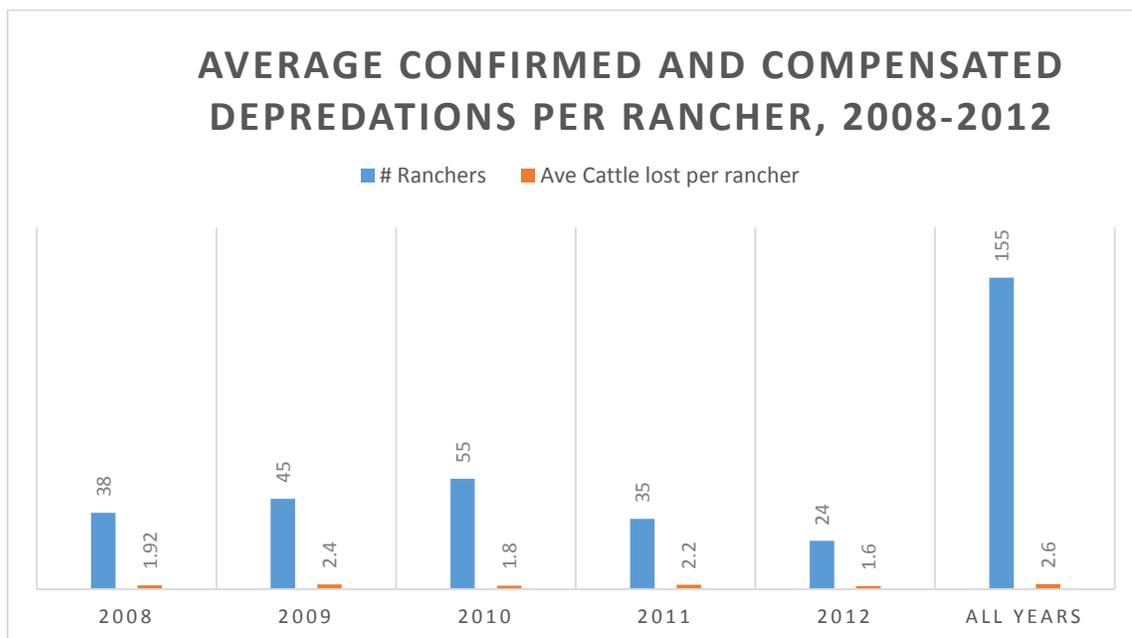


Figure 2: Average Confirmed and Compensated Depredations per Rancher from 2008-2012. Source: Montana Livestock Loss Board Database of Confirmed Losses.

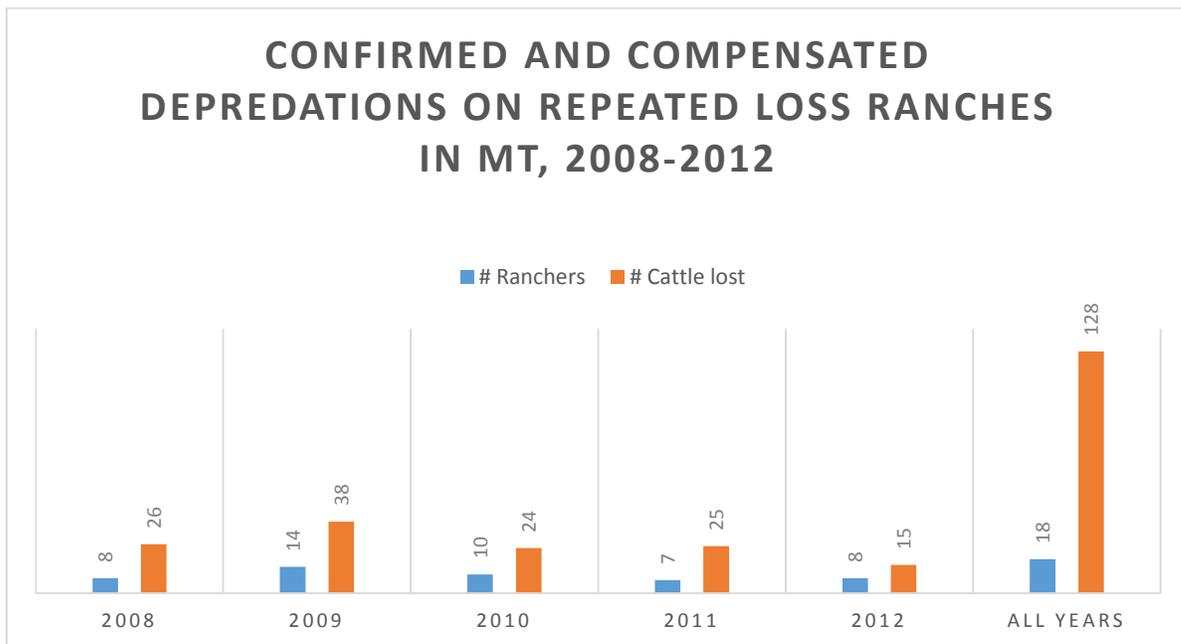


Figure 3: Confirmed and Compensated Depredations on Repeated Loss Ranches in MT, 2008-2012, Source: Montana Livestock Loss Board Database of Confirmed Losses.

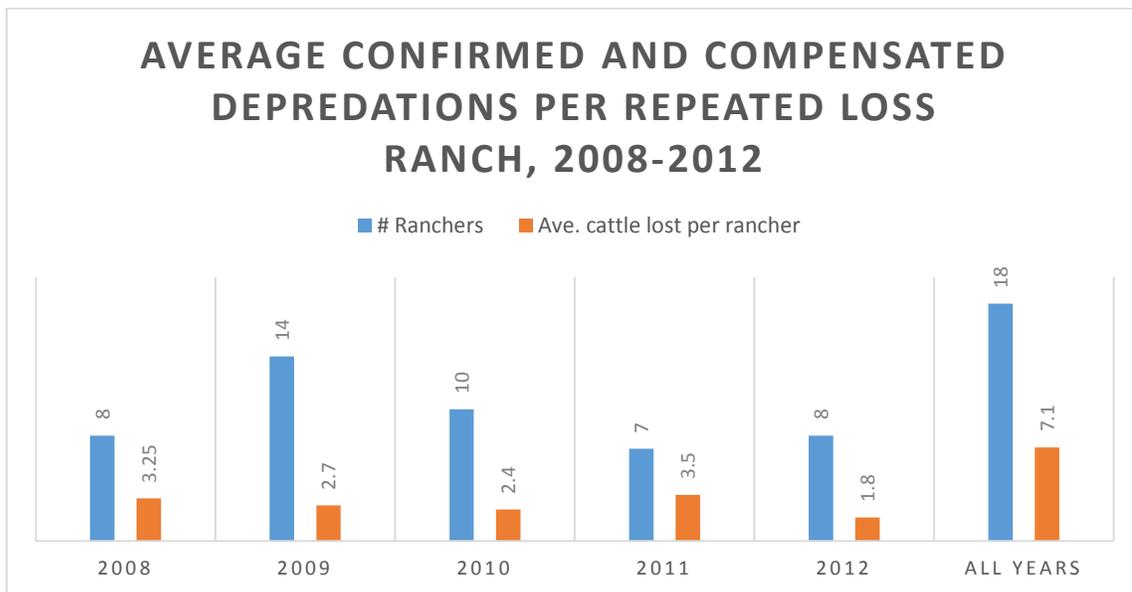


Figure 4: Average Confirmed and Compensated Depredations per Repeated Loss Ranch from 2008-2012. Source: Montana Livestock Loss Board Database of Confirmed Losses.

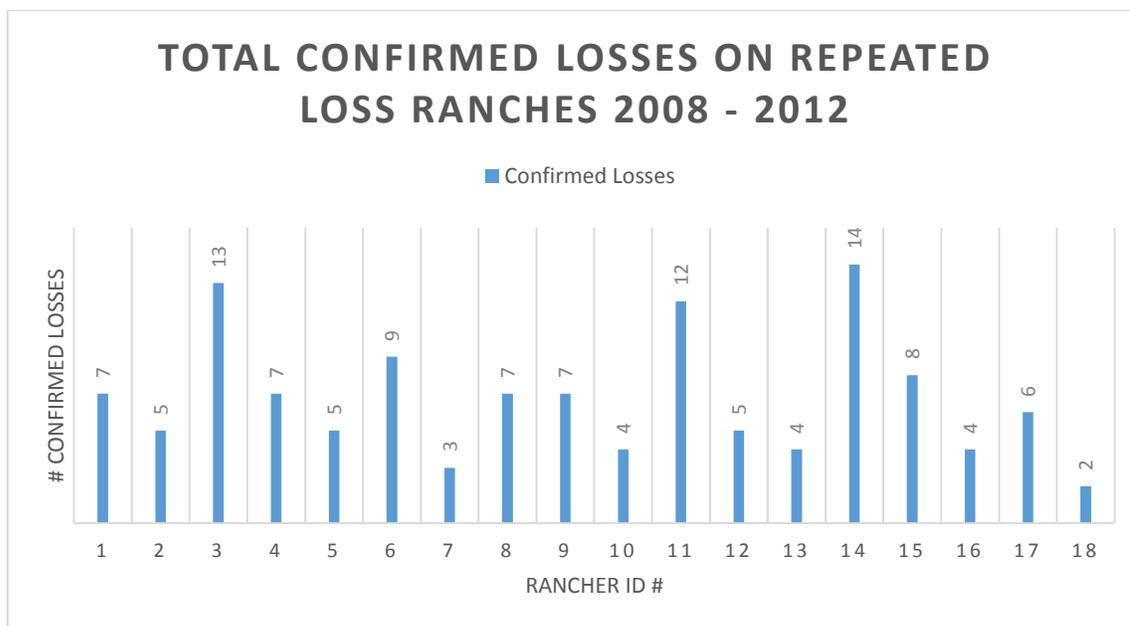


Figure 5: Total Confirmed Losses on Repeated Loss Ranches from 2008 - 2012. Source: Montana Livestock Loss Board Database of Confirmed Losses.

Theoretical Framework

This research utilized a modified human dimensions of wildlife (HDW) theoretical framework to guide project implementation (Manfredo 2009). Data analysis followed this framework while incorporating the theory developed by Shvik (2006) suggesting that ranchers may evaluate tools based on biological effectiveness, economic efficiency, and psychological assuagement. Initially, my hypothesis based on the HDW framework alone was that personal and societal pressures may drive each rancher's

emotional reaction to a depredation event and his or her subsequent cognitive decision to adopt a certain management strategy.

A breakdown of the variables that were used to guide data collection is as follows: Independent causal variables are extrinsic and intrinsic norms and values. Extrinsic (societal) norms and values affect ranchers' decisions on two societal levels: First, the larger western ranching identity and cultural community with roots in the historical and contemporary processes described in Chapter 2. Because this is the culture with which ranchers identify, however loosely or exactly, culturally normative beliefs and values may suggest "appropriate" emotive and cognitive reactions to an experience (Manfredo 2009). The larger western ranching identity and cultural community is generally individualistic, values freedom, private property and family ties, distrusts government regulation, and considers wolves as threats to livelihoods (Nie 2003). The second set of extrinsic variables I considered in designing the data collection instrument were circumstantial factors within a rancher's immediate community. Circumstantial factors that I anticipated encountering included whether the surrounding area was a "boundary" community, i.e. located adjacent to the Yellowstone National Park wolf reintroduction site or whether the study area included a community-driven infrastructure for managing wildlife conflict in the form of a watershed or ranchlands group.

Intrinsic (personal) processes that I expected could affect ranchers' decisions included: a rancher's generational history and past and present family members' experiences and stories of the land, ranching, wildlife, wolves, and wolf depredation; a

rancher's personal life history and direct experiences of the land, ranching, wildlife, wolves, and wolf depredation; and a rancher's personal norms and values.

I expected my dependent variables to be a rancher's initial emotional response to the depredation event, followed by a rancher's cognitive rational response to adapting to the problem of depredation. I considered the adoption of a particular management strategy (how ranchers are adapting) as the ultimate dependent variable, but I included the emotional and cognitive variables in order to elucidate the decision-making process itself (why ranchers are adapting in certain ways).

Methodological Approach

Social science approaches to researching human dimensions of wildlife (HDW) and human wildlife conflicts (HWC) are well established (Manfredo 2009, Treves 2010, Torkar et al. 2011). The most systematized methodologies are largely surveys designed to test attitudes, norms, values and behavior, which are analyzed quantitatively (Manfredo 2009). Qualitative approaches to explore attitudes, norms, values and behavior, on the other hand, are increasingly recognized as important to human dimensions research for their ability to elucidate interviewees' unique experiences and actions based upon their underlying perspectives and ideologies (Torkar et al. 2011, Goldman et al. 2010). I delineated the study population as ranchers in western Montana who have had confirmed losses to wolves and received compensation from the Montana Livestock Loss Board. Because this population generally shares cultural experiences and values, qualitative

methods draw out richer nuances than quantitative survey methods alone (Torkar et al. 2011).

As the modified HDW framework suggests, emotional and cognitive decision-making processes as well as personal (intrinsic) and societal (extrinsic) interactions may influence the actions people take in response to human-wildlife conflicts (Manfredo 2009, Treves 2009). Human-wildlife conflicts are often defined as interactions between humans and wildlife that result in damage to one or both parties (Conover 2002, Manfredo 2009). However, disagreement exists within the literature about whether this definition adequately represents the human monetary interests that underlie the conflicts (Redpath et al. 2014). Therefore, I focused specifically on livestock depredation, which implies monetary loss.

I chose a qualitative ethnographic methodology to aid my understanding of ranchers' decision-making processes. Ethnographic research emphasizes the informants as the experts in the experience and knowledge that the researcher wishes to learn about (Scarce 1998). A qualitative, ethnographic methodological approach was therefore appropriate for me, an outside researcher, to adopt for exploring how and why ranchers in western Montana respond to losing cattle to wolves. I thus utilized the HDW interpretive framework outlined above to guide data collection. Analysis followed grounded theory, which directs data analysis as a "constant comparative" process whereby the researcher analyzes data *while* collecting it to continually refine and deepen thematic material, interview questions, and lines of inquiry as new insights into meanings emerge (Stern & Porr 2011, Corbin & Strauss 2008). Therefore, while the HDW framework guided data

collection and initial analysis, I allowed themes to emerge from the data itself so I could evaluate whether the framework adequately represented the data and incorporate additional relevant frameworks, such as the Shvik (2006) framework for evaluating ranchers' likelihood to adopt certain tools, rather than fitting the data rigidly to the HDW framework that initially guided the project.

Selection of informants

I selected ranchers from the Montana Livestock Loss Board's database of ranchers who had applied for and received compensation for dead livestock that USDA Wildlife Services confirmed as wolf kills from 2008 thru July of 2012. Within this database, I selected ranchers using two criteria: 1) Ranchers who had lost cattle (not only other domestic animals such as sheep or dogs, although some of the ranchers I interviewed had lost these animals in addition to cattle), and 2) Ranchers who had experienced at least one depredation per year over two or more years. This selection allowed me to narrow in specifically on cow-calf ranchers who had suffered repeated depredations over multiple years, to best represent ranchers that experience the "hot spot" phenomenon of wolf depredation. Using this method, I selected ranchers from a variety of counties across western Montana, generally representing the state wolf range. There were 28 ranchers that met the requirements. One was deemed too far to travel for an interview, which left 27.

I followed a convenience purposive technique for sampling, as outlined by Babbie (2010), whereby I contacted ranchers who lost cattle to wolves and conducted interviews with whomever was willing and available to contribute. I made initial contact to the 27 ranchers by letter printed on the Humboldt State University letterhead explaining the project, requesting an interview, and notifying further contact (Appendix I). I followed up with phone calls to schedule interviews. I left voicemails if ranchers did not answer the phone and made a second phone call after a week if they did not respond to my first voicemail. If they did not answer or return my second phone call, I assumed they were not interested in being interviewed. Of the 27 eligible ranchers, 2 refused outright to be interviewed, and 6 did not answer or return my calls. I conducted a short interview over the phone with one rancher, but decided to throw the data out for lack of depth. I therefore conducted 18 interviews from December 2012 thru April 2013.

I recorded and transcribed interviews with rancher consent. 6 ranchers declined to have their interview recorded, so I took detailed notes during the interviews and wrote memos immediately thereafter, following Stern and Porr (2011). Data analysis occurred simultaneously with data collection as I coded identifiable themes and patterns that emerged from the first sets of interviews and tailored subsequent interview questions to target the identifiable themes (Stern and Porr 2011, Corbin and Strauss 2008). My goal was to reach a saturation point, when interviews stop yielding new thematic material. I did begin to see signs of saturation and repeated themes, but what halted my data collection was lack of further ranchers to interview who met the selection criteria and agreed to participate in the study.

Study area

I roughly defined four different areas where ranchers were located: Northwest Montana, Rocky Mountain Front, Southwest Montana, and Central Montana. There were ranchers who met the criteria of having repeated confirmed losses in all of these areas, and I expected to possibly see some regional differences depending on the history of wolf occupancy in the area. Northwest Montana and the Rocky Mountain Front are both in the northwest Montana core recovery area according to the Recovery Plan. Wolves recolonized both of these places naturally from Canada without the aid of augmentation. I defined ranches in Northwest Montana as being to the west and south of Glacier National Park, but north of the Clark Fork River. These ranches were surrounded by both public and private working lands, but were not directly adjacent to protected National Parks or Wilderness Areas. I defined ranches in the Rocky Mountain Front as being to the east and directly adjacent to Glacier National Park. I separated these two regions within the northwest Montana core recovery area because of the differences in ranches being either adjacent to mixed use working lands or a protected National Park. The environment in these two places is also completely different, with Northwest Montana experiencing both boreal and maritime climatic influences west of the Continental Divide and the Rocky Mountain Front experiencing the dry, cold, and windy conditions of boreal and plains climatic influences east of the Continental Divide. The areas I defined as Southwest Montana were ranching communities within either the central Idaho or the Greater Yellowstone Area core recovery areas according to the Recovery Plan. Because both

these recovery areas had wolves reintroduced to them, I anticipated that the reintroduction may have more influence on how ranchers felt and reacted to wolves preying upon their cattle. The areas I defined as Central Montana were ranching communities that occurred near the nexus of the three core recovery areas, therefore representing the general ranching region in Montana that was farthest from the “sources” of wolf dispersal, but solidly in the path of dispersal for all three recovery areas. These ranching communities represent some of the most recent to have wolves establish within them, so I anticipated that the shorter amount of time that ranchers have had wolves as an element on their landscape may influence how they felt and reacted to the risk of depredation. I spoke with five ranchers in Northwest Montana, two ranchers on the Rocky Mountain Front, eight ranchers in Southwest Montana, and three ranchers in Central Montana.

Methods

I employed mixed methods to determine how and why ranchers in western Montana are adapting to wolf depredation. The main tool for data collection was in depth semi-structured interviews with a mixture of closed ended and open-ended questions. Torkar et al. (2011) conceptualize qualitative interviews as “conversations where the researcher gently guides the interviewee through an extended discussion,” which follows well with ethnographic methodologies employed by other researchers exploring human relationships and conflicts with large carnivores (Scarce 1998, Goldman et al. 2010).

Closed ended questions addressed generally quantifiable information such as whether ranchers were multigenerational, what type of operation they ran, and whether they were ranching at the time of the wolf reintroduction. Each interviewee was asked the same set of closed ended questions to provide specific information for comparison (Torkar et al. 2011, Goldman et al. 2010).

The remainder of each interview consisted of open-ended questions intended to illicit rich, ethnographic responses. Open ended questions covered the same thematic areas for each interview, but were flexible in structure and content according to how each interview, or conversation, flowed to best accommodate the nuances of each rancher's perspective and take advantage of valuable lines of inquiry as they arose. In accordance with the HDW framework that I used to design the interview schedule, core open-ended questions asked to every rancher explored: 1) the rancher's first experience with depredation and immediate reaction, as well as ensuing experiences, if applicable; 2) the rancher's adoption of a particular management strategy; 3) the rancher's decision-making process that led to his or her adoption of that management strategy; and 4) the rancher's lifeworld, i.e. personal history, individual and cultural ideology, and community relationships. The fourth and final section of interviews elicited the richest responses, but it proved challenging in the data analysis to really elucidate how each rancher's personal history may have contributed to their reaction towards wolves, as one interview was not adequate enough to build trust and delve deeply into the nuances of each rancher's personality. Primary supplemental data were gathered through participant observation of community meetings, ranchers at work, and wolf activity as the opportunities arose.

Secondary data were gathered through content analysis of news articles, magazines, television programs, books, and other popular media to situate the research within the larger context of national, regional, and local wolf conflict discourses. A copy of the interview schedule and a full interview transcript can be found in Appendix A.

Data analysis

Analysis followed the method for data reduction and analysis outlined in Miles et al. (2014). I first transcribed interviews and interview notes using the interview schedule as a template. Using track changes in Microsoft Word, I coded the interviews with categories according to the HDW framework and variables outlined above. I then developed a matrix display in Microsoft Excel with variables on the X axis and ranchers on the Y axis to display the codes. This way, I could analyze codes both within and amongst ranchers using the filter and sort functions within Excel. With the data thus reduced, I was able to analyze for larger themes that encompassed the initial round of codes for more explanatory comparisons. The coding sheet, code definitions, and coded matrix display can be found in Appendix A.

Data Storage

With participant permission, interviews were recorded digitally to ensure that data analysis was based upon verbatim, true representation of each rancher's statements and

narratives. Interviews were strictly confidential, i.e. only I know the identity of the ranchers interviewed linked to the statements they made. To maintain confidentiality after data were collected, I coded ranchers in a numbers system that I used in all transcriptions and interview notes. Interview recordings did not include identification. All interview notes, transcriptions, and recordings were securely locked in a file cabinet for the duration of the data collection and analysis period. Recordings were transcribed as soon as possible, and recordings destroyed immediately following transcription. I have linked nothing that a rancher said or did to his or her name in the project write-up.

Geographically, I only identified ranchers by their association with a general region of the wolf range in Montana, i.e. Southwest Montana, Northwest Montana, Rocky Mountain Front, or Central Montana.

RESULTS PART I: THE EMPIRICAL WHY

Depredations Close to Home

During late Fall thru early Spring, the time of the year when cattle are close to the home ranch as opposed to being out on summer grazing range, 13 of the 18 ranchers I interviewed experienced this type of confirmed depredation.

The bulk of confirmed depredations during this time period occurred during calving activities, when there were vulnerable young cattle on the ground. There were eleven ranchers who reported losing cattle during the winter-spring calving season. Ten of those ranchers lost new calves and yearlings or adults, while one of them lost only recently-weaned yearlings and one adult. Six ranchers lost cattle that were on and around the home ranch outside of calving season, either just before being turned out to range or upon return from range in the fall.

Ranchers that lost cattle during calving season shared a variety of experiences with depredation events. Several of them recounted how the wolves became familiar with the human activity surrounding calving (i.e. ranchers checking pregnant cows and newborn calves at intervals throughout the night to aid in labor if necessary and attend to any sick or weak calves), and hunted the calving yard during the short time periods between human presence. A few ranchers also described how wolves would kill newborn calves that a rancher had just checked while the rancher was still in the calving yard:

“You know, calving, somebody’s out there, you take two hour checks. Like you go out there and if nothing’s happening, two hours later you’ll come back. So the longest period of time would be two hours. But the wolves would come in and nail you in between that or while you’re out there checking them in the dark...they’re pretty smart. As long as the light’s not on ‘em they just go about their business. I don’t know if they’re used to humans or if they’re just smart that way but they know how to work around us. They were killing calves while we were out there checking. You’d check a calf, you’d go around, you’d come back by there on the same path coming back out and the calf you’d just checked would be all strewn out across the tracks you just made. 30 minutes at the most. When there’s a group of ‘em it don’t take ‘em very long to eat the entire thing. You’ll see tracks and blood and just a little bit of hair, I don’t know how graphic you want to be but on these baby calves the only thing they do not seem to eat is just a flat plate on the top of the skull of a baby calf. A lot of times you’ll find that. Just a little 2 by 2 chunk of skull. It might be that they crush everything else and it pops loose because of the way the skull has fractures in it for it to grow and it pops out. They eat ribs, bones, everything.”

Confirmed calving depredations often happened in temporal clusters from a few days to a few weeks apart, demonstrating that wolves had identified calves as a food source. Several ranchers were just one of many in an area that a single pack of wolves was circulating through to kill calves. For example, the valleys of Southwest Montana are some of the coldest places in the Northern Rockies on record. As a result, certain valleys are not winter range for ungulates, which migrate out of the valleys in the winter. Several large wolf packs learned to stay in these areas in the winter and kill cattle during calving season, and then continued to kill cattle during rest of the year even when natural prey had returned.

Depredations that happened close to home outside of calving season occurred from Fall thru early Winter in and around the home ranch. These depredations were not

as frequent or routine as calving depredations, but occurred on the same ranches that also experienced calving depredations. Only one ranch experienced depredation close to home that did not also lose cattle during calving season.

Depredations on Summer Range

12 ranchers experienced confirmed losses out on the range. Ranchers highlighted that range depredations were inherently more difficult to detect than depredations closer to home because cattle were spread out, often through rugged and forested country, requiring ranchers or riders to travel farther to check on them. Depredations were confirmed on both private ground range and public allotment range.

9 of the 12 ranchers that experienced range depredations also complained of missing cattle at the end of the season after round up. An additional 2 ranchers who did not have confirmed range depredations complained of missing cattle. Ranchers expect a certain percentage of death loss on the range due to disease, noxious weeds, weather events, and predation, which they do not detect until bringing their cattle home in the fall and comparing the final head count with the initial head count that was put out on range in the spring. The 11 ranchers that complained of missing cattle implied that the number missing was far greater than they expected from other causes based on their past experience. Most of them speculated that the increase in missing cattle coincided with wolves recolonizing the landscape and attributed the apparent increased losses to wolf depredation. Quantifying the magnitude of undetected loss is extremely difficult and

subject to localized forces that may cause the magnitude to change over space and time. These data suggest that ranchers believe wolves to be at least partially responsible for their missing cattle at the end of the range season.

Indirect Losses

While this study did not target data on indirect losses to wolves, significant data emerged from the interviews suggesting indirect losses are of great concern to ranchers. 15 of the 18 ranchers described indirect losses to wolves, i.e. losses to their economic bottom line that did not include death loss. While most of these ranchers had confirmed range losses, 3 who had only calving depredations claimed indirect losses as well. Indirect losses that ranchers highlighted included reduced conception rates in cows, reduced weaning and sale weights in calves, and increased disease incidents in all cattle due to the stress caused by wolves. While these losses are inherently more difficult to quantify than direct death loss, researchers are currently striving to do so in order to better understand the true costs of wolf conservation that ranchers bear. In an attempt to quantify the cost of indirect losses to ranchers, Steele et al. (2013) estimated that for every confirmed depredation in northwestern Wyoming, the economic equivalent of 7 animals are lost in weaning weights, conception rates, and increased sickness. A similar study conducted on Montana ranches corroborated these results, finding that ranches that have experienced a confirmed depredation lost 22 pounds on the average calf weight in

their herd, while ranches that had not experienced confirmed depredations had no significant impact to liveweights (Ramler et al. 2014).

Rancher Evaluations of Management Prescriptions

Ranchers who experienced depredations responded with a variety of management prescriptions to minimize the risk of further depredation, all of which fall into two categories: 1) Lethal management of wolves, and 2) Adjustment of ranch activities. Lethal management of wolves refers to any management action that involves killing wolves, both discriminately and indiscriminately, to prevent further depredation. Adjustment of ranch activities refers to any management action that changes ranch operations, cattle management, or human behaviors to prevent further depredation. Following Shvik's (2006) tripod of evaluations that may influence why ranchers respond in certain ways, I will review ranchers' experiences with each management prescription and discuss their evaluations of how biologically and economically efficient each is. These two concepts clearly emerged from the data, but I have re-termed them as biological effectiveness and economic efficiency to delineate clearly between them. Henceforth, they will be referred to as "effectiveness" and "efficiency". Furthermore, I have used the concept of "feasibility" to encompass both effectiveness and efficiency. For example, if ranchers evaluate a tool as both effective and efficient, it may therefore be feasible to increase implementation on a wider scale. More ambivalent or negative evaluations of effectiveness and/or efficiency may degrade a tool's overall feasibility. I

will utilize Shvik's final concept, the psychological assuagements that may affect ranchers' evaluations of management prescriptions, in combination with Manfredo's (2009) HWD framework in the final section of this chapter in order to analyze why ranchers evaluated tools in certain ways.

This project did not analyze the actual ability of any of these management prescriptions to prevent wolf depredations on cattle. Rather, it explored ranchers' evaluations of how worthwhile the prescriptions are, whether they have used them or not, and therefore how likely it is for a given prescription to be adopted by ranchers on a broader scale where wolves persist alongside cattle herds.

Lethal management of wolves

Every rancher that experienced wolf depredations said these depredations also resulted in wolf removal and that it unequivocally helped to prevent further depredations. This was a significant departure from the literature, which overall defines lethal management of wolves as reactive and only non-lethal management of wolves as preventative. Rather, ranchers themselves appear to also define lethal management of wolves as preventative because it prevents further depredations during a cycle where wolves are preying on cattle, therefore minimizing risk. This may be an important distinction to understand when framing available tools in communication with ranching communities: ranchers value quick, lethal response to problem wolves as a preventative strategy and do not seem to consider it reactive, as the literature suggests it is.

Wildlife Services removed the majority of wolves by trapping or aerial gunning, although several ranchers also removed wolves themselves. Ranchers could remove problem wolves legally by either obtaining a 45 day kill permit issued from the state to shoot or trap specific wolves or by shooting wolves in the act of harassing, threatening to kill, or killing cattle. A few ranchers also admitted to removing wolves illegally. Many ranchers reported frustration with ESA policies that made it difficult for ranchers to legally remove wolves on their properties unless they could prove very specific circumstances. All ranchers suggested that it would be effective and efficient for them to be allowed to remove problem wolves themselves. All ranchers also believed that removing the problem wolves that were depredating on their cattle was helpful in preventing further depredations. For example, one rancher described an instance out on the range involving missing cattle:

“Our association ran 2500 pairs and came up missing 80 calves. Out of 80 calves, 56 were unaccountable. Normal would be 20-25 unaccountable. 5 were confirmed wolf kills of the other 24 (that were found). We also lost 22 cows unaccounted for. Generally you lose very few cows because they’ve been through the disease problem. That fall they killed 26 wolves out of that area. Since that time we haven’t had the losses.”

Sixteen of the ranchers specifically evaluated USDA Wildlife Services’ response and ability to perform lethal control. Overall, ranchers viewed WS favorably in the agents’ ability to do good work with the rancher’s best interests in mind while following the law. While most ranchers viewed WS response as both efficient and effective when implemented, several (6) evaluated relying on WS to either confirm kills or remove wolves as inefficient because the supply of agents could not meet the demand for quick

response. Ranchers attributed this to lack of agency funding, resulting in agents being spread too thin across a large area and a reduction in air support for finding and killing problem wolves. According to one rancher, this situation caused him to stop calling WS to respond to depredation events and instead illegally remove problem wolves himself. Most of the ranchers demonstrated a faith in WS professionalism and attributed blame to other aspects of the federal government for the lack of WS feasibility. For example, several ranchers referenced the irony of reintroducing wolves and having substantial ESA funding for management while their populations, and conflicts, were low. Then, with increased populations came biological recovery, delisting, and subsequent funding loss when conflicts remained an issue and increased. As one rancher said:

“So, we end up picking up the bill on all this and the federal government stepped away and everybody’s happy because they introduced a new species into the environment where they don’t have to deal with the consequences. And it’s pretty big consequences for us, there’s a big dollar bill on all of this.”

In 2012, two counties in the study area, Madison County and Beaverhead County, instigated county fees on livestock producers to provide WS with funding for wolf removals. In both counties, a majority of livestock producers signed a petition to self-impose a \$0.50 fee per head of cattle and County Commissioners passed resolutions to create boards for overseeing the redistribution of funds (Madisonian 2012). During interviews, ranchers in these counties, and others, stressed the importance of being able to fund WS “to get the plane in the air,” while expressing frustration that the producers themselves are providing that funding.

Eleven ranchers discussed the issues of how and how quickly to respond to problem wolves. Several ranchers said that more discriminate control of specific problem wolves would be effective, specifically referencing past USFWS and Montana Fish, Wildlife & Parks policies for responding to depredations in a “reactive and incremental” manner under threatened species management and the subsequent state management plan after delisting (USFWS 1987, Montana Fish, Wildlife & Parks 2002). Ranchers perceived reactive and incremental policies as ineffective, citing their experiences that depredations did not stop under this policy until the entire pack was removed. Ranchers argued for removing the entire pack in the first place. Preliminary results from a shift in management may both support and refute the need for this strategy. After wolves were delisted in 2011, FWP began to transfer the authority for deciding when to remove problem wolves over to WS, which has since responded to depredations by initiating lethal removal more quickly following a first offense. Although causation has not been specifically tested, both wolf removals and depredations have declined since this shift in management and fewer full packs have been removed (Bradley et al. 2014). It may be that the WS quick response has resulted in removing the offending wolves in the area immediately before they can teach the behavior of killing cattle to the rest of the pack. Some research does suggest that selective, or targeted, removal of problem carnivores could select for a wilder population that is less likely to come into conflict with humans (Treves and Naughton-Treves 2005). This hypothesis should be rigorously tested in the context of wolves and cattle, but one rancher’s words describe it well:

“I don’t think all the wolves prey on cattle and just because you have wolves in an area doesn’t mean they’re gonna prey on cattle. But, some of the wolves do. In the past few years we’ve dealt a lot with FWP, the state agency, and their protocol has been that if you have a confirmed wolf kill generally they’ll take out one or two of the pack, then if that doesn’t work they’ll take out the rest of the pack. So you have this incremental thing where you sustain more loss. Because if you have a pack that’s working cattle you aren’t gonna educate them. They’ve learned that that’s a food source and they’re gonna come in there. So, there’s this reluctance to deal with the real issue because you have some wolves that prey on cattle and if they would be proactive and remove the villains so to say, and then if you have other wolves in the area that have a different food supply, I think we could do better. There’s always gonna be conflict. We have wolves, we have cattle. They’re good eating, that’s why we raise them. But if they would be more proactive in dealing with the problem wolves and if they would go to the work and put collars on so that you know which wolves you are dealing with because if you don’t have collars you don’t know which wolves are giving you problems. I’ve always heard this with predators – you’re always going to have predators but you’re better off with the predators you have than killing them and bringing in a new group. So with the wolves, if there’s wolves in an area and they’re not bothering you, you can coexist there. But the ones that turn onto a new food source need to be taken out of the equation...I think there’s a lot of them that for whatever reason aren’t interested, and I think you can have a viable population of predators if you deal with the problems. But if you have this protectionist attitude that every wolf is a warm fuzzy animal and, you’ve been around doing interviews, and you realize, they’re a predator, and they’re a vicious predator, but a lot of them have a different food source. So I think that’s the direction that we need to go. Because we are stuck with them. They’re not going away.”

Ten ranchers said that an increase in indiscriminate killing of wolves would be effective in preventing further depredations. This ranged from regulated hunting and trapping seasons to ranchers arguing for something more liberal such as classifying wolves as predators and/or reintroducing poison campaigns and government bounties to maximize efficiency in effective wolf removal strategies. However, preliminary research suggests that the relationship between indiscriminate killing of wolves and levels of

depredation is a complex one. Some research hypotheses suggest the opposite of what ranchers perceived: that indiscriminate killing may disrupt pack dynamics and result in more, smaller packs on the landscape with younger breeding pairs that are less experienced hunting natural prey and therefore more vulnerable to rely on cattle as a food source and pass the behavior to their offspring (Treves 2009). A study on how indiscriminate hunting pressure affects cougar spatial ecology in the state of Washington found that hunting effectively doubled the probability of human encounters with cougars and increased cougar densities threefold due to increased home range sizes and subsequent overlap and competition for resources (Maletzke et al. 2014). Similarly, a study that assessed the relationship between lethal control of wolves and livestock depredation in Montana, Wyoming and Idaho over a 25 year period suggested that higher wolf mortality leads to higher livestock depredations the following year (Wielgus and Peebles 2014). However, this study did not separate targeted removal of problem wolves from indiscriminate public hunting in its analysis. It is currently unknown how increased indiscriminate hunting and trapping pressure on wolves is affecting their spatial distribution and subsequent vulnerability to conflict with humans specifically in western Montana. These processes are highly complex and subject to a variety of confounding factors in evaluating cause and effect, but require research to inform management that can reach the goal of effectively reducing depredation risk.

Adjustment of ranch activities

In addition to relying on lethal control of wolves, 17 of the 18 ranchers adjusted their ranch operations, cattle management, or human behaviors to prevent further depredations. These ranged from heightened awareness of landscape processes to building a brand new facility for calving operations in an area less likely to be frequented by wolves.

Attentiveness to landscape processes

Twelve ranchers described their adaptation to paying more attention to landscape processes such as wolf sign, and other natural history related signals of increased risk of cattle depredation. Attentiveness to these landscape processes often went along with checking cattle more often. Eight ranchers described the process of learning wolf ecology through observing tracks and sign of wolves and other wild animals that interact with them, such as elk, ravens, or coyotes, in order to better detect wolves on the landscape. Ranchers used these techniques for several purposes: to prevent an attack before it occurred by increasing human presence, hazing wolves, or moving cattle to a new area when practicable; to detect dead or injured livestock early enough to preserve the evidence for WS confirmation; or to aid FWP and WS in finding wolves for collaring or removal.

For example, one rancher said that during calving season after all the calves are on the ground and pairs are still being fed hay at the home ranch in a large pasture,

“We pretty much check the perimeter every day. If there’s tracks there, then we’ll start going out right at dark. Seems like the wolves, they’ll kill right at dusk and right at light, so you have to be out an hour before it gets light. Just a lot of times the presence, especially after we’ve shot at ‘em a couple times, spooked ‘em. Do that 3 or 4 times and if they’re hungry they’ll go find an elk or a deer. At least that’s what I think they’re doing because they’ll leave. Then it’ll be a week. And then they’ll be back. It’s just a never ending vigil that we didn’t have before. And you can tell...if you go out in the morning and the coyotes are yapping you know the wolves aren’t around...Now that they’re here, it’s a lifestyle change. You have to be more aware. Like the older calves, we didn’t used to check them in the morning, we’d just go to the younger calving lot and now we go both ways. It doesn’t take that long but you still gotta do it. And if you see tracks you start looking, did they go inside the fence, and a lot of times they won’t, but like I said you better be expecting that the next couple nights they’ll be back and that’s when we’ve noticed they try to get something. They’re smart. You have to kinda live with them to know what they’re gonna do and what they’re not gonna do so we use different ways, riding the four wheeler, going up in the dark with the headlights on, it doesn’t take them long where they’re like oh this is not good and they leave.”

It should be noted that wolves likely behave differently in different areas due to varying personalities, pack dynamics, and landscape ecology, among other things (Bradley and Pletscher 2005). Further, each ranch is different with its own set of variables. Each rancher that reported paying more attention or knowing where the wolves are had his or her own experience with piecing signs together.

“In spring, you look at the cows out there in the yard and when they start grouping in a clump, that’s a sign the wolf is here. I have dogs, they told me the wolf was here. In summer, less of a problem, but the wolf is still here. I wish the cows went over to the forest for more shade and grass but they won’t go, they squeeze to the valley. Anytime they hear the wolf, they come into the open space and group up there...It’s happened every year and I kind of know the wolves around. I know where I live, I know where the wolves live, I kind of know what we are going to face. So, get ready for it. For some reason, they like to come when the storm comes. When it’s calm, less so. When a big storm comes, they come, either a big

rain or wind and snow. I say today I'm going to have visitors. And I would say 75% of the time I guessed it right. The wolves are smart animals.”

Ranchers did not evaluate attentiveness to landscape processes in the same way they evaluated other management prescriptions. All ranchers framed this adaptation as a matter of course, a natural progression of learning to be attentive in a landscape recently repopulated by wolves. It was included here because of its significance in frequency during interviews. Ranchers who did not report doing it did not evaluate it. The ranchers who exercised it evaluated it as effective. Their assessment of its efficiency was split. When paying more attention involved heightened awareness of clues during routine activities, it was quite efficient. When paying more attention involved checking cattle more often or spending more time tracking or patterning wolves, it was time consuming and inconvenient, therefore inefficient. The drawbacks of this inefficiency, however, were outweighed due to perceived necessity and effectiveness, therefore promoting increased attentiveness to landscape processes may be quite feasible on a wider scale.

Range riding

For the purposes of this project, “range riding” refers to any increased human presence on summer and fall grazing range for reasons related to wolf depredation risk, from paying an employee explicitly to ranchers doing it themselves. Nine ranchers practiced some form of range riding and offered evaluations of its merit as a tool to reduce depredation. Six of these ranchers, representing the largest operations running

cattle on the largest grazing allotments mixed with cattle from other large operations, had the most negative evaluations of range riding.

One rancher described his operation with 300 cow-calf pairs on 10,000 acres of Forest Service land, saying feasibly he could only get to them all once every 2 weeks, but that he tries for once a week, which is still insufficient for preventing depredations. He said, “You might catch your loss quicker, but you won’t eliminate it with a range rider. It’s hard to justify a range rider’s wage because it’s not producing,” (Interview 15).

Negative evaluations of range riding were also often correlated with complaints about missing cattle and the inability to detect and confirm losses on summer grazing range. While all ranchers who mentioned this admitted there are other sources of loss, they claimed that since wolves repopulated the area their numbers of missing cattle have risen significantly. One rancher claimed his grazing association of 2,500 pair came in 80 calves and 22 adult cows short at the end of the summer. While he admitted that wolves get blamed for much that they aren’t responsible for, such as death loss to disease, other predators, or noxious weeds, these numbers were well beyond the previously steady loss rates before wolf recolonization to the area. Other ranchers supported this claim:

“In this valley, where you can really tell, there’s a pack running up there in this country in a grazing association. 1100 head of cattle. They’ve got two range riders. Kept seeing wolves all summer long. When everybody came out in the fall, we were short 15 calves and the neighbors came in short 20, but the riders had never found a confirmed kill even though they were up there every single day.”

One rancher elucidated the issue with range riding on large public grazing allotments in grazing associations. When initially asked if he was doing anything to

protect cattle from wolves, he replied by describing the principles of a rest-rotation grazing system:

“It’s not really possible. It’s a rest-rotation grazing system, if you’re familiar with that. On a piece of ground to simplify it, if you had six pastures through the year you’d only use four of them. Two would be rested and you would alternate rest pastures annually. And that’s way simpler than it is up there – I think we have 15 pastures or something like that, and 2500 pairs. So, each pasture gets a complete year’s rest every 3rd or 4th year to make sure the plants stay healthy. Then we have to meet riparian standards, in this area mostly stream bank disturbance, so we have guidelines as far as how much impact is on a piece of creek. And some of the pastures are 6,000 acres. And you have 800, sometimes a thousand cows, sometimes more, in an area. So, they just have to be out there. There isn’t really a way to protect them, they’re just out there.”

This rancher described previously having two range riders in the grazing association whose primary purpose was to keep cattle distributed in small bands and moving around so as not to over-impact the resource, but that they had added a third paid rider to help deter predators. He was skeptical as to whether the latter had merit, because:

“Part of it is that they’re nocturnal. It’s hard to have someone out there riding in the dark, that would be hazardous. [Wolves] work at night after it cools off, that’s what we understand. I know some of the other grazing units around us, they had a wolf rider for a number of years. I’m fairly doubtful that unless—you start talking 5,000 – 7,000 acre pastures and one person being out there and you’d never know they were there it’s such a big area. If it was down here and in fields that would be a different situation. But in the forest up there, one person is pretty small and the cattle have to be dispersed for the regulations. If you tried to round them up and night ride them, the cattle wouldn’t do well and the resource would be impacted. You run into certain things that there’s no good way of doing it.”

Similarly, another rancher reported:

“On the allotment, we have to have two full time riders at least just to satisfy the rest rotation standards with the Forest Service and keep ‘em out of the riparian areas, etc. As far as protecting the cattle from wolves I could put five or six guys out there and it wouldn’t be enough to cover the ground and keep the wolves out. We run on about 50,000 acres of pretty rough ground. A lot of timber, canyons, lots of cover for them to hide in. It’s hard enough to find a cow in there, much less the wolves.”

Three ranchers of smaller operations with less grazing area to cover, either on public or private land, offered more positive evaluations of range riding. This was also correlated with range being closer to the home ranch. Further, the rancher that did the most range riding personally was the only rancher in the study not to prepare his own hay for winter feed. While he evaluated range riding as effective, the amount of time necessary to deter wolves was extremely inefficient for him and would be infeasible for ranchers who cut hay:

“On the range it used to be once a week that you would go out and check and see that they were moving around, now you’re out there 12 hours a day every day or else your herd would get wiped out... You gotta be there. Makes it a lot more expensive and time consuming to do that kind of stuff on range... we are basically on range just about every day somewhere, the two of us, our gas, it’s a pricey situation. *We buy our hay, so there would be no time to do that if we were haying ourselves. It’s one or the other. We are probably the only outfit in this area able to go out every day just because we buy our hay.*”

Only one rancher exercising range riding had an overtly positive evaluation. His herd, while out on range on the Rocky Mountain Front adjacent to Glacier National Park in good wolf and grizzly bear habitat, was relatively small and easily accessible from the home ranch. He argued for a model where non-profits and government organizations

fund range rider programs where someone is camped constantly out on the range with cattle.

An additional four ranchers not using range riding to deter wolves offered negative evaluations, strengthening my assessment that ranchers evaluated range riding overall as ineffective, inefficient, and therefore infeasible. However, these evaluations were based on the range riding model of only one or two people, with little to no coordination with FWP about known wolf pack home ranges, denning sites, or rendezvous sites, covering thousands of acres of rangeland. For ranchers that must hay during the summer, it may be impossible to range ride personally to the degree necessary to actually deter wolves. Further, ranchers are unlikely to pay somebody else to range ride unless it is proven effective.

It may be that addressing some combination of these hindering variables renders range riding more effective and efficient for ranchers. For example, several ranchers said that if there were more people available to range ride it may work. Further, the Blackfoot Challenge Range Rider program in the Blackfoot Valley of west-central Montana has demonstrated preliminary results that a cost share range riding program that prioritizes rider coordination with wolf managers and ranchers may help a rider be more effective across a large landscape. The three Blackfoot Challenge range riders (1 full time, 2 part time) partner both with the watershed group and FWP to locate wolf packs, disseminate information on potentially high areas of conflict to key ranchers and the whole community, and prioritize areas to focus human presence. This approach to a range rider program, in combination with a carcass removal program and several electric fencing

projects, may have resulted in a near elimination of conflicts from the Blackfoot Valley while the wolf population has continued to rise (Wilson, personal communication, September 11th, 2015, Bradley et al. 2015). Future funding efforts for range rider programs in western Montana could focus on increasing the number of riders and building partnerships and trust between grazing associations and FWP to better predict likely conflict areas.

Carcass removal

Calving is a time when ranches sustain high death loss of both cows and calves due to birthing complications, weather, disease, and other causes. This period can coincide with wolf denning periods and grizzly bears becoming active after the winter denning period, escalating the likelihood of depredations (Wilson 2011). Traditionally, ranchers dispose of dead cattle in “bone yards”, large pits on the ranch that hold carcasses while they decompose. This method can draw in wolves, grizzly bears, and other carnivores to scavenge on the ranch, where they are more likely to encounter or prey upon live cattle. Carcass removal refers to methods for disposal of dead livestock that do not attract wolves or grizzly bears.

Three types of carcass removal operations existed in the study area: burying carcasses, carcass redistribution, and carcass composting.

Only one rancher buried his carcasses, which he evaluated as an effective, efficient, and feasible method for preventing further wolf depredations. However, this rancher was in a western part of the state that does not currently support a grizzly bear

population. Because grizzly bears will excavate carcasses buried deep underground, this method is ineffective in much of the study area.

In the spring, Montana Fish, Wildlife & Parks operates a carcass redistribution program to collect and redistribute dead livestock throughout Wildlife Management Areas (WMAs) that are closed to the public in the spring. These WMAs are located in the foothills of the Rocky Mountain Front, adjacent to the Bob Marshall Wilderness and away from private land. The Blackfoot Nation operates a similar program on the northern Rocky Mountain Front, redistributing carcasses in the foothills adjacent to Glacier National Park.

The Blackfoot Challenge pioneered a carcass composting program in the Blackfoot Valley that has spread to other bear and wolf occupied ranching communities in western Montana, as well as in other western states and in Canada (Wilson 2011). From mid-February to mid-May, a U.S. Fish and Wildlife Service sponsored collection truck is available to haul carcasses to an electrified MT Department of Transportation composting facility. The resulting compost is used in re-vegetation projects.

Six ranchers exercised carcass removal (one buried carcasses, two redistributed carcasses, three composted carcasses), and all evaluated the practice as extremely effective, efficient, and feasible for them. Ranchers not exercising carcass removal did not evaluate it.

Fladry

Fladry is a temporary fencing technique designed to deter wolves by frightening them. A single polywire strand with temporary supports is erected with red strips of cloth attached to the rope every foot. The flags frighten wolves and can deter them for a period of time. Four ranchers used fladry to prevent further depredations with varying success. Often, the polywire itself is electrified.

One rancher used fladry around a small herd of cattle during calving season, erected at the recommendation of FWP after wolves had killed one calf. Although the rancher tracked the wolves in a spring snowstorm to see that they had returned to the cattle and circled the fladry looking for a way in but did not cross the boundary, a young calf wandered outside the fladry and was killed while its mother tried to reach it but was kept back by the electrified fence. This rancher was considering installing a shorter wire below the fladry to contain the calves and prevent this from occurring again. He perceived the fladry to be effective if the calves would remain inside it. Another rancher who was not using fladry echoed that it is a temporary deterrent, but effective.

Another rancher tried to use fladry around 350 calving cows in southwestern Montana at the recommendation of a non-profit group. She said it took eight days to install the fladry and that it wouldn't stand up in the wind. Soon after it was installed, the snow began to melt and the area became too wet for the cows to calve and she had to move the pairs to a new area. For her operation, she evaluated fladry as ineffective. The third and fourth ranchers who used fladry installed it after wolves killed calves, but the wolves continued to depredate despite the deterrent.

Four other ranchers of relatively large operations who had not implemented fladry also evaluated it as ineffective. One rancher captured the general sentiment well:

“We’ve never tried any of that fladry around here. As far as where would you start and where would you end and who’s gonna maintain it? If you had your cattle in a small area you could try it if you’re getting hit that hard, but to be real honest if it’s that bad you’re in bad trouble before you even start on that fladry. As far as I’m concerned it’s just a joke. I mean a wolf if he’s that hungry he’s either gonna jump over it, crawl through it, or crawl under it and you might just nip him on the way by a little bit.”

Therefore, the review of fladry was mixed, but skewed towards ranchers perceiving it as biologically ineffective and economically inefficient and therefore infeasible.

Changing the calving pattern

Changing the calving pattern refers to any way that ranchers altered their calving process to reduce depredation risk. Four ranchers changed their calving pattern in some way.

One rancher changed his calving timing from February to April. He calved in three different outdoor pastures that wolves accessed in late winter. In spring, the wolves didn’t access the calving yard and he perceived the change to be effective. Because this was a yearling operation, he was able to ensure adequate weight gain before sale despite calves being two months younger on average. Calf-based operations may find this change less feasible due to the weight gain concerns of calving later in the year and having less time to add pounds before sale in the fall.

Two ranchers kept their calving times the same, but kept their cows and calves closer to the inner ranch compound for longer than in the past. Both of these ranchers used to turn pairs out in fringe pastures after initial calving to take advantage of spring green-up and to spread calves out. They both said keeping pairs closer for longer was effective because they could monitor the cattle more easily, but that their vet bills were higher because calves would contract and spread diseases to one another due to being so close together for so long. Another rancher who suffered losses during calving season but did *not* change his calving pattern described how he operated with two calving facilities. The first round of calving would occur at the home ranch, but after half the expected calves were on the ground, he moved the remaining pregnant cows to a calving facility two miles away so the newborns would not contract any diseases that the older calves carried because they could succumb to the disease more easily. Even though wolves targeted the second, farther calving facility, this rancher did not consider changing that calving pattern because of the higher likelihood of losing newborns to disease if they were not moved to the farther calving facility. Therefore, ranchers evaluated this strategy overall as only somewhat effective, and stressed the importance of weighing the apparent benefits of keeping pairs closer to prevent wolf depredation with the possible costs of increasing disease rates in young calves. Smaller operations may benefit more from this strategy than larger operations because their cattle will be less concentrated in a finite space.

One rancher in the southwestern Montana suffered repeated depredations during calving season by large wolf packs that had become highly reliant on cattle and were

subsequently removed. His home ranch and calving area are located adjacent to densely forested National Forest, which he understood to be within the wolves' core home range. He tried moving calving operations even closer into the ranch compound, but continued to suffer losses. After repeated depredations over several years during calving season, in 2011 he built a new facility with new corrals and buildings eight miles away towards the middle of the valley, surrounded by open prairie. He perceived this move to be quite effective, as he hadn't suffered any more losses since the change. However, it was extremely expensive to build the facility and continually inefficient to calve eight miles from his home, when his calving pastures used to be within sight of the ranch house.

These responses about changing calving operations highlight the need for site-specific responses to wolf depredation. While moving calving closer into the ranch compound was an effective strategy for some ranchers, for one rancher it exacerbated the problem because the ranch compound was within a depredating pack's home range, and he chose to move calving very far from the ranch compound.

Changing the range pattern

Two ranchers changed other aspects of their range pattern to reduce risk of depredation by wolves. One of them suffered depredations in a low-elevation late season pasture that he has since stopped using because of the depredations and the frequency of wolf observations and wolf sign in that area. This was a small operation that had ample range for cattle and therefore could use a different area. He evaluated this strategy as effective but inefficient due to time inconveniences. The other rancher ran a larger herd

of cattle on a large swath of private ground that covered mountainous and forested area as well as foothills and bottomland. He restricted cattle from ungrazed pastures where wolf activity was concentrated to prevent conflict. He evaluated this strategy as somewhat effective, but was extremely angry to not be able to utilize his private resource, abundant grass for cattle, because of the wolf threat.

Ranchers who range on public allotments have less freedom to alter their range pattern because of rest-rotation standards. For example, if an open pasture on an allotment becomes occupied with wolves that are preying on cattle, a rancher may not have the option to move cattle to another pasture away from the wolf activity because it may be under rest management for the season. Further, the sheer size of the allotment and the amount of cattle in it may prevent ranchers from detecting conflict areas at all. Therefore, changing the range pattern may be effective and efficient opportunistically for ranchers that range on private land and have relatively consolidated or small herds, but those ranchers exercising it did not evaluate it as an effective long term solution but rather a temporarily necessary inconvenience. Further, ranchers with larger herds and rangeland, as well as ranchers that range on public allotments, may perceive it as totally infeasible to change their range patterns to effectively prevent depredation.

Livestock protection dogs (LPDs)

LPDs are breeds of dog specifically developed to protect livestock from wolves, bears, and other large carnivores throughout the world that can prey on livestock. Two

ranchers were using LPDs; however only one of the two was using dogs for cattle. The other ran cattle, but used the dogs for his sheep.

The rancher using LPDs in cattle decided to try them after suffering repeated losses in southwestern Montana by a pack depredating on cattle that was subsequently removed. After the wolf removal, this rancher purchased four LPDs, two Great Pyrenees/Akbash crosses and two Komondor/Akbash crosses, from a breeder in Billings, MT. Different LPD breeds have different guardian instincts – this rancher’s Pyrenees crosses stayed very close to the cattle and herded them together when wolves were around, while the Komondor crosses patrolled the perimeters of the herds and went out to meet wolves if they were in an area. This rancher described several instances of the dogs successfully protecting cattle from wolves out on summer grazing range that supported 700 cow-calf pairs. She described a few instances where the dogs deterred wolves from neighboring ranches’ cattle when the wolves were not present in hers but in herds up to three miles away. She attributed this success to the dogs being able to set up a territory *after* Wildlife Services removed the previously depredating wolf pack. Subsequent wolves that came through, she theorized, recognized the dogs’ territory and were less likely to attack the dogs in large numbers. Conversely, she thought if she’d added the dogs to an occupied wolf territory, the wolves would have destroyed them. While she mentioned the dogs require food and veterinary care, which is an added cost of time and money, she perceived the dogs as so highly effective as to outweigh the apparent inefficiencies. In this case, the rancher evaluated the dogs as feasible for deterring wolves from cattle.

The other rancher using LPDs for his sheep also evaluated them as effective for sheep and expressed both interest and concern with using them with cattle. Originally he had two Great Pyrenees/Akbash crosses to protect the sheep from coyotes, and expanded to 6 dogs with the band to deter wolves. While he hadn't lost any dogs to wolves, he did have a confrontation where two dogs were wounded. He hadn't tried the dogs with the calves because most of his problems were with the sheep and he was concerned with the cows being protective of their calves around the dogs. This rancher was open to putting dogs with cows long before calving in order to get the adults used to having the dogs around before calving and becoming protective of their calves. He voiced concern about the differences between cattle and sheep ranging, where sheep are largely concentrated in a single large group while cattle are spread out in small bands over a large area often with rest rotation standards on the areas most vulnerable to wolf depredation. He voiced concerns with how this would impact the efficacy of LPDs protecting cattle.

Several ranchers not using LPDs expressed both interest and concern with the method. One rancher in southwest Montana, who also was familiar with the rancher using LPDs in cattle, was convinced of their effectiveness but did not currently have wolves depredating on his cattle. While he believed that LPDs would not be as effective if implemented after further depredations, the expense of their purchase and care deterred him from implementing dogs while he was suffering no losses. He planned to implement them as a preventative measure in the event that he thought he needed them. Other ranchers voiced similar concerns to the rancher using dogs with his sheep about their

efficacy with widely distributed cattle out on summer range, as well as concerns about losing LPDs to wolves. One rancher said,

“Cattle don’t stay in a band like sheep do. You don’t want ‘em to, you want ‘em to disperse over the range and with limited water you want ‘em in bunches that are small so they don’t overwhelm the water sources or trample the range too bad. If you want dogs that would work up there, it would probably take a hundred or more so they’d be close enough that they wouldn’t be clear out of range of all the cattle...I also know of a guard dog just off our south end there two years ago that was with a band of sheep and was killed by wolves. So, if the wolves are just gonna come kill your guard dog, then it probably isn’t much good anyway.”

When I told this rancher that there was a rancher in Montana using guardian dogs with cattle and recounted that rancher’s theory about territoriality, he said,

“I’ve heard people talking about it more and more. Dogs, if they are capable of doing the job, would probably be better than people because they are more like wolves, they see what’s going on, and they can be out there 24/7. I think anything that is gonna work is gonna have a cost to it for sure. But if we can just find something that works – I’m not anti-dog for sure. I’d be interested in finding out more.”

Ranchers demonstrated interest in using LPDs with cattle, but have legitimate questions and concerns. Adding another type of animal to care for and potentially lose is a big commitment for a rancher, but if it is proven effective ranchers may be willing to implement it. It will be important to test the effectiveness of LPDs in different situations to delineate clear methods of implementation that result in the highest success rate. The Wildlife Services Predator Ecology & Behavior Project is conducting a study titled “Evaluating the effectiveness of livestock protection dogs as a management strategy for mitigating livestock depredations,” to evaluate which breeds of LPDs are most effective

at protecting livestock (sheep) and to evaluate whether spiked collars enhance their success rate (Marlow 2012, Young 2013). Further research should focus on the effectiveness of breeds with range cattle specifically.

Electric fencing

Electric fencing refers to a permanent electrified enclosure that deters wolves (or grizzly bears) from entering it to prey on cattle. Electric fencing projects designed to protect cattle from wolves typically focus on calving yards at the home ranch, rather than large range areas, due to the permanence of the fence, the cost of the materials, and the labor required to both build and maintain the fence.

One rancher utilized a permanent electric fence surrounding his calving yard to prevent further depredations. After suffering losses in his calving yard by a pack that was depredating on his and his neighbor's calves during calving season and was subsequently removed, he worked with a local non-profit to fund and build an electric fence around the calving area. The local non-profit brought funding for the fence materials and the rancher provided the labor for building the fence. Because this rancher also decided to keep his cattle closer for longer during the calving season, they constructed the fence around a larger area than the main calving yard so the cattle could spread out and reduce the risk of disease in the calves, totaling about a mile of fence. Since the fence was constructed, the rancher only suffered one depredation event in the calving yard: although the rancher was checking the fence routinely, the bottom wire popped out of an insulator and grounded the electric pulse so the wolves could get through without a shock. Despite this loss, the

rancher evaluated the electric fence as a feasible method because it was highly effective at deterring wolves and the funding that the local non-profit brought for the materials alleviated economic inefficiencies. However, the fence's temporary failure highlights that electric fencing is not a permanent cure-all upon construction, but an effective tool that requires routine checking and maintenance, which still may overlook a problem.

A rancher on the Rocky Mountain Front evaluated outside funding to build electric fences around calving yards. He did not pursue funding because he perceived it as ineffective and inefficient, therefore infeasible, that he could maintain the fence once it was built. On the Rocky Mountain Front, he said, the constant wind blows snowdrifts over fences so animals walk through them. He highlighted that melting snow is like concrete and would combine with the wind to blow down the fence during calving time. The maintenance needed to keep a fence viable in this environment was too much for this rancher to consider. Another rancher declined an offer by a non-profit to fund an electric fence around a calving yard where he had experience depredations because he feared they would micromanage his pasture.

Another rancher constructed a two strand electric fence around his calving yard to keep the cattle in, but thought that it may have deterred a wolf after it came in and dragged a newborn away. This depredation was unconfirmed, but the rancher speculated that the wolf may have received a shock, because no further losses occurred that season. While a two strand wire is not up to the established standards for deterring wolves and grizzly bears, this rancher perceived electric fencing to be effective.

Overall, these ranchers perceived electric fencing to be effective, but concerns about cost, maintenance, and outsider oversight deterred some ranchers from perceiving it as efficient. Outside funding may ameliorate some of these concerns, although ranchers may be more likely to accept funding from some sources than others depending on personal relationships, trust, and credibility. It may be helpful in the future for a variety of outside organizations to provide funding for electric fencing. However, these ranchers' evaluations of electric fencing question whether it may be feasible to implement on a larger scale.

In summation, ranchers evaluated available tools on a continuum from effective and efficient to ineffective and inefficient. Ranchers evaluated paying more attention and carcass removal the most positively and they evaluated fladry the most negatively. Livestock Protection Dogs, range riding, electric fencing, and changing some aspect of range or calving patterns were evaluated across the spectrum depending on the situational variables discussed for each tool above. Next, I will review the results surrounding ranchers' perceptions of wolves, speculations about wolf management, and experiences with wolves before analyzing why they may be psychologically assuaged to evaluate certain tools positively or negatively.

RESULTS PART II: THE THEORETICAL WHY

Interviewees largely corroborated the theories set forth by Nie (2003), Lopez (1978), and Scarce (1998) that the ranching community in Montana perceives wolves as deeply threatening symbols of governmental control and other national forces that devalue the ranching identity. Furthermore, these feelings may intensify amongst ranchers who disproportionately bear the costs of wolf conservation through repeated depredation experiences and the emotional trauma associated with them. An interesting nuance also emerged from this population that had numerous direct encounters with wolves, the animals not the symbols: while ranchers were threatened by how people use wolves in service of social and political agendas, they were also threatened by the wolves themselves to varying degrees based on their wolf encounters, depredation experiences, and associated emotions. This nuance resulted in deep identity-based shame in ranchers feeling compelled by law to failure, and presents a new addition to the literature that should be explored further. Building trust between ranching communities and outside partners is therefore critical in working to put solutions on the ground to prevent depredations. Building this trust may be extremely difficult where conflicts are worst because trust is lowest, so nonthreatening messages and messengers are essential. Furthermore, ranchers must trust in proposed solutions' effectiveness and efficiency in order to be willing to implement them.

The Symbolic Wolf

I am wrapping up an interview that has been particularly difficult for me. A rancher has just finished telling me that his son suffered grave injuries in a snowmobiling accident while chasing a wolf away from a calf that it had killed and was feeding on in the calving yard. A story was released in a nearby city paper and the comments section was flooded with hate messages towards the boy, who was at that time recovering with serious complications in the hospital. The rancher tells me all of this while looking into his lap behind the brim of a beaten felt hat and I cannot see the expression on his face. He falls into silence. I take a long breath and ask my last question.

“Overall, how have your experiences losing your cattle to wolves affected your operation and your life as a Montana rancher?” It seems shallow, after what he has just told me.

He says, “Well, the guy that shot the kid is out of jail before the guy that shot the wolf. Everybody gets caught up with the romantic image of the wolf, but it’s more complicated, people need to realize it’s not 1800, the wolves can’t just run across the landscape like they used to. You get a bigger stack of comments from people with no interest, from California and New York, while [the] Stockgrower’s [Association] writes one letter that represents 300 ranchers versus 300 letters from environmentalists. They’re protecting the crows now – even when they’re pecking out the eyes of a baby calf.”

He finally looks me in the eye and asks quietly: “Why do we have to pay for someone else’s dream?”

To many ranchers, wolves symbolized a power struggle dictated by governmental control and other national forces that threaten the ranching identity's very legitimacy. The USFWS reintroduction of wolves to the Northern Rockies dominated ranchers' discussions of governmental control both within the areas surrounding central Idaho and Yellowstone National Park and even in northwest Montana, where wolves in fact were not reintroduced but naturally recolonized. Ranchers characterized the wolf reintroduction as a government scheme to insert governmental control on private land management or even to remove ranchers from their land, a blatant violation of private property rights. Additionally, many ranchers perpetuated the narrative that the reintroduced wolves are a non-native sub-species from the north that is larger, forms larger packs, and is more aggressive than the original sub-species that occupied the U.S. Northern Rockies. Ranchers often speculated that the government chose this subspecies intentionally because they are more likely to prey on cattle and help encourage ranchers to sell their land. For example, one rancher in the NW MT recovery area said:

“They got them introduced here in '99 or 2000, got them started in the area, and of course they were protected. I mean, holy cow! If youda done something to some of those wolves they woulda tried to take your ranch away! It was a huge fine and a huge deal. They had more protection on the Endangered Species List than human beings themselves. Ranchers should be on there and be equal!”

Rooted in these claims was the fear that the nation is progressively devaluing ranching as an appropriate or necessary use of both public and private western lands. These ranchers felt overpowered and outnumbered by these outside values, and

emphasized the disproportionate economic burden that ranchers bear, through both direct wolf depredation and indirect loss, which threatens the viability of their way of life.

Many ranchers emphasized their community's contribution to the nation to defend their continuing presence on the land, arguing that outsiders do not understand what ranchers contribute to society or what they experience living with wolves. Many of them pleaded with me to "tell the true story" because they felt the national population majority did not support their persistence as a community, but hoped that outsiders would support ranchers if they truly understood their experiences. These ranchers described how they feed the American people, convert grass into protein on rangelands that are otherwise uncultivable, improve biodiversity of grasses and forbs by grazing rangelands to promote disturbance, maintain clean water, and provide open and interconnected wildlife habitat. Wolves, they explained, are impeding their ability to provide these services. Other ranchers believed outsiders understood their plight with wolves, but intentionally supported wolf conservation at the expense of ranching with an agenda to end ranching in the west in favor of recreation and wildlife. For example, one rancher in the NW MT recovery area grappled with how to continue making a living in this changing climate of social values:

"I get two sale offers a summer for small parcels, but if you're going to buy 40 acres, buy the other 3,000! I don't want to chop it up, I want to keep the water clean. The South Fork of the [river omitted] runs through here! But there's more people interested in bears and wolves than against bears and wolves...Economically, if it's costing more to maintain all this than you are getting out of it, is it worth it to be here? I've toyed with rentals on this place – keep running cows, and then you want the wolves and the bears here because people love to see them...Is that the answer? What's an alternative for me? The neighbors have listed real estate. Okay,

if I sell, do I become a farmer somewhere else? This is the only thing I know. I can't drive a truck or become a fisherman. I don't know those trades.”

As this interview attests, ranchers' observations of the changing national interests in western lands threatened their identities because ranchers characterize cattle production not as a job but as a way of life. Another rancher said, “You feel like you're a lamb being led to slaughter sometimes,” in reference to how FWP agents responded to his depredations with what he perceived as a thinly-veiled pro-wolf agenda. As these and other interviews demonstrated, many ranchers believed that the nation valued wolves above people with the Endangered Species Act as the power mechanism for implementing intended changes in the makeup of the west.

Further, 16 of the 18 ranchers were descendants of a multigenerational ranching family that had raised cattle and often sheep on the same lands for generations, many of them originally homesteaders in the late 1800s and part of the wolf eradication effort. A deep-seated belief emerged from several interviews that wolves are fundamentally not compatible with livestock, where ranchers described how their ancestors were forced to eradicate the wolves to establish viable ranches. This type of generational knowledge suggested a cultural identity grounded in eradicating wolves to allow livestock to survive. To these ranchers, wolf conservation symbolically opposes livestock production. The interviews also demonstrated that this perceived incompatibility between wolves and livestock, that “there's a reason my grandfather got rid of them in the 30's,” is grounded in the core of a rancher's identity: the responsibility to keep cattle alive.

“I guess that’s the thing that gets me is you spend, especially during calving it’s a 24/7 job, but you’re also out there to make sure you keep them alive. That’s how we keep money is by selling the live ones but we owe quite a bit to that animal to make sure that, you know, it’s a grotesque way they get killed. I think these people back in New York think [cattle are] just getting shot and then the wolf eats them, but that’s not true. So we owe it to the cattle because we keep them confined, they can’t get away. They’ve lost all their defense instincts...they’re domesticated, I guess is the word I’m looking for. So we owe them a lot to make sure this doesn’t happen to them (shows me a photo of a calf with the hind end eaten out of it), and there for a while the government had our hands tied, you couldn’t shoot the wolves.”

Four ranchers admitted that this situation was, “forcing me to break the law,” by illegally killing wolves to keep their cattle alive. As one rancher said:

“And I came into it, years and years ago, I felt that as a life strategy I wanted to be honest and above in everything I did. And one of the things is, being the laws of the land, working with people who are law enforcement and everything else, and that was my goal to do with the wolves...(Takes a deep breath). It becomes...it’s impossible to both protect your cattle and to work well with FWP in this situation...I’ll spend time out there looking and hunting and whatever else, just chasing them off. You’re allowed to shoot at them to chase them off. And, between you and me, when I first got here, that’s all I would do but if I have the chance now, I’ll break the law. So it’s turned me into a willing criminal, which I didn’t want to admit to before.”

Many ranchers echoed these sentiments, that the government and general American populace prevented them from doing their jobs as ranchers, which was akin to preventing them from acting out their identities. When one considers how ranchers currently perceive wolves while also taking into account how cattlemen and wolves have interacted throughout history, it becomes clear that wolves are a very heavy symbolic weight on the collective rancher mind.

The Biological Wolf

I am sitting at the table of a hundred year old ranch house with a rancher whose family came here in 1894, who has lived in this house her whole life. She has experienced 13 confirmed wolf depredations over the past five years. She has tried fladry, which did not work, and livestock protection dogs, which she believes are working. She is finishing telling me a story after I've asked her how her experiences losing cattle to wolves have affected her life as a Montana rancher:

“When they were in there with those four calves, my ranch hand called and he said ‘it’s a mess you’d better get up here’. They tore the lips off these calves. They gutted these calves and ate this much out of one calf and that is all.” She holds her fist up to show me how much the wolves had eaten. “They didn’t eat. They were playin’, teaching the young, something. It’s not a pretty sight.”

I purse my lips and nod. She says, “They’re just being wolves, but it’s a big thing for us to have to live with this.”

She looks out the window and keeps talking. “I think they introduced bigger wolves than what was here originally. These are big boys. First one they killed up there at our pasture, there were 15 in that pack. They flew and it took ‘em all summer to get that pack out. But we were riding up there and the government trapper came by and at that point they had to take the heads into the lab, so he came walking across to us and he’d just killed that first one and he said, ‘if you wanna see the real deal you go look,’ and there was this white wolf and she was a female and her head was laying there and I

swear her canine teeth were as big as my little finger.” She looks back at me. “I mean they are killing machines and I don’t trust ‘em. If I was out there in the willows in the dark and they were looking for a meal they wouldn’t care if it was me or my dog.”

She gets up from the table and opens a drawer by the desk in her kitchen and pulls out a folder that’s six inches thick and bulging with loose papers and photographs. “This is my wolf kill file,” she says. “It is not a little thing.” She sits down across the table and sets the folder in front of me. I open it to a photograph of dead calves with their innards strewn out over the snow. There is another picture of a twisted dead foal.

“This is why we ‘love’ the wolves so much, when we see things like this. You are just trying to take care of them and then to have that happen...It’s sickening. It’s a mess. And then this little colt, you know? I think it’s harder when it’s my horses.”

Ranchers recounted their direct encounters with wolves and depredation experiences in great detail.

The most consistent descriptions of wolf encounters referenced how cunning they were upon targeting livestock as their prey. Fifteen ranchers described how depredating wolves would essentially lie in wait, usually under cover of darkness or vegetation, and work around human activity or lure cattle away to be killed. Ranchers described depredation events as extremely violent, gory scenes, with calves often mutilated or eaten alive. Ten highlighted the natural brutality in the way wolves hunt and take down prey, how they enjoy killing and often kill more than they can eat for “pure pleasure” and to teach their pups to hunt. Twelve ranchers perceived wolves as impressive, intelligent

animals and amazing hunters. Five ranchers additionally said that wolves are beautiful animals. While these latter views seemingly contrast with the former perspective that wolves are brutal killers, five ranchers overlapped these views and held that wolves are both impressive, intelligent animals and brutal killers. Six ranchers specifically said that wolves are doing what comes naturally to them, that “they are just being wolves.” A clear pattern of repetition emerged from these responses that suggest this population of ranchers that has experienced repeated depredations has a consistent view of wolves: in the context of livestock depredation, wolves are intelligent and powerful apex predators that demand both respect and fear (Table 1).

Table 1: Rancher Characterizations of Wolves

Rancher	“Creatures of Darkness”; Lying in wait; Wolves at the door	“Brutal, joyful, wasteful killers”	Impressive, intelligent animal; Amazing hunter	Beautiful animal	“Just being wolves”
1	X				X
2	X	X	X	X	X
3	X	X			X
4	X	X	X		
5	X	X	X	X	
6		X			X
7	X		X		
8	X		X	X	X
9	X	X	X		
10	X		X		
11			X		X
12	X	X	X		
13		X			
14	X	X			
15	X		X	X	

Rancher	“Creatures of Darkness”; Lying in wait; Wolves at the door	“Brutal, joyful, wasteful killers”	Impressive, intelligent animal; Amazing hunter	Beautiful animal	“Just being wolves”
16	X				
17	X			X	
18	X	X	X		

While much of the literature focuses on how wolves represent socio-political forces that threaten ranching in the west, these data suggest that, from the perspective of the cattleman or woman that has had direct interactions with wolves and suffered repeated depredations, wolves also represent a significant, tangible threat from a very real, wild animal. For example,

“We were close to the wolves a lot with a spotlight. If you’ve ever spotlighted coyotes, they’ll stand there and look at you. A wolf never will. He’ll look once and then you know he’s there...She couldn’t even go out, my wife, it scared the hell out of her. We have a water tank up there in the corner and she come through there on the 4-wheeler and he was standing right across the fence, 40 yards from her, and looked right at her. And they’ve got the damndest yellow eyes and its: WHOOOAAAAA! Stands the hair up on your neck and she come a foggin’ down and I took the other 4 wheeler up there and a rifle to see if they had come in the pen that night. There were 3 up there that night that we saw but we spooked them on and they headed up the meadow. The next morning they were right back. I called FWP and they brought some snowmobiles out and made a big run up the crick and thought we had run ‘em off, but they came back and killed those 2 calves that night.”

This finding is significant because the emotions that ranchers experience as a result of these direct interactions with wolves may compound those associated with wolf symbolism in this population of ranchers that incurs the most damage to wolves. The next

section will review these emotions and their implications for driving how ranchers choose to adopt management prescriptions to prevent further depredations.

The Theoretical Wolf

This population of ranchers experienced both the symbolic wolf and the biological wolf over the period of this project, resulting in a combined experience of a theoretical wolf that is rooted in reality and symbolic construct. These experiences gave rise to emotions that likely impacted their evaluation and adoption of management prescriptions to reduce further depredations. Ranchers ultimately experienced a myriad of emotions from anger and hatred to guilt and sadness. For instance,

“I’ve been lucky, every one has been confirmed and paid for. But it’s a shame because I didn’t raise these lambs for a wolf to kill them and the maggots to eat them. It’s such a waste. Yeah, I got paid for ‘em, but what a waste! What a waste... That’s the thing that drives me crazy, they’re such a wasteful animal... Nothing worse than to go down like that morning when I went down there and there’s 23 dead and four or five running around with the back ends chewed out of them – it’s awful what they do. It’s FUN to be in there and just RIP and TEAR...”

However, I did not directly ask ranchers what emotions they experienced. Some ranchers offered exact quotes that named emotions, and many more demonstrated emotions that I attempted to interpret. Because not all of the emotions that I observed were the result of a direct inquiry, I cannot use Manfredo’s framework, nor develop an alternative adequate framework, for attributing true meaning to them.

Emotions were not clearly stratified amongst depredation responses, although both the anger and hatred that I interpreted only occurred in those ranchers who did not believe wolves were compatible with livestock. However, many ranchers perceived that the government and other outsiders compelled them by law to act against who they fundamentally are as human beings and fail in their identities by not protecting cattle from wolves. I interpreted this as outsider-imposed shame that likely affected how ranchers perceived wolves and wolf management based largely on their individual personalities and life experiences. However, my study design and interview schedule did not allow me to soundly attribute cause and effect to how personalities, life experiences, and emotions impacted the way ranchers evaluated management strategies and made their decisions.

Therefore, I did not adequately test the modified HDW theory adapted from Manfredo (2009) in order to explain the phenomenon of how ranchers respond to wolf depredation on domestic cattle through adopting different management strategies. The extrinsic variables of ranching culture, community, and generally anti-wolf rhetoric; and ranchers' direct experiences with wolves, wolf depredation, and emotions were largely shared amongst the ranchers I interviewed. However, these commonalities did not correlate with differences in the actions that ranchers took. Therefore, the intrinsic variables of life history and individual personality are potentially more responsible for the different reactions that I observed in the field than the other variables, although I did not adequately test for emotions, so emotions could also play a significant role. Further research should explore these relationships in order to build a theory explaining how

these interactions may drive ranchers' perspectives on wolf management and behavior towards wolves.

However, these data do suggest relationships between how ranchers evaluated wolf management and what management prescriptions they adopted, suggesting two different perspectives on how to manage risk within the population. A subtle divide emerged between ranchers who believed that “We have to change,” and those who believed “wolves are incompatible with livestock,” “wolves are a conspiracy against ranching,” and “I don’t really know how you protect yourself from wolves”, which I have termed “We cannot change”. Table _2_ below delineates each group of ranchers and compares how they reacted with adjustment of ranch activities and lethal management of wolves.

Table 2: Comparison of Ranchers' Management Responses with Perspectives on Wolf Management.

Rancher Perspective on Risk Management	Rancher ID and Location	Adjustment of Ranch Activities	Lethal Management of Wolves
“We have to change”	Rancher 2, Southwest Montana	Change calving operation, Paying more attention	Killing wolves personally
	Rancher 3, Southwest Montana	LPDs	Killing wolves personally
	Rancher 8, Southwest Montana	Range riding, Paying more attention	Killing wolves personally

Rancher Perspective on Risk Management	Rancher ID and Location	Adjustment of Ranch Activities	Lethal Management of Wolves
	Rancher 10, Central Montana	Electric fence, Range riding Paying more attention	Killing wolves personally, Paying for the plane, Helping WS
	Rancher 11, Rocky Mountain Front	Range riding, Carcass removal	N/A
	Rancher 17, Northwest Montana	Fladry (electrified)	Killing wolves personally
"We cannot change"	Rancher 1, Northwest Montana	Carcass removal, Paying more attention	Helping WS
	Rancher 6, Southwest Montana	Range riding, Paying more attention	Killing wolves personally
	Rancher 8, Southwest Montana	Range riding, Paying more attention	Killing wolves personally
	Rancher 12, Rocky Mountain Front	Carcass removal, Range riding	N/A
	Rancher 13, Northwest Montana	Paying more attention	Killing wolves personally
	Rancher 15, Central Montana	Change calving pattern, Carcass removal, Paying more attention	Paying for the plane
	Rancher 16, Central Montana	Carcass removal, Paying more attention	N/A
	Rancher 18, Northwest Montana	Range riding, Paying more attention	Killing wolves personally

Only Rancher Eight, in bold, overlaps the two categories of risk management perspective. Location did not correlate with any one group; in fact, both groups contain ranchers from each of the four locations: Central Montana, Rocky Mountain Front, Northwest Montana, and Southwest Montana. Management strategies are relatively consistent between the two groups, with paying more attention, range riding, and carcass removal being the most frequently implemented tools. However, some ranchers who said “we have to change” also implemented the more time, energy, and money-consuming management prescriptions, such as electric fencing, LPDs, changing the calving operation, and fladry.

Lethal management of wolves remained important across the spectrum of ranchers, but there was a divergence in whether managing risk should focus on wolf control or rancher practices. Three of the eight ranchers who believed wolves are incompatible with livestock and a conspiracy against ranching (“We cannot change”) reported killing wolves personally. This could represent a reporting bias whereby those who believed in a conspiracy were less likely to report illegal or controversial activity (killing wolves) to an outside interviewer. However, the ranchers who fell into the “We cannot change” category also consistently stressed the need to systematically remove more wolves from the population.

Ranchers who believed “I don’t know if there’s anything we can do to protect ourselves from wolves,” held that greatly reducing or ideally eliminating the wolf population is the only thing that will render their operations viable, and focused on changing state management policies to allow for more lethal control of wolves. This

included managing them as predators, which allows an unregulated open season year-round, and using poison baits to control the population. For instance:

“We don’t want to have to live with them. They were planted here by the federal government, they are not just going to stay there in the park – I believe the feds knew this and intended it. They invaded our private land and destroyed our property. That shouldn’t be legal. We met with a lawyer to see if there was anything we could do to legally challenge ‘tolerating’ wolves on our private land. This was an introduction, not a reintroduction... after the environment had created its own balance in the absence of wolves in it. The environment didn’t need them anymore, but they were introduced anyway! ‘Non-lethal’ management? That’s bullshit that people are putting time, energy, and money into that. It’s all part of trying to convert private land away from ranches. They have to be managed as predators.”

Likewise,

“It seems like just about every year we’ve had some losses of some kind. Some years worse than others. They got ‘em delisted and that’s really helped and they got the hunting season on and that’s helped. I mean, everything helps. But to cure the problem they’re going to have to go a few steps further. As far as I’m concerned they [need] to list them...as a predator – they want to sell wolf tags? That’s fine. I mean, I’m not gonna buy one. Years ago they used to put baits out, poison baits, or whatever...[when WS] will take the whole pack out...they’ll use helicopters. I mean, it gets extremely expensive...it ain’t something that’s like they used to do back in the fifties, where they used to go put a poison bait out and that was the end of it. They took care of THE problem and that was it. And no cost to it.”

Ranchers who believed “We have to change,” also held that greatly reducing the wolf population would render their operations viable, but only if they concurrently adapt their operation to most effectively address the threat. This group of ranchers widely believed that eliminating the wolf population entirely is not politically realistic, and so

did not rely on that as a possibility in thinking about how to manage risk. As one rancher said in response to how his experiences losing cattle to wolves have affected his life,

“When you first find [your cattle killed] it’s really frustrating. I didn’t want the wolves and a lot of other people in Montana didn’t want the wolves. But we got ‘em. And it doesn’t do a damn bit of good, you know, I jump up and down and scream and holler, but that doesn’t do nobody any good. So we have to learn to live with them.”

Likewise,

“They put them out there, they needed some way to regulate them before this. And it wouldn’ta got to be this big a problem I don’t think if they woulda kept the numbers back a little bit. And it would be nice for me if I could still calve right down here in the river bottom because I’m just 15 minutes from the calving lot. Now I gotta drive, if I come home, I have to drive 8 miles down there, 8 miles back...you end up staying down there. It’s a hassle because we’re so spread out...it’s a hassle that way but I think we owe it to the cattle to protect them the best we can even though it’s expensive, and it adds up, fuel, everything else...it’s a government imposed tax to a point. Because by putting them in here it costs us more to do everything because we have to change. We can’t do it like we used to. Yeah, it’s just something we have to deal with I guess, which is alright.”

This stratification may represent two opposing perspectives on how to manage depredation risk within Montana’s ranching communities, both with the generational knowledge of wolves being incompatible with livestock in the past, but in disagreement over whether the focus of the current problem should be on eliminating wolves because they are inherently incompatible with livestock or on ranchers adapting their ranching operations to attempt to be more compatible with wolves.

Ranchers who believed, “We have to change” represented those who are attempting to augment a model of ranching that was institutionalized in the absence of

wolves and is bound to generational and cultural identity, as demonstrated by those who believed, “We cannot change”. The barriers to coexistence, therefore, are embedded within the framework of ranching itself. It will be critical as wolves persist on the landscape for ranchers, managers, and funders to prioritize efforts to manage wolf depredation risk that do not further threaten the ranching identity or ranch financial viability. This will mean removing problem wolves efficiently, increasing revenue for financial compensation to ranchers that have experienced depredation for indirect losses, and increasing revenue and peer-learning outreach for implementing preventative tools that ranchers evaluate as effective, efficient, and culturally acceptable. Figure 5 presents a visualization model of the divide of perspectives on how to manage risk and management strategies.

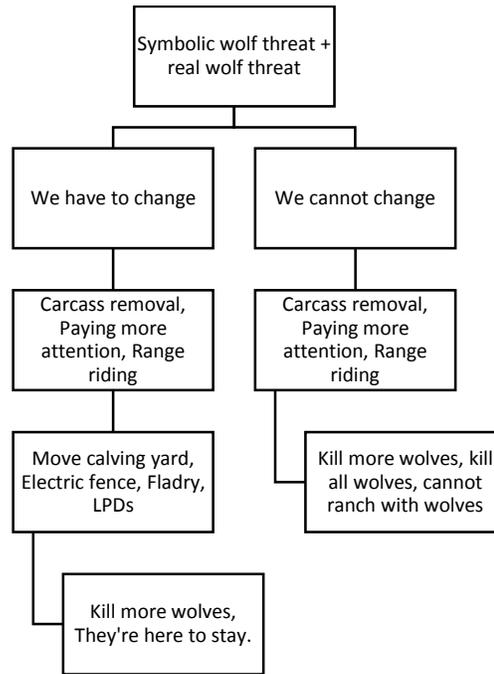


Figure 6: Flow Chart Illustrating the Perspective and Management Action Divide Amongst Ranchers

CONCLUSIONS AND MANAGEMENT CONSIDERATIONS

The HDW framework outlined by Manfredi (2009) partially explains the data that emerged from this inquiry. My proposed hypothesis based on this framework was that personal and societal pressures drive each rancher's emotional reaction to a depredation event and his or her subsequent cognitive decision to adopt a certain management strategy. The study design did not allow me to adequately explore ranchers' personal life experiences enough to gauge that variable's causative influence on emotions or decision making. The conducting of a single interview, rather than multiple interviews, resulted in ranchers heavily emphasizing societal pressures, experiences, and opinions over their personal backgrounds. Furthermore, I did not inquire nor analyze the current or historic economic state of each ranch, so cannot infer whether economic stresses may be correlated with response to wolf depredation. They did adequately offer their personal perspectives on wolves and wolf management, as well as their experiences with depredation itself and evaluations of management strategies. Their emotions were inherent in their descriptions and were not restricted to depredation experiences, but were not supported in my study design with an adequate framework for interpretation.

The identifiable themes that emerged from the data were cultural identity, depredation experiences, perception of wolves and wolf management based on depredation experiences and cultural identity, evaluation of management strategy, and actions with management strategies. The development that most ranchers held a deeply generational cultural identity that was threatened by the national social forces that wolves

represent became even more interesting when a divide in risk management perspectives emerged from the data. While ranchers largely shared the perceived threat of “symbolic wolves” and the internal struggle they experienced in being compelled by law against protecting their cattle from “biological wolves”, they were divided in thinking either that ranchers can and must adapt to wolves on the landscape or that wolves must be eradicated or strongly controlled to allow ranching to persist.

The sources of this divide remain elusive and are likely sourced in the deeply personal subjective experiences, individual personalities, and ranch history and economic state of each rancher, especially considering that individual locations were not correlated with the divide in risk management perspectives. However, the subtle correlation of this divide with certain management actions (i.e. ranchers who believed “We cannot change” were exercising the most effectively evaluated measures to manage depredation risk, while ranchers who believed “We have to change” were exercising the most effectively evaluated measures as well as experimenting with techniques that were evaluated as questionably effective or efficient), indicates that these processes warrant further inquiry. My sample size was so small that this subtle difference may just be a random occurrence, but a broad-scale survey may reveal a correlation if there is one. What this research does suggest is that that first ranchers evaluate whether a tool is effective to begin making a decision about how to act. The differences in their individual personalities and deeply personal backgrounds and emotional experiences may combine with their empirical evaluations to determine why they react differently according to these two risk management perspectives.

Not only do ranchers who experience repeated depredations face a real threat to their economic bottom line, the animal that presents that threat also symbolizes national forces beyond ranchers' control that devalue their identity and way of life. The stakes are therefore high – the ranchers that experience the highest conflict may be the most vulnerable to selling their land and thus converting wildlife habitat to development and altering rural character. While there appears to be a perception within the population of ranchers suffering the most losses to wolves that they must adapt their operations to wolves on the landscape, many ranchers interviewed believed the situation is ultimately irreconcilable. Further, most ranchers, including many of those choosing to adapt, cited how wolves represent a nationally growing western land ethic that does not accept their presence. The fact that the United States government and people chose to reintroduce wolves to Yellowstone and Central Idaho at ranchers' perceived expense to their wishes and livelihoods underlies this concern very clearly.

The results of this inquiry suggest that efforts to improve coexistence between ranchers and wolves should address ranchers' primary concerns of removing problem wolves and compensating for indirect losses, as well as prioritize funding for non-lethal tools that ranchers evaluate as biologically effective, economically efficient, and culturally acceptable. Such efforts that focus on ranchers' concerns may aid those ranchers who find it difficult to reconcile wolves with cattle in implementing more tools that protect their cattle from wolves. This approach may result in empowering ranchers that have incurred repeated losses in the past and may reduce depredation events overall.

It may also build mutual trust between wolf advocates and ranchers, thus shifting the intractable national debate over wolves towards tractability.

Removing problem wolves and obtaining compensation for indirect losses on rangelands were primary concerns of ranchers who had suffered repeated confirmed losses to wolves. The effects of wolf mortality on depredation incidents are currently under intense speculation and research. One recently published study suggests that population-level human induced mortality to wolves in the Northern Rockies may be positively correlated with livestock depredations in subsequent years (Wielgus and Peebles 2014). However, this study included targeted removal of problem wolves with indiscriminate public hunting in its mortality analysis, so cannot speculate on the relationship between localized problem wolf removals and localized depredations in subsequent years, or the “hot spot” scale that I targeted with this research (Wielgus and Peebles 2014). Further research should isolate how wolf removals associated with “hot spot” depredations may affect depredation risk locally over time. This will likely require comparing wolf removal and depredation data prior to 2009, when regulated public hunting seasons were initiated, with wolf removal and depredation data after 2009 in order to isolate the time when the only human source of wolf mortality was targeted removal due to livestock depredations and compare those trends with the current reality of regulated public hunting as an additional mortality source.

Indirect effects such as reduced liveweights and pregnancy rates in cattle herds that have had confirmed losses have recently been quantified (Ramler et al. 2014, Steele et al. 2013). The magnitude of underdetection of loss on rangelands is more difficult to

quantify, although Oakleaf et al. (2003) suggested that rancher detection rates were low by a factor of six in an Idaho grazing allotment study. These data and others suggest that cattle herds that have had confirmed losses likely also have undetected loss to wolves (Oakleaf et al. 2003). As more studies refine these numbers, a priority for wolf conservation should be to secure funding to compensate ranchers for indirect losses and undetected losses, as well as direct losses.

Every rancher interviewed for this project was exercising some form of non-lethal adjustment to their ranch activities. Livestock Protection Dogs stood out as a practice that was not implemented widely, but had high psychological assuagement in that many ranchers not practicing it were quite interested testing it. Ongoing research is currently evaluating the actual efficacy of certain dog breeds (Young 2013), and this inquiry suggests research should include testing the efficacy of dog breeds with range cattle specifically.

Carcass removal, attentiveness to landscape processes, and range riding represented the most frequent package of non-lethal measures that ranchers utilized to prevent further depredation. These tools may therefore hold the most potential for managers, funders, and ranchers to feasibly apply preventative tools more broadly. Ranchers evaluated carcass removal and paying more attention as both effective and efficient. Many carcass removal programs that are partnerships between non-profits, the USFWS, FWP, the Montana Department of Transportation, and other partners are underway and expanding to new areas in Montana. This research strongly supports these programs' continued expansion. The practice of increasing attentiveness to landscape

patterns is a more subtle tool that ranchers seem to adopt based on instinct and the ranching necessity of responding to environmental pressures as they arise. However, educating ranchers more directly about wolf life history, behavior, and interpreting tracks and sign may further help them read cues on the landscape that reveal the potential for depredation and enhance their ability to prevent losses. This education may be most effective if delivered by ranchers to their peers.

While ranchers evaluated both carcass removal and attentiveness to landscape processes as highly effective and efficient, they did not evaluate range riding as effective or efficient although they practiced it frequently. This apparent inconsistency may result from range riding having high psychological assuagement, as something that cattlemen have practiced as a matter of course throughout their history, but not always to protect cattle from wolves. More often, range riding is practiced to move cattle to new pastures or keep them scattered in small groups to reduce impact to the range or meet rest-rotation standards for public allotments. Such infrequent visits are not enough to prevent depredations. Ranchers cited capacity and scale as the main reasons that range riding cannot effectively prevent wolf depredations. They cannot afford to spend the time themselves, or pay someone else, to be monitoring cattle more frequently and cattle are so spread out on the range that it is impossible for riders to be effective even if they have the time.

However, the traditional model of range riding focuses only on the presence and location of range riders and cattle, rather than wolves. Oakleaf et al. (2003) suggested that calves may be more vulnerable to depredation in close approximation to wolf dens or

rendezvous sites. Some models, such as the Blackfoot Challenge model, are being tested to combine range riding with wolf monitoring under the theory that if riders, or ranchers, know where the wolves are they can more effectively prioritize their spatial efforts to protect the most vulnerable groups of cattle (Bradley et al. 2015). There may be significant trust barriers to this model, as wolf managers may be reluctant to share sensitive wolf location data with riders or ranchers for fear of illegal killing. However, because of the apparent high psychological assuagement ranchers hold for range riding, there is a great opportunity to improve the biological efficacy of range riding and implement it on a broader scale. Risk reduction resources should be put into transferring the Blackfoot Challenge model of prioritizing range rider efforts to other ranching communities across western Montana.

More funds are needed to help ranchers who incur the costs of wolf conservation. As the ranchers interviewed for this project pointed out, funding to address livestock depredation has decreased as wolf populations and depredation rates have increased and ranchers are increasingly incurring more costs. Currently, funding for compensation in Montana is allocated by the Montana Livestock Loss Board, under the Montana Department of Livestock. The Board's primary funding sources are private citizen donations and federal grants. Environmental organizations that support wolf conservation could help pay the costs of wolf conservation that ranchers disproportionately bear. Some organizations, such as Defenders of Wildlife, do support ranchers by providing technical support and funding for non-lethal tools to prevent cattle depredation. Although Defenders of Wildlife used to pay direct compensation for wolf depredation, the

organization ceded this responsibility to the state upon wolf delisting. National environmental organizations have the potential to leverage enormous funds through campaigns to support wolf conservation. However, the majority of campaigns to support wolf conservation pit wolves against rural people, resulting in an intractable social conflict between ranching and environmental communities. Further, popular environmental rhetoric often criticizes ranchers for being unwilling to implement non-lethal tools based on the assumption that they are lazy or uncooperative. It is imperative to rework this popular rhetoric to represent what this research suggests: that ranchers' reluctance is more likely sourced in concerns over whether tools are actually effective at preventing depredations and, if so, whether effective tools are also financially efficient and therefore feasible to be implemented on a wider scale. If popular environmental society ceases to disregard the ranching identity in favor of wolves, ranchers may feel less symbolically threatened by the mere presence of wolves in the West and may be more likely to accept them.

Tools that ranchers who held the perspective "We have to change" utilized in addition to the three popular tools mentioned above also warrant funding for implementation and further research into efficacy. Livestock Protection Dogs (LPDs) in particular were of high interest to ranchers not already implementing the tool, which supports the robust USDA Wildlife Services research underway to evaluate LPD efficacy given different situations (Young 2013, Marlow 2012). Furthermore, ranchers in this study overwhelmingly trusted the Wildlife Services agency and personnel and may be more willing to implement and experiment with their recommendations. This nuance

suggests that funders should focus on LPDs as an innovative tool to back as this research develops.

It is imperative for a trustworthy messenger to deliver results and suggestions to rural communities, such as the ranching community of western Montana (Frykman 2015). Each rancher I spoke with expressed honest interest in what I was learning from other ranchers. I informed them as I could during interviews, maintaining anonymity but delivering details about tools as best I could, but committed to reporting back to them what I learned once I was able to sort through all of the data. This trend of interest corroborates rural communications theories that messengers from within the community and messages in the community's language are critical for overcoming trust barriers to implementing solutions (Frykman 2015). Peer to peer learning about management tools to prevent wolf depredation may be an effective method to increase implementation of strategies that protect cattle from wolves. The efficacy of peer to peer learning in this context deserves further inquiry.

Arguably the most compelling development of this research was the strong correlation between rancher risk management perspectives and the package of tools they adopted. The most frustrating development of this research is my lack of ability to search for causes of this correlation due to the limitations of the data. Future research should return to this question through a methodology designed to build rapport and trust over multiple interviews and field visits with ranchers to target how their individual personalities and life experiences may explain the divide in risk management perspectives and correlating management actions that I observed.

However, this research may be empirically useful to the ranchers, wildlife managers, land managers, universities, government agencies, environmental groups, and other NGO's actively engaged in addressing the problem of wolf depredation on domestic livestock because it highlights those tools that ranchers experiencing high levels of depredation may be willing to implement on a broader scale. This inquiry would benefit from a broader-scale survey of all ranchers across western Montana to determine whether the finding that these 18 ranchers are most widely implementing attentiveness to landscape patterns, carcass removal, range riding, and lethal control is consistent within the larger community of Montana's ranchers. Such a survey should also target rancher's evaluations of the risk management tools reported upon here. These types of qualitative and quantitative studies that target ranchers' experiences with and perceptions of tools to reduce the risk of wolf depredation can complement ongoing studies that are testing the actual biological effectiveness of the tools themselves. By focusing resources on tools where positive rancher evaluations overlap with biological effectiveness, we may increase implementation of tools that work. This, in turn, may reduce depredation and associated wolf removals, thus alleviating the biological problem of livestock depredation that serves as fodder for the larger symbolic conflict over wolf management in the west that has so perpetuated polarization on local, regional, national, and even international scales. While I would argue that we currently remain firmly in the era of contemporary conflict and wolf depredation on domestic livestock will always remain contentious, efforts that integrate the ranching community with other organizations in problem-solving

activities may alleviate both the biological *and* symbolic threats that wolves pose to ranchers, eventually moving us toward an era more characterized by coexistence.

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APPENDICES

Appendix I: Introductory Letter to Ranchers

HSU LETTERHEAD

Rebekah T. Rafferty

[\(406\) 212-8483](tel:(406)212-8483)rtr10@humboldt.edu

DATE

Dear _____,

I am a graduate student at Humboldt State University researching how ranchers in western Montana are responding to cattle depredation by wolves. I am especially interested in learning about what folks may be doing to respond to the risk of livestock losses to wolves. When I contacted the Montana Livestock Loss Board to get their input, they agreed that my project is important. They provided basic contact information for ranchers who had submitted livestock loss claims. This project is funded by Humboldt State University.

I would like to visit with you about what you may have done that works (or does not work) to protect your cattle from wolves. **The information you provide me, if you choose to do so, will be strictly confidential. Nothing you say will be linked to your name in any write up of my project, and nobody other than me will ever know who you are. This protocol is standard for my university and will help ensure that I can obtain objective and thorough information.** My hope by contacting people like you

is to learn more about your experiences with wolf depredation and to identify possible practices that protect cattle from wolves.

After finishing my thesis, I intend to share my results with everyone who participated in the study and other Montana ranching communities if they are interested.

Please feel free to contact me at home at [\(406\) 754-0011](tel:4067540011) or on my cell at [\(406\) 212-8483](tel:4062128483) if you have any questions about my proposed research. I will follow up with you through a phone call in the coming weeks to possibly schedule an interview at your convenience. Thank you in advance if you might consider helping me out with my research.

Best wishes,

Rebekah Rafferty

Appendix II: Interview Schedule

SCHEDULE:

BEFORE BEGINNING – Thank you for taking the time to help me with my research.

As I mentioned in my letter, I am hoping to learn more about your experiences with livestock losses to wolves.

I'd like to begin with a few background questions about your ranch.

BACKGROUND QUESTIONS –

- 1) How long have you (or your family) lived here?
- 2) What brought you (or your relatives) here?
- 3) Can you tell me a little bit about your operation (type, general size, grazing cycle - layout of pastures/allotments)
 - a. How does your year usually go – calving cycle, haying cycle, range cycle?
 - b. What cattle breeds do you use? And why?
 - c. Were you ranching here at the time of the wolf reintroduction?

DEPREDAATION EXPERIENCE QUESTIONS –

- 1) When did you first experience a confirmed loss of your livestock to wolves?
 - a. What happened?
- 2) When the first loss happened, what did you do afterwards? (probe for a short term response vs. long term response)
- 3) How often have you lost cattle to wolves since then?
- 4) Could you tell me the details of those incidents?
 - a. Did you (do the same thing as the first time afterwards)? (if not), what did you do? And why?
- 5) Did any of your livestock losses result in wolf removal?

- a. Did that help or not help?

ADAPTATION TO A PARTICULAR MANAGEMENT STRATEGY QUESTIONS –

- 1) Do you manage your cattle differently when you think that there is a risk of losing livestock to wolves. (And, I'm really learning here, so would you mind if I stopped you to explain something that I might not understand)?
- 2) So, specifically, since you experienced your first depredation, have you had to change anything about how you manage your cattle?
 - a. How did you come to that decision?
 - b. Can you describe the way you've changed anything in detail? So, earlier you described your operation for me in detail – have you changed any of those practices to address the threat to your cattle?
 - i. Do you think that those efforts have worked to lessen the threat to your cattle?
- 3) Have there been any local efforts in the community to respond to wolf activity that you know of or have participated in? (Like a range rider program, carcass removal, electric fencing, dogs)
 - a. If there were efforts, would you want to be a part of that? Do you think they would help?
 - b. What led you to participate?
 - c. Have you tried any strategies that were recommended or come up with?
 - i. How do you think they have helped or not helped?
 - d. What efforts do you think have been most successful in on the ground solutions?
 - e. Were there challenges about the process or implementation? If so, what were they?
- 4) Overall, how have your experiences losing your cattle to wolves affected your operation and your life as a Montana rancher?

ENDING QUESTIONS

1. Do you have any concerns about wolves or your experiences that we haven't talked about?
2. Is there anything that you think I should have asked you?
3. Do you have any questions for me?
4. May I call you with follow up questions, or for a second interview?