

An Evaluation of Social, Ecological and Administrative Factors that Influence the Effectiveness of Wildlife Damages Compensation Programs

Alexa N. Frederick

ABSTRACT

This paper investigates the social, ecological, and administrative factors that can impact the implementation of compensation programs as a human-wildlife conflict management strategy in the United States. Compensation programs are currently the source of over \$5 million dollars worth of conservation spending, so understanding how to make them effective is key to efficient spending of limited resources. A key finding to this study was that less than 75% of current compensation programs clearly identify goals and less than 50% state intentions to perform follow up studies. Moving forward, ensuring clear goals and outcomes will be an important aspect of compensation program planning and implementation. In terms of factors that influence program implementation, presence of a fundamental barrier, species being compensated for, and perception of wildlife conflict were the most important indicators. Future directions for this study include repeating a systematic review in another country with compensation programs and conducting surveys in regions with compensation programs to evaluate tolerance improvements.

KEYWORDS

Human-wildlife conflict, systematic review, conflict mitigation strategies, United States program inventory

INTRODUCTION

Since the origin of humans as a species, we have always been in some form of conflict with the wildlife we share our landscapes with. Human-wildlife conflict (HWC) inevitably emerges when the needs of wildlife species and humans do not align. Modern HWC is not only related to basic survival needs and resource competition, but extends to issues related to equity, class, race, values, and power in human society. HWC is generally defined by scholars as a situation in which wildlife pose threats to human life, economic security, or welfare (Nyhus 2016). Even though the term “human-wildlife conflict” suggests equal importance of both parties, the term is typically reserved for situations in which humans experience negative consequences from interacting with wildlife. In the United States, HWC causes an estimated \$2 billion USD per year in losses through agricultural, livestock, and property damages (Messmer 2000). Beyond these tangible damages, indirect losses also arise from threats to human livelihood, threats to personal safety, and opportunity costs (Decker 2002). Even though HWC is understood through the lens of human losses, wildlife can also face negative consequences from HWC, like retaliatory killing (Nyhus 2016). Human-wildlife conflict has been increasing in frequency on a global scale, and will likely only continue to do so as humans expand their impact on the natural environment and increase their demand for resources (Madden 2010, Venter et al. 2016).

To reduce the negative consequences of conflict for humans and wildlife, conservationists have developed multiple strategies to avoid, mediate, and reactively mitigate conflict. For conflict like livestock predation and agricultural losses, these strategies include improved land management practices, regulated wildlife harvest, wildlife translocation, and compensation schemes (Distefano 2003). In this case, preventative strategies (e.g. using a guard dog to scare wildlife away) would always be preferable, since they block conflict before it even happens. In reality, however, preventative measures are not always socially acceptable, politically viable, or economically feasible, as they usually demand monetary investment and a change in human or wildlife behavior. Because human and wildlife behavior are difficult to change, and because even the most effective preventative measures don’t have a 100% success rate, reactive mitigation strategies are almost always elements of conflict remediation strategies. Reactive mitigation strategies take place after the conflict has already occurred; their goal is to neutralize the negative effects of the conflict at hand. That said, the feasibility of individual strategies varies by region.

Since reactive mitigation doesn't require as much individual buy-in from those who experience conflict, it is especially key in areas where the political landscape may not lend well to engagement around HWC. The United States has a complicated history and relationship with wildlife conflict mitigation, and resolution strategies. For example, in the US, there is strong polarization around large carnivore conservation and the US's role in protection (Nyhus 2016). Because human attitudes are difficult to change, reactive conflict mitigation often serves as a necessary first step in developing trust; it helps build rapport between those who advocate for wildlife protection, and livestock producers who need realistic management solutions to protect themselves from losses (economic and otherwise).

When it comes to crop and livestock damage, the most common reactive solution focuses on minimizing economic losses and compensates producers for some portion of the market value of what was lost. It's called a compensation scheme. A compensation scheme is a reactive mitigation tool that operates by submission of claims of damages, and return of monetary or monetary equivalent value items (Morrison et al. 2009). The complexities of what a compensation scheme entails, however, have made it an increasingly researched topic (Ravenelle and Nyhus 2017). Compensation schemes have seen a dramatic increase in scholarship and implementation over the last ten years, potentially due to its attractiveness as a reactive mitigation solution (Ravenelle and Nyhus 2017). The underlying concept, at its core, is simple: if people don't suffer economic losses as a result of HWC, they may be more tolerant of wildlife presence.

Despite the increase in compensation scheme popularity, there is little consensus among the conservation community over whether these compensation schemes are effective uses of conservation dollars. Several papers in the existing literature argue whether compensation schemes "work" or "don't work" (Yoder 2000, Rondeau and Bulte 2007). However, this binary assessment of success oversimplifies the complex ways that compensation schemes operate in practice. Other potential metrics of success—like improvement of attitude towards wildlife, and decrease in retaliatory killing, for example—have yet to be considered in a systematic analysis or evaluation. There has also been limited research on what makes a successful program in terms of administration (e.g. time to payment, method of payment, method of damages verification, and more) (Nyhus 2003). Additionally, the social, political, economic, and ecological factors that affect compensation schemes have not been studied extensively. Therefore, there are three main gaps in our understanding of the effectiveness of compensation schemes. First, we need to understand the

scope and role of compensation schemes in the US. Second, we need a clearer understanding of how NGOs and governmental organizations can and should define compensation program success. Finally, we need a systematic evaluation of the non-administrative factors that affect the implementation, reception, and long-term success of compensation programs.

Questions

Central Research Question

What factors impact the implementation of wildlife damages compensation programs in the United States?

Sub Questions

1. What kinds of definitions of success can exist for compensation schemes and how should those change based on program goals?
2. What are the specific social, political, economic, ecological, and procedural factors that contribute to the relative success of compensation program implementation?
3. What are the broad trends in compensation scheme implementation in the United States and how do those impact conservation?

FRAMEWORK

Inventories that track the basic presence and key components of compensation schemes have helped identify broad patterns in compensation scheme implementation. One such study found that the United States had no long-term compensation scheme that is federally supported, either by funding or policy (Wagner et al. 1997). The compensation schemes that were tracked were managed primarily by pro-wildlife non-profits and state wildlife departments. Since the last inventory of US compensation schemes was published in 1997, there's little in-depth tracking of current compensation schemes in place today. The 1997 inventory identified twenty-three total schemes in place across twenty states. Nineteen out of the twenty-three schemes were managed by

state wildlife and agriculture departments, while the remaining four were managed by pro-wildlife non-profits (Conover, Schmidt, and Wagner 1997).

More recently, scholars have completed inventories that examine macro-trends on compensation schemes. One recent study did a global inventory of compensation schemes and identified common pitfalls and recommendations across programs (Nyhus and Ravenelle 2017). The most common recommendations from this study were dedicated to improving the administrative processes of compensation schemes, like decreasing time to pay, time to verification, and similar efficiency issues (Nyhus and Ravenelle 2017). The same study found that less than 5% of the reviewed compensation programs identified the explicit goal of the compensation program (Nyhus and Ravenelle 2017).

As inventories became more commonplace, debate began over whether compensation schemes “worked” or not. Based on concepts rooted in economics, some papers argued that on a theoretical level, compensation schemes would artificially promote the practice of agriculture beyond when it was reasonable or acceptable (Rondeau and Bulte 2007a). This is because Rondeau and Bulte considered compensation as an economic incentive to stay in a business that may have otherwise been shut down without payments (Rondeau and Bulte 2007a). In contrast, another study concluded that by using different economic theory by building a cost-benefit model of wildlife damages, that in fact, compensation schemes should operate as a cost distributor (Yoder 2000). This cost distribution should actually make compensation receivers more likely to tolerate wildlife on their land (Yoder 2000).

While these broad review papers provide insight into the scope of compensation program presence, and theoretical arguments about whether compensation schemes “work” initiate important conversations about the potential impacts of compensation programs, they provide little insight into program implementation and methods for improvement. In addition to inventories and debates, case studies were also a core portion of this analysis. Case studies help clarify how culture, perception, governance, and funding can affect specific locations, and track a compensation scheme through its lifetime. The issues in compensation scheme theory are reviewed firsthand when faced with questions like: What losses are ranchers, farmers, and other rural residents really experiencing? How can those be mitigated by money? And in what ways is monetary compensation not enough? Two additional case studies contributed to the understanding of conflict management within this particular system. The first study identified that perception of a

“fundamental barrier”—that is, a barrier of beliefs, values, or understanding between two conflicting groups—makes resolution and mitigation more difficult (White, Marshall, & Fisher 2007). This can be seen along protection and use value perspectives. For example, the reintroduction of wolves into the US has been polarizing and provides insights on how a fundamental barrier is perceived and propagated. From a use value perspective, minimized exposure to a physical landscape, and undervaluing more traditional “American” ways of making an income are cited as the primary reasons why urban residents support wolf protection (Bruskotter, Schmidt, and Teel 2007). From a protection value perspective, lack of compassion and educational or scientific shortcomings are pointed at as the reasons why rural residents resist wolf protection (Bruskotter, Schmidt, and Teel 2007). Both sides use emotion as their primary catalyst, whether that be alienation, anger, frustration, or fear. It's an example of how emotional polarization can make conflict mitigation and resolution more challenging.

Gaps

Case studies contribute to understanding how specific systems work, but because they're inherently location specific, the findings can't always be extended beyond the reaches of the original study area. In research about compensation schemes overall, gaps are apparent in critically evaluating compensation scheme implementation on a broader scale. The specificity of case studies combined with the broad scale investigations of inventories would bring a level of functional trend analysis that could really move this study area forward. Additionally, the most productive studies have been those that consider the human impact of the system in question. The inventories about compensation schemes were somewhat lacking in considering factors beyond presence and reported results.

A commonly cited compensation scheme research paper written by Philip Nyhus reviews what Nyhus defines as six core elements of a successful compensation scheme (Nyhus 2003). Three of the core elements are related to funding and payment and the fourth is clear and communicated guidelines. The last two are site specificity and measures of success, meaning that one third of the core elements of a successful compensation program should be how the program is catered to the people affected by conflict and tracking appropriate data to ensure relevancy. Yet, most of the research that's been published has been focused on first four elements (i.e. procedural

and process-oriented). This shows a clear gap in what is needed, versus what is present. Additionally, exploring relationships between different environmental, geographical, and social elements in play would be highly valuable in compensation scheme research (Nyhus and Ravenelle 2017).

METHODS

I utilized the most recent inventory of compensation programs as a starting point in updating the list of programs within the United States (Wagner et al. 1997). From this base list, I searched scholarly sources like JSTOR, Science Direct, and Google Scholar using relevant search terms in varying combinations (e.g. “wildlife compensation,” “wildlife damages,” and “compensation schemes” with the state and species name). Finally, I also gathered government reports and public press releases via Google’s search engine. For each search term, I reviewed all relevant resources through page twenty of the corresponding search results. I used any scholarly article, study, government document, or press article that mentioned compensation programs at least once. This ensured that papers discussing wildlife management in general were filtered out, making the volume of information significantly more manageable. I did not however, require that compensation programs be the central topic of every paper I used, since I wanted to understand how compensation programs fit into broader conversations about conservation as a whole.

For each resource, I recorded information on the context of the compensation scheme presented in the case study. The information below was collected from government documents and scholarly articles, as it pertains to the structure, funding, and implementation of the program:

Location of the case study	State or region
Form of payment	Cash: monetary value of lost or damaged property
	In-kind: direct replacement of lost or damaged property
Method of verification	In-person: employee of state confirms predation and damage by physically visiting the location of damage
	Remote - non-digital: phone confirmation or notification of damage
	Combination of above
Time to compensation	Within 2 weeks, 1 month, 3 months, 6 months, 1 year, or unspecified
Eligibility criteria for payment	Minimum husbandry requirements: e.g. reasonable attempt at utilizing non-lethal conflict prevention strategies (specifics change by program)
	Participation in HWC management planning: e.g. attending town halls or allowing research on premise (specifics change by program)
	No eligibility
Species being compensated for	Taxa, behavior, spatial, and resource requirements
Sponsor of scheme	NGO, state government, or national government
Annual cost of program	In USD
Structure of compensation scheme	Ex-post: reactive payments after damage, fund managed by 3rd party facilitator
	Performance: proactive payments based on environmental achievements (i.e. reaching a certain population threshold)
	Insurance: reactive payments after damage, fund built through landowner buy-in, but managed by 3rd party distributor)

Each piece of information collected was put into a table, where there was a predefined selection option to ensure consistency when reviewing the case studies (option specifications above).

Though success is a difficult term to define for compensation programs, I made a basic definition of the impacts usually covered by compensation program. Every compensation program needed to do two things. One is to positively impact conservation goals in terms of wildlife population and occupancy as a result of the compensation scheme. Two is if the majority of stakeholder needs are self-identified as being met. Ideally, in-depth surveys would be required to have a deep understanding of stakeholder satisfaction. However, given the scope of this study, I used public press sentiment as a proxy for understanding stakeholder satisfaction.

I completed simple analyses to understand the scope of compensation programs by calculating total cost of all compensation programs, total cost by state, and average cost by species to better understand the scope of compensation program usage in the US.

RESULTS

Overview

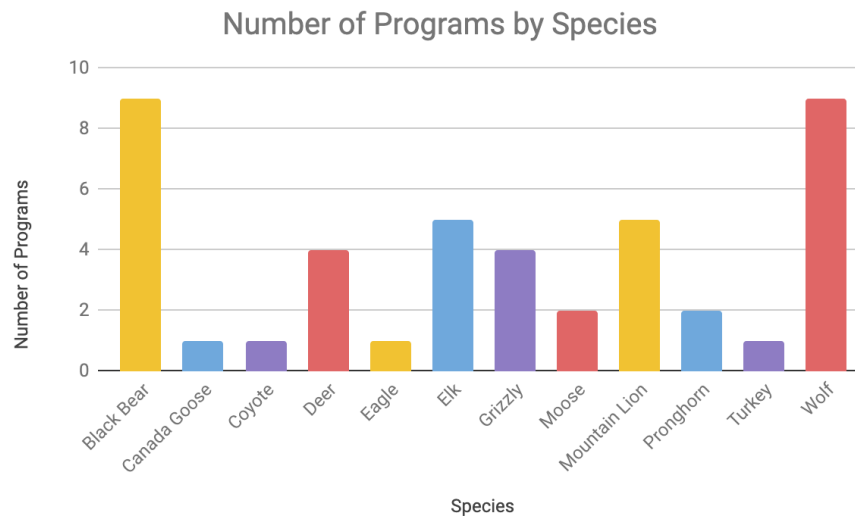
Across the United States, there were 44 active programs across 17 states for 12 unique species (Appendix B, Figure 1). In total, about \$5,500,000 USD was spent on compensation programs in a single year, when adjusted for 2019 dollars (Appendix B). Annual cost was not consistently available across all years studied, so I utilized the most recently available data and adjusted it to the 2019 value of the US dollar. The oldest cost value was from 2005. Since the last inventory in 1997, 20 programs were closed, and 16 new programs were created (Appendix C). Out of the 44 programs, 3 did not have complete data available. This was because two of those programs were in early development phases, and one did not track total claims per year. I found that of the 8 data points I tracked across compensation programs, 4 were consistent across the board (Table 1).

Table 1. Four out of the eight primary data points collected were almost ubiquitously present across all programs.

Data Consistent Across Programs	Result
Form of payment	Cash
Method of verification	In-person
Program sponsor	State government ¹
Program structure	Ex-post ²

¹ one program was a cross-state collaboration (AZ-NM) and one was managed by an NGO (FL)

² one program (AZ-NM) had a combination of ex-post and performance payment options available

Figure 1. The most frequent species to be compensated for was tied for the wolf and black bear, followed by elk, mountain lions, deer, grizzlies, moose, pronghorn, geese, coyotes, eagles, and turkeys, respectively.

*the Mexican and Grey Wolf were both put under the “wolf” umbrella

In this analysis, I also collected a number of differentiators between the 44 different programs (Table 2). I also tracked if there were any eligibility requirements for program recipients. I identified five different categories of eligibility requirements that were used in varying frequency (Table 3).

Table 2. These factors were the biggest source of differentiation over all programs.

Differentiating Factors
Time to compensation
Operating budget
Presence of goals and follow-ups
Species

Table 3. Minimum land management practices were the most frequent, but were varied in what was specifically asked of each landowner. Most programs required “effort” in putting practices in place to limit conflict, but did not specify what “effort” was defined as.

Category of Eligibility Requirements	Frequency
Minimum land management practices	16
No eligibility requirements	10
Individual buy-in	8
Specific damage type	3
Participation in planning	2

Subquestion 1: What kinds of definitions of success can exist for compensation schemes and how should those change based on program goals?

A total 70% of programs clearly identified goals, but only 57% tracked success metrics or completed a follow up study. Of those that were identified, minimizing loss to landowners, identifying and rewarding the value that private lands provide for hunting and recreation, and developing tolerance among landowners were some of the most common goals. The follow up studies conducted as surveys helped judge program perception and community sentiment (before vs. after the program). These follow up studies were executed primarily by researchers outside of the managing governmental agency.

Subquestion 2: What are the specific social, political, economic, ecological, and procedural factors that contribute to the relative success of compensation program implementation?

The factors that varied across compensation programs were: state, species behavior, operating budget, political distribution, and history of conflict and management. While the total cost of compensation programs across the country is important, it's also important to understand how those costs are broken down. Spending varied widely by state, and also by species (Figure 3, Figure 4, Figure 5).

Figure 3. The total spend on all compensation programs in a single year across species was \$5,534,109.15.

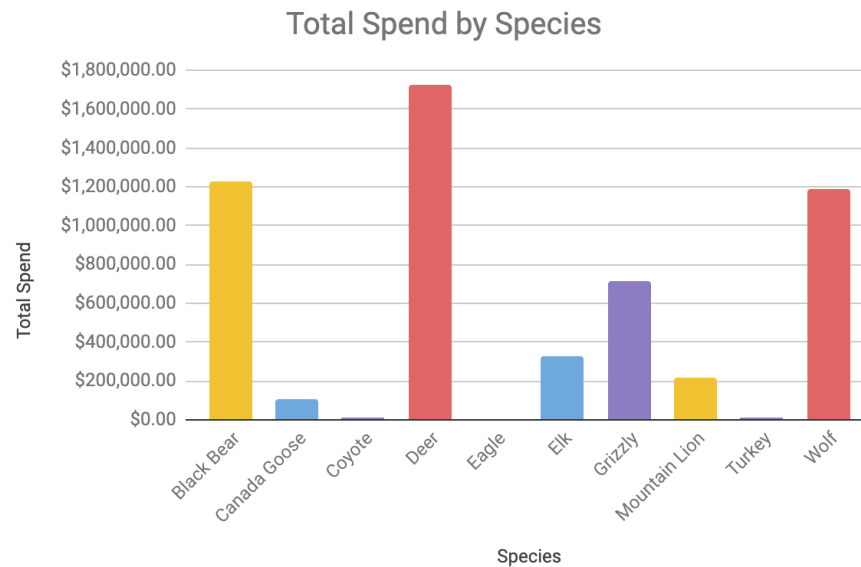
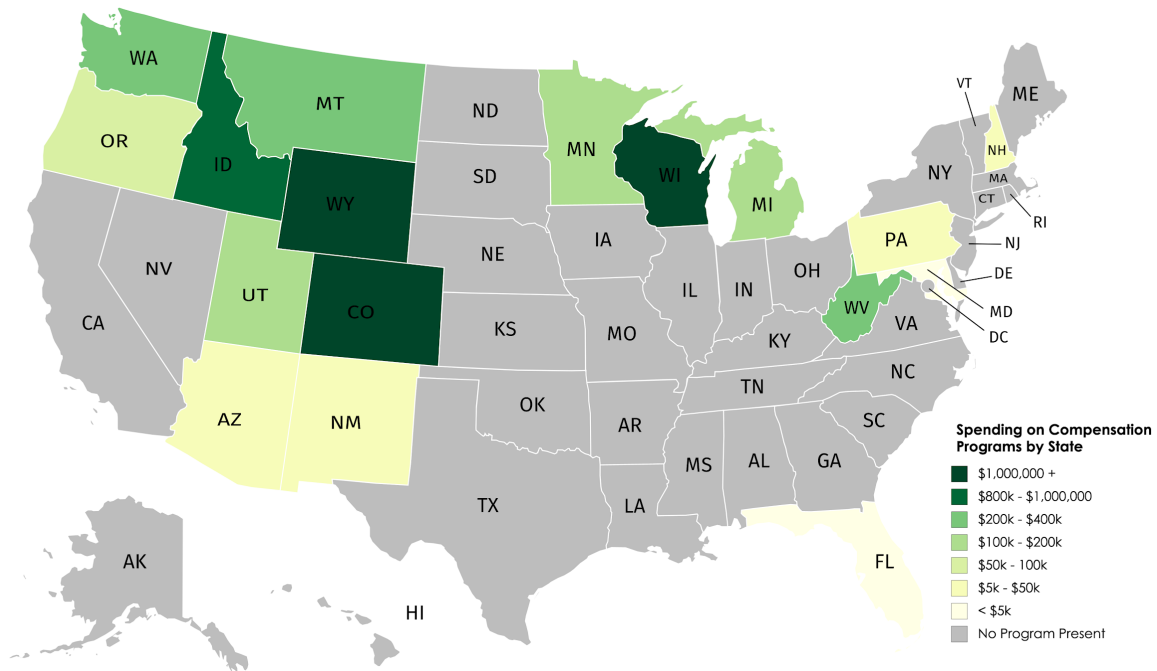
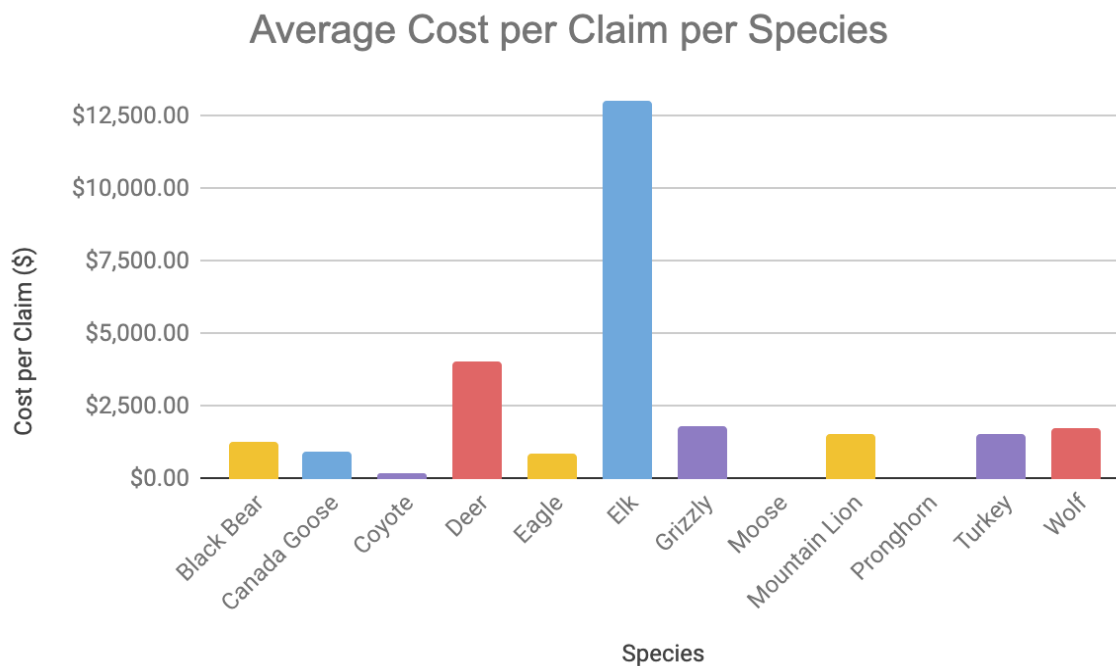


Figure 4. Total spending on compensation programs by state.**Figure 5.** There was a broad range of costs per claim per species from \$174.78 (coyotes) to \$13,035.90 (elk).

Subquestion 3: What are the broad trends in compensation scheme implementation in the United States and how do those impact conservation?

There was nothing specific that I tracked to directly lead to “results” for this subquestion, but I noted trends that I noticed throughout the time of the study. One key finding was that after 2010, I could not find any evidence of NGO-funded compensation programs. The second key finding was that the language in management plans and compensation programs shifted from “tolerance” and “conflict mitigation” to “coexistence” and “conflict prevention” over the last 10 years (Defenders of Wildlife 2010; Wilson et al. 2017). The third key finding was that, out of 44 total compensation programs, only 3 were nationwide; the remainder were state or regionally administered.

DISCUSSION**Introduction**

Though previous research has studied the administrative aspects of implementing a compensation scheme, there is room to expand on how other factors can affect the implementation compensation programs. My research looked at the factors that could contribute to compensation scheme programs by conducting a systematic review of compensation programs across the United States and looking for trends across social, political, economic, ecological, and administrative aspects of a given program.

Subquestion 1: What kinds of definitions of success can exist for compensation schemes and how should those change based on program goals?

The first research question sought to collect and understand the gamut of success definitions for existing and previously executed compensation programs. I found that less than 75% reported explicit program goals, and less than 60% reported completing any studies tracking success.

Without clearly defining goals and desired outcomes, there is no way to benchmark the success of a given compensation scheme. The lack of clarity in defining measures of success makes it challenging to determine where funding makes the biggest impact, and when funding should be distributed to alternate conflict management strategies (in the event that any given scheme failed). To help remedy this issue, I created a table of potential program goals, recommended metrics to track, and various definitions of success (Table 4). These goals and associated metrics are a collection of the goals that have been reported by programs, previous studies that have tracked compensation scheme success, and issues that are most frequently discussed by the public.

There are two primary categories of program goals that I've identified: social and environmental. In general, social goals are related to a program's impact on people, while environmental goals are related to a program's impact on the natural environment. Compensation schemes should clearly identify what priorities are most relevant to the region and species in question to ensure appropriate expectations about outcome. Within the social and environmental goals, I made a subcategory of goals separates "setup" goals from "outcome" goals. Here, I define a setup goal as one that can be tracked in the initial stages of program implementation. These goals generally require smaller changes in human or wildlife behavior with results that can be seen in the early stages of program implementation. The other category is "outcome". These goals can only be tracked after a compensation scheme has been established in a region, and usually requires a study to be assessed. These goals usually require larger shifts in human and wildlife behavior and perception, and therefore may take years to assess results.

A key example of why differentiating goal types are important can be seen in the difference between support for compensation scheme presence and tolerance for wildlife by landowners. The former goal can be accomplished by hosting town halls, and educational initiatives before a program is implemented. The latter goal, however, can only be tracked after the program has been established in a region. A real-life example of this distinction can be seen in Wisconsin, where initial studies demonstrated high support for compensation program presence, but a follow up study provided limited evidence of attitude shifts in landowners (Treves et al. 2003). This implies that the success of a compensation program is not as clear or easily achievable as not as clear or easily achievable as setup goals might initially project. Both setup and outcome goals should be measured to gain an accurate understanding of program success.

Table 4. Proposed goals and metrics of success possible to utilize when planning.

		Goal	Metric	Success
Social	<i>Setup</i>	Improved public attitude towards species management plans intended to increase population	% of population	Increased survey percentage of positive perception of species
	<i>Outcome</i>	Increased and/or secured funding for program	\$	A percentage increase in available funding
	<i>Setup</i>	Increase engagement in compensation program development and non-lethal conflict management solutions	% of population	An increase in number of individuals participating in planning through commenting on policy updates and taking surveys
	<i>Outcome</i>	Decreased litigation costs/frequency	\$	A percentage decrease in the litigation cases per year
	<i>Outcome</i>	Improved press/public discourse	% total press	An improved ratio of positive:negative press
	<i>Outcome</i>	Improved tolerance towards goal species by landowners	% of population	A percentage increase in positive attitudes from landowners
	<i>Outcome</i>	Increased trust between landowners and public/governmental management agency	Discourse	More positive language regarding compensation programs and facilitators
	<i>Setup</i>	Increased support for compensation scheme	% of population	Increase in participation in community outreach events
	<i>Setup</i>	Reduce impact on local businesses	\$	Decrease total losses from landowners experiencing conflict or maximize total compensation provided

Environmental	<i>Outcome</i>	Recovered population within certain range	# individuals	Removal from the Endangered Species list
	<i>Outcome</i>	Self-sustaining population suitable for hunting	# individuals	Regular hunt providing additional compensation program support
	<i>Outcome</i>	Management of another species (i.e. wolf -> deer)	# individuals	Manageable and consistent populations of predator and prey species
	<i>Outcome</i>	Recovery of environmental element (i.e. willow trees)	# individuals	Established population of recovery species

Subquestion 2: What are the specific social, political, economic, ecological, and procedural factors that contribute to the relative success of compensation program implementation?

Even with clear goals and definitions of success outlined, conservation planners still have to understand their program region in order to select a goal that will support stakeholder needs most directly. Understanding this nuance allows planners to understand what impact certain social, political, economic, ecological, and administrative factors have on compensation scheme success. In my research, the factors that had the most significant impact on implementation were: presence of a fundamental barrier, the species being compensated for, and perception of conflict.

Factor 1: Presence of a Fundamental Barrier

In this study, one of the factors most likely to affect the success of a compensation program was the presence of a fundamental barrier. A fundamental barrier is a perceived barrier of beliefs, values, or understanding between two conflicting groups that makes conflict resolution and mitigation more difficult (White, Marshall, & Fisher 2007). I established that a fundamental barrier was present based on a few indicators: persistence of negative sentiment in the press, and high instances of litigation. I decided on these indicators because fundamental barriers are likely to develop when there are perceptions of power imbalance and social vulnerability and can be expressed via language that demonstrates a perception of differing values (Skogen, Mauz and

Krange 2008, Bruskotter, Schmidt, and Teel 2007). The greater the likelihood of a fundamental barrier being present, the less likely the compensation program was to satisfy all program stakeholders.

A clear example of how a fundamental barrier can affect compensation program success is the case of the wolf compensation program in Michigan. Mistrust was developed through an instance in 2014, when multiple overstatements of a wolf's damage was claimed to a compensation program (Barnes 2019, Barnes 2015, Dickenson 2014). The claimed damage led to that wolf's removal and served as supporting evidence for the development of a wolf hunt (Barnes 2019). The resulting press sentiment was negative. Anti-wolf supporters called the time of the incident an "era of fear and death," while pro-wolf supporters pinned it on the "negligence" and "misinformation" of local farmer practices (Jackson 2014, Pacelle 2016, Dickenson 2014). This example shows how pre-existing fundamental barriers can influence compensation scheme success.

Understanding the potential for the presence of a fundamental barrier is important for conservation planners because it can help guide the approach of implementing conflict management strategies. Compensation schemes have been suggested as a conflict mitigation tool for building trust between social groups and wildlife managers, and in the process, overcoming fundamental barriers (Nyhus 2016). Even after a compensation scheme is implemented, there opportunities facilitate trust building between the general public and program recipients. For example, a program could cover both probable and confirmed damages to demonstrate trust in program recipients, and could provide compensation for minimum husbandry practices to help build trust in the general public.

Factor 2: Behavior and Ecology of Compensated Species

Another factor that impacts the success of compensation schemes is the species at the center of the conflict. There were sixteen total species with compensation programs across the United States, but only two species that had consistently mixed reception (wolves and grizzlies) and two species that had mixed reception (elk and coyotes). There are many possible reasons for inconsistent success for these species which could include but is not limited to: social behavior, diet, as well as type and amount of damage.

The first way that the species can affect success is through social behavior. Though wolves and grizzlies both had mixed responses, wolves had significantly more negative public press. One of the primary differences in behavior is each species' ability to adapt to human presence. Wolves have demonstrated a certain level of comfort on human landscapes by making dens on private property and repeat attacks on the same farms (Fritts et al. 1992). Grizzlies, on the other hand, prefer territories far away from human presence (Craighead and Mitchell 1982). This high visibility to humans may disproportionately place blame on wolves. Coyotes and elk have also demonstrated an ability to thrive in human landscapes, but may be more acceptable because they've been consistently present in the United States, and may therefore be an assumed risk to landowners.

Another important aspect of behavior could be species diet. Perhaps a reason why wolves and grizzlies have a more mixed reception than coyotes and elk is that they're both larger-bodied opportunists. This means that they hunt, scavenge, and have a large caloric demand (Fritts et al. 1992, Craighead and Mitchell 1982). Another potential contributor to mixed success is the type and amount of damage that these species cause. Both grizzlies and wolves hunt and kill livestock, while coyotes only scavenge, and elk only cause physical property damage (like damage to agricultural crops and fencing) (Thomas and Toweill 1982).

Factor 3: History and Perception of Conflict

Biological and behavior characteristics of the species in question don't tell the whole story. The total spend for deer damage was 44% higher than wolves, and yet wolves were met with negative sentiment more frequently. This helps demonstrate that human emotion can play just as much of a role as ecology in determining the success of compensation schemes. In order to successfully implement a compensation program, conservation planners have to understand how it might be perceived by recipients and by the public. Opinions about wildlife and perception of wildlife conflict are influenced by cultural norms, identity, emotional experiences with wildlife, previous experiences with government, political ideology, socioeconomic status and personal values (Teel et al. 2003).

An attitude survey conducted after the implementation of a compensation program in Wisconsin confirmed that occupation, gender, and personal values are better predictors of wolf

perception than any first-hand experience with a wolf (Treves et al. 2003, Treves et al. 2009). This shows the real-world impacts of the ties between identity, occupation, and beliefs about wildlife and the importance of perception of a compensation scheme. Occupation is not simply a method of earning income in the United States. Especially for those with generational ties to their occupation, attacks by wolves on their occupation can be perceived as an attack to one's identity.

For coyotes, grizzlies, and wolves, there has been a history of pest management (Houben 2004, Wydeven 2009, Smith and Bangs 2009a., Clark 2009). Wolves were systematically eradicated through the early 1900's and grizzlies bountied through the early 1930's (Smith and Bangs 2009a., Clark 2009). After the Endangered Species Act (ESA) protected wolves and grizzlies, generations of farmers, ranchers, and other rural residents could no longer manage wildlife with as much agency as they previously had. Coyotes and elk were also hunted extensively, but were never afforded protection under the ESA, which has provided flexibility in using lethal methods to manage conflict. With species protected under the ESA like the grizzly and wolf, there can be a perception of "others" interfering with state affairs. The perception that outsiders are influencing local policy and politics ties reinforces the idea of political power imbalance and social vulnerability for those who are experiencing conflict the most.

Subquestion 3: What are the broad trends in compensation scheme implementation in the United States and how do those impact conservation?

Having a complex understanding of compensation program implementation is as much a function of understanding factors that affect individual programs as it is of understanding broader trends in program implementation. While my first two sub questions address individual programs more directly, my last sub question aims to understand the broader trends of compensation program implementation across the United States.

One trend I noticed about compensation schemes was in the source of funding. Early on, it seemed that an NGO, the Defenders of Wildlife (DoW), was responsible for the funding and management of most regional compensation programs. The DoW funded compensation until each species they covered had state programs established. In the last 15 years, research into compensation schemes as tools for human-wildlife conflict management has grown rapidly (Ravenell and Nyhus 2017). A non-profit has more flexibility in testing out conflict management

strategies, which is perhaps the reason why the DoW had such a significant role in early compensation program development in this context. It might stand to reason, then, that NGO's like the DoW would serve as testing environments for other kinds of human-wildlife conflict management, and could be a source of ideas for government agencies to follow.

If the activities of NGOs can be used as a predictor for where human-wildlife conflict and compensation program implementation will go next, then the relatively recent trend of "coexistence" would be the next focus area for governmental agencies. While the goal of early compensation schemes was to develop tolerance for wildlife, the DoW is shifting towards long-term strategies based in changing human and wildlife behavior. The DoW now contributes to the implementation of guard dogs, fencing, and other conflict prevention and "coexistence" strategies (Defenders of Wildlife 2010). Some states have tried to move towards a "coexistence" over "tolerance" focus, with protective range riding programs in Montana and subsidized fladry devices available in Washington (Defenders of Wildlife 2010; Wilson et al. 2017). This change in tone seems positive, but requires a much higher level of engagement from those affected by conflict. An eventual shift to coexistence may be preferable, but an established compensation scheme might be necessary before greater levels of engagement and trust are gained. It's important to be able to gauge both the source of funding and amount of engagement required when deciding what kinds of human-wildlife conflict management strategies should be used. Compensation programs can serve as a low-engagement, trust-building option for facilitators with limited funding and access to engagement strategies.

Synthesis: What factors contribute to the relative success of wildlife damages compensation programs in the United States?

My central research question asks what kinds of factors affect the success of wildlife damages compensation scheme implementation in the United States. This question was formed for two reasons: one, because compensation programs have been looked at as fairly simple tools for HWC management. Second, it was formed because given that funding and human capital is limited wildlife conservation, I wanted to provide research that would help distribute resources dedicated to compensation programs more precisely. Previous research has shown that a compensation program must have fast, accurate verification of damage, sustainable funding, and clear rules and

guidelines in order to function properly (Nyhus 2003). I wanted to build off of this research and understand how cultural, political, and ecological factors could impact compensation programs.

Functional administration is a basic requirement for a compensation program. In order to have an effective, long-term compensation program, one must consider how factors like species behavior, stakeholder engagement, and historical context can affect perception and implementation. If these factors are taken into account, specific educational initiatives, stakeholder engagement tactics, and follow-up studies can be done to make HWC management more successful.

A significant finding of this study was the relatively small proportion of programs that identified achievable goals. With more information on how to understand the complexity of each individual program, it will be easier for conservation planners to identify goals that will help progress conservation within their own state. Though there are limited resources available to program facilitators, utilizing some to conduct surveys of the public and compensation recipients can be used to guide future spending and justify existing budgets.

LIMITATIONS AND FUTURE DIRECTIONS

Even though this study has contributed to a deeper understanding of compensation schemes, the study was limited. This study's conclusions, due to the specificity of the United States' history of wildlife conflict and structure of governance, can not be directly applied to any other nation. Therefore, it would be valuable to repeat this study in another country. Especially in countries like Sweden and the United Kingdom, which have had much more extensive experience with compensation programs, it would be valuable to study how national ownership of wildlife and previous experience with compensation programs could impact their overall success and effectiveness. Subsequently, it would be valuable to better understand how the United States can improve their own programs by comparison.

Another limitation of the study was the inability to definitively cross-check my inventory of programs for accuracy. The last inventory of compensation program presence in the United States was done in 1997 (Wagner et al. 1997). I utilized the most up to date resources available online, but due to the limited resources and staff at state wildlife departments, the data was often outdated by a few years. A potential follow-up to this study could be tracking down each

compensation program sponsor across the country and requesting information that isn't posted online to develop a precise understanding of the exact scope of compensation programs in the US.

A final future direction for this study would be to conduct surveys in regions where compensation schemes seem to have the most mixed reactions, and determine how compensation programs have changed tolerance of wildlife. As it stands, there is only one set of surveys that demonstrate the impact of compensation schemes in the US through a survey, so it may not be representative of any other program currently in place.

BROADER IMPLICATIONS

The implications of this study are far-reaching, but two arise as having the biggest potential impact on human-wildlife conflict management more broadly. The first question that this study brought up is what the role of governance has with respect to HWC management generally, and compensation programs specifically. NGO's seem to be incubators for human-wildlife conflict strategy testing, which would make state governments the long-term managers. The role of government, on a basic level, is to ensure safety and wellbeing of the people who are governed (Powell 2018).

Where does that leave the national government? Even for species protected at a national level under the ESA, the government has highly limited participation. Only for species that were reintroduced into the United States with national sponsorship and are currently protected are eligible for any funding from the federal government. This effectively means that only wolf compensation programs can receive any kind of federal support. This question of ownership and responsibility becomes especially relevant within the context of recent statements released by the White House. In April of 2019, the current administration stated an intention to end federal protections for the Grey wolf as a signal of species recovery and with the goal of "return[ing] management of the species to the states and tribes" (Wamsley 2019). By removing the wolf from the protection of the ESA, the federal government releases itself a from obligation of damages compensation from wolves. This has the potential to hurt anti-wolf supporters if they currently receive any form of compensation as it could take away up to \$900,000 currently provided by the Wolf Demonstration Grant (Division of Public Affairs 2016).

The idea behind a compensation program is simple: to provide a market value for crops and livestock damaged by wildlife with the idea that mitigating income loss would effectively “zero out” the losses for those who experience conflict. Another attractive assumption about compensation programs is that it redistributes the cost of conservation to those who want to support conservation goals. However, the only thing that compensation programs take into account are losses with a clear market value. The expectation in implementing compensation programs has been that they will improve tolerance. Tolerance, however, is guided by perception of wildlife, and compensation for the market value of a head of cattle can’t be expected to “zero out” the disappointment, opportunity cost, or feelings of social vulnerability. By considering the less quantifiable forms of loss, it seems that the redistribution of costs that compensation programs are designed to facilitate are not as cut and dry as they seem to be. This may be because it’s not just the market value loss, but the terms on which they lose their animals. This is not to say that compensation programs can’t be an effective, and likely necessary tools for conservation planners. Compensation programs provide a way for pro-wildlife supporters and wildlife managers to recognize the risk and loss that landowners face as a result of having wildlife present. However, this does imply that compensation alone is not enough to drive significant change in value placed on wildlife and that other strategies that increase engagement, improve education, and increase available funding need to be done in together to effectively manage human-wildlife conflict.

ACKNOWLEDGEMENTS

I truly would not have been able to finish this thesis without the support of family and friends. Kurt Spreyer’s understanding and patience with me through the challenging parts of my year was absolutely key to me being able to finish this thesis. Our discussions in office hours encouraged me to explore my topic thoroughly and gave me the opportunity to be thoughtful and intentional in my writing. I also want to recognize Kaitlyn Gaynor, my thesis mentor. Her unwavering enthusiasm has continually refreshed my own interest in this paper and her belief in my abilities has challenged me to grow throughout the year. I want to thank my partner, Taylor Orcutt, whose endless kindness and generosity for this and beyond is the only reason I made it through my years here at Cal with (some) semblance of grace. Lastly, I would like to recognize my sister, Dana Frederick, who has helped look over every piece of writing that’s impacted my life from my high

school term papers, to my college admissions essays, application cover letters, and now this. Thank you all, and I'm excited to celebrate the end of these four years with you.

REFERENCES

- Administrative rule R657-24. 2017, December 16. . <https://wildlife.utah.gov/r657-24.html>.
- Agarwala, M., s. Kumat., A. Treves., L. Naughton-Treves., December 2010. Paying for wolves in Solapur, India and Wisconsin, USA: Comparing compensation rules and practice to understand the goals and politics of wolf conservation. Biological Conservation Volume 143, Issue 12 pp 2945-2955.
- Allen, J. 2009. Wolves at the Door. <https://onwisconsin.uwalumni.com/features/wolves-at-the-door/>.
- Claims Program - 2016 Summary Report. USDA, APHIS, Wildlife Services. D.C., USA. As it was, so it is. 2016, August 24. . <https://pocahontastimes.com/as-it-was-so-it-is/>.
- Associated Press. 2017, July 20. As coyote sightings rise in Pennsylvania, farmers get creative in effort to protect livestock. <https://www.outdoornews.com/2017/07/20/coyotes-sightings-rise-pennsylvania-farmers-try-protect-livestock/>.
- Associated Press. 2018, July 6. Montana livestock board went \$8K over budget in kill claims. https://billingsgazette.com/outdoors/montana-livestock-board-went-k-over-budget-in-kill-claims/article_04f3abc4-4793-5c84-a661-6a73b500d05c.html.
- Bechtel, W. 2018, September 4. Washington Wolf Killed After Judge Approves Lethal Action. <https://www.drovers.com/togo-wolf-pack-removal>.
- Bernales H. H., and DeBloois D. 2017. Utah Black Bear Annual Report 2016. State of Utah Department of Natural Resources Division of Wildlife Resources. Salt Lake City, UT, USA.
- Bjonlie, Dan. January 2017. Annual Black Bear Mortality Summary Harvest Year – 2016. Wyoming Fish and Game Large Carnivore Section. Cheyenne, WY, USA.
- Black Bear Lottery Applications Now Open. 2018, July 20. . <https://news.maryland.gov/dnr/2018/07/20/black-bear-lottery-applications-now-open/>.
- Brown, G. 2018, February 8. State Lawmaker Proposes Ending Payments For Hunting Dogs Killed By Wolves. <https://www.wpr.org/state-lawmaker-proposes-ending-payments-hunting-dogs-killed-wolves>.

- Bruskotter J.T., R.H. Schmidt, and T.L. Teel. 2007. Are attitudes toward wolves changing? A case study in Utah. *Biological Conservation* 139:211–128.
- Bump, J. K., C. M. Murawski., L. M. Kartano., D. E. Beyer., B. J. Roell., 17 April 2013. Bear-Baiting May Exacerbate Wolf-Hunting Dog Conflict. *PLOS one*.
<https://doi.org/10.1371/journal.pone.0061708>
- Cameron, A., M. Bakkenes, L.J. Beaumont, Y.C. Collingham, B.F. Erasmus, M.F. Siqueira, A.Grainger, L. Hannah, L. Hughes, B. Huntley, C.D. Thomas, A.S. van Jaarsveld, G.F. Midglet, L. Miles, M.A. Ortega-Huerta, A.T. Peterson, O.L Phillips, and S.E. Williams. 2004. Extinction risk from climate change. *Nature* 427:145-148.
- Cargill, C., and L. Stavick. 2019, January 25. Bill Proposes Per Capita Payment as Eligibility Requirement for Predator Reimbursement. <https://mfbf.org/Article/Bill-Proposes-Per-Capita-Payment-as-Eligibility-Requirement-for-Predator-Reimbursement>.
- Carpenter C. P. 2012. Big Game Bulletin. West Virginia Wildlife Resources. Charleston, WV, USA.
- Clark, J. 2009. Aspects and Implications of Bear Reintroduction. Pages 92-125 in M. W. Hayward and M.J. Somers, editors. *Reintroduction of Top-Order Predator*. Blackwell Publishing Ltd. Hoboken, NJ, USA.
- COLORADO PARKS & WILDLIFE. 2019.
<https://cpw.state.co.us/aboutus/Pages/GameDamageResources.aspx#Identify>.
- COLORADO PARKS & WILDLIFE. 2019.
<https://cpw.state.co.us/aboutus/Pages/GameDamageResources.aspx#Identify>.
- Colorado Parks and Wildlife. 12/30/15. Human-Bear Conflicts. Colorado Parks Service. Denver, CO, USA.
- Colorado Parks and Wildlife. 2015. FY15 Game and Damage Report. Colorado Parks and Wildlife. Prepared for the Colorado General Assembly pursuant to C. R. S. 33-3-11. Denver, CO, USA.
- Colorado Parks and Wildlife. 2015. FY15 Game Damage Annual Report. Colorado Parks and Wildlife. Prepared for the Colorado General assembly pursuant to C.R.S. 33-3-11. Denver, CO, USA.
- Conover M.R. 2002. *Resolving human-wildlife conflicts: the science of wildlife damage management*. CRC Press, Boca Raton, Florida, USA.
- Conover, M.R., R.H. Schmidt, and K.K. Wagner. 1997. *Compensation programs for wildlife damage in North America*. USDA: APHIS. University of Nebraska - Lincoln, Lincoln, Nebraska, USA.

- Coronado, R. 2018, February 3. A Hounder's Response to Claims About Hunting from Roads & Compensation for Wolf Attacks on Hounds. <https://wolfpatrol.org/2018/02/03/a-hounders-response-to-claims-about-hunting-from-roads-compensation-for-wolf-attacks-on-hounds/>.
- Craighead, J. J., and J. A. Mitchell. 1982. Grizzly bear. Pages 515-556 in J. A. Chapman and G. A. Feldhamer, eds. *Wild mammals of North America: biology, management, and economics*. The Johns Hopkins Univ. Press, Baltimore, Maryland.
- Defenders of Wildlife. 2006. The Bailey Wildlife Foundation Wolf Compensation Trust. <http://www.pinedaleonline.com/wolf/pdf/DefendersPayments.pdf>
- Defenders of Wildlife. 2009. Wolf Compensation Trust. https://www.defenders.org/sites/default/files/publications/statistics_on_payments_from_the_defenders_wildlife_foundation_wolf_compensation_trust.pdf
- Defenders of Wildlife. 2010 Frequently Asked Questions: Transitioning Wolf Compensation. https://defenders.org/sites/default/files/publications/faq_transitioning_wolf_compensation.pdf
- Defenders of Wildlife. 2019. Defenders Fulfills Commitment on Compensation. Defenders of Wildlife. <https://defenders.org/press-release/defenders-fulfills-commitment-compensation>
- Defenders of Wildlife. 2019. Defenders Shifts Focus to Wolf Coexistence Partnerships. Defenders of Wildlife. <https://defenders.org/press-release/defenders-shifts-focus-wolf-coexistence-partnerships>
- Demotts, R. and P. Hoon. 2016. Whose Elephants? Conserving, Compensating, and Competing in Northern Botswana. *Society and Natural Resources*, 25:837-851.
- Dhungana, R., T. Savini, J.B. Karki, and S. Bumrungsri. 2016. Mitigating human-tiger conflict an assessment of compensation payments and tiger removals in Chitwan National Park, Nepal. *Tropical Conservation Science* 9:776-787.
- Dickman, A.J. 2009. Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. *Animal Conservation* 13:458-456.
- Diehm, C. Spring 2013. Wolves, Wisconsin, and Aldo Leopold. *Minding Nature*. Volume 6 number 2
- Division of Public Affairs. 2016. U.S. Fish and Wildlife Service Announces \$900,000 in Wolf Livestock Demonstration Project Grants. U.S. Fish and Wildlife Services.
- Dokken, B. 2018, April 18. DNR officers at front lines of Minn. wolf depredation compla... <https://www.duluthnewstribune.com/news/science-and-nature/4430685-dnr-officers-front-lines-minn-wolf-depredation-complaints>.

- Donovan, J. 2019, February 21. Bear Baiting May Put Hunting Dogs at Risk from Wolves.
<https://www.mtu.edu/news/stories/2013/april/bear-baiting-may-put-hunting-dogs-risk-wolves.html>.
- Dougherty, C. 2014, June 27. Are Pennsylvania Coyotes a \$4 Million Problem?
<https://www.outdoorlife.com/blogs/big-buck-zone/2014/06/are-pennsylvania-coyotes-4-million-problem>.
- Drake, P. 2015, December 2. State hits record for depredation payments. GreatFalls.
<https://www.greatfallsribune.com/story/news/local/2015/12/01/state-hits-record-depredation-payments/76633908/?from=global&sessionKey=&autologin=>.
- Fecht, S. 2017, February 6. Hunters may need to keep their paws off Wisconsin wolves.
<https://www.popsci.com/wisconsin-wolves-endangered-species-hunting-poaching>.
- Fish and Wildlife Service. 15 March 2019. Endangered and Threatened Wildlife and Plants; Removing the Gray Wolf (*Canis lupus*). Federal Register.
<https://www.federalregister.gov/documents/2019/03/15/2019-04420/endangered-and-threatened-wildlife-and-plants-removing-the-gray-wolf-canis-lupus>
- Frame, P.F. and H. L. Allen. 2012. Washington Gray Wolf Conservation and Management Annual Report 2011. Pages WA-1 to WA-11 in U.S. Fish and Wildlife Service Rocky Mountain Wolf Recovery 2011 Annual Report. USFWS, Ecological Services, 585 Shepard Way, Helena, Montana, 59601.
- Friedmann, H. and P. McMichael. 1989. Agriculture and the State System. *Journal of the European Society for Rural Sociology* 29:93-117.
- Fritts, S. H., W. J. Paul, L. D. Mech, and D. P. Scott. 1992. Trends and management of wolf-livestock conflicts in Minnesota. *US Fish Wildl. Serv. Resour. Publ.* 181., Washington, DC. 27 pp.
- Full Statute Name: Revised Statutes Annotated of the State of New Hampshire. Title XVIII. Fish and Game (Ch. 206 to 215-C). Chapter 207. General Provisions as to Fish and Game. Wildlife Damage Control. 1970, April 1. <https://www.animallaw.info/statute/nh-wildlife-damage-wildlife-damage-control>.
- Full Statute Name: West's Idaho Code Annotated. Title 36. Fish and Game. Chapter 11. Protection of Animals and Birds. 1970, October 1. .
<https://www.animallaw.info/statute/id-predators-chapter-11-protection-animals-and-birds#s1109>.
- Full Statute Name: West's Idaho Code Annotated. Title 36. Fish and Game. Chapter 11. Protection of Animals and Birds. 1970, October 1. .
<https://www.animallaw.info/statute/id-predators-chapter-11-protection-animals-and-birds#s1109>.

- Funk, W. H. 2018, April 2. Wyoming Is Waging a War on Wolves.
<https://www.sierraclub.org/sierra/wyoming-waging-war-wolves>.
- Geranios, N. K. 2017, December 11. Eastern Washington wolves not hurting numbers of deer, elk, similar wildlife, report says. The Seattle Times Company.
<https://www.seattletimes.com/seattle-news/eastern-washington-wolves-not-hurting-numbers-of-deer-elk-similar-wildlife-report-says/>.
- Gibbs, H.K., T.J. Lark, and J.M. Salmon. 2015. Cropland expansion outpaces agricultural and biofuel policies in the United States. *Env. Res. Lett.* 10:1-12.
- GJEP, S. 2017, August 2. Wisconsin wolf population approaching 1,000.
<https://www.wbay.com/content/news/Wisconsin-wolf-population-approaching-1000-427416443.html>.
- Gordon, S. 2017, November 16. Bears, Wolves And People In Search Of Balance.
<https://www.wiscontext.org/bears-wolves-and-people-search-balance>.
- Hammill, J., Policy Issues Regarding Wolves in the Great Lakes Region. Predator-Prey Workshop: Policy Issues Regarding Wolves in the Great Lakes Region. Pp 378-390
- Handwerk, B. 2013, December 11. Predator Insurance: When Livestock Becomes Prey, Conservationists Pay. National Geographic Society
<https://news.nationalgeographic.com/news/2013/12/131210-wildlife-conservation-compensation-predators-science/>.
- Haney, J. C., T. Kroeger., F. Casey., A. Quarforth., G. Schrader., S. A. Stone., 2007 Wilderness Discount on Livestock Compensation Costs for Imperiled Gray Wolf *Canis lupus*. USDA Forest Service Proceedings pp 1-11.
- Hansmann, D., and D. Thornton. 2018, February 1. Hunter welfare?
<https://isthmus.com/news/news/senator-risser-wants-state-to-stop-paying-hunters-for-dogs-killed-by-wolves/>.
- Houben, John M., "Status and Management of Coyote Depredations in the Eastern United States" (2004). *Sheep & Goat Research Journal*. 7
- Idaho Department of Fish and Game. 2017. FY 2017 Idaho Legislative Budget Book. Idaho Department of Fish and Game. Boise, ID, USA.
- Idaho Department of Fish and Game. 2018. A Landowner's Guide to Preventing Big Game Damage and Filing Damage Claims. Idaho Department of Fish and Game. Boise, ID, USA
- Idaho Legislature. 2019.
<https://legislature.idaho.gov/statutesrules/idstat/Title36/T36CH1/SECT36-115/>.

- Jefferson, T. 1781. Query XIX. Notes on the State of Virginia.
- Jenkins, D. 2018, April 16. Compensation to ranchers small part of Washington's wolf budget. https://www.capitalpress.com/state/washington/compensation-to-ranchers-small-part-of-washington-s-wolf-budget/article_b45d3624-4683-5ce1-aca4-d2578d424500.html.
- K, White. 2018, December 25. Predators Eat Away Montana Livestock Loss Board Budget. <https://www.northernag.net/predators-eat-away-montana-livestock-loss-board-budget/>.
- Karant K.K., A.M. Gopalaswamy, R. DeFries, and N. Ballal. 2012. Assessing patterns of human-wildlife conflicts and compensation around a central Indian protected area. *PLOSOne*, 7:1-13.
- Karant, K.K., A.M.Gopalaswamy, P.K. Prasad, and S. Dasgupta. 2013. Patterns of human-wildlife conflicts and compensation: Insights from Western Ghats protected areas. *Biological Conservation*, 166:175-185.
- Karnowski, S., and S. Foss. 2012, September 5. Wolf's recovery seen in livestock loss payouts. <https://www.mprnews.org/story/2012/09/05/environment/wolf-recovery-payouts>.
- Kellert, S.R., M. Black, C.R. Rush, and A.J. Bath. 1996. Human culture and large carnivore conservation in North America. *Conservation Biology* 10:977-990.
- Kloskowski, J. 2010. Human-wildlife conflicts at pond fisheries in eastern Poland: perceptions and management of wildlife damage. *European Journal of Wildlife Research*, 57:295-304.
- Lackey C. W., R. A. Beausoleil. 18-22 May 2009. Proceedings of the Tenth Western Black Bear Workshop. Nevada Department of Wildlife, WAFWA. Reno, NV, USA.
- Landers, R. 2015, December 2. Montana predators kill fewer livestock, but payments up. <http://www.spokesman.com/blogs/outdoors/2015/dec/04/montana-predators-kill-fewer-livestock-payments/>.
- Landers, R. 2017, March 11. States still spending millions on wolf recovery. https://billingsgazette.com/outdoors/states-still-spending-millions-on-wolf-recovery/article_19ccc365-0b91-5a81-abb8-62d1fe0c2901.html.
- Landers, R. 2018, March 17. Washington's gray wolf population increases for ninth consecutive year. *The Spokesman-Review*. <http://www.spokesman.com/stories/2018/mar/17/washingtons-gray-wolf-population-increases-for-nin/>.
- Livestock Loss Board. 2019. . <http://liv.mt.gov/Attached-Agency-Boards/Livestock-Loss-Board>.

Living with Black Bears. 2019.

http://dnr.maryland.gov/wildlife/pages/hunt_trap/bblivingwith.aspx.

Living with Black Bears. 2019.

http://dnr.maryland.gov/wildlife/pages/hunt_trap/bblivingwith.aspx.

Loveridge A.J., S.W. Wang, L.G. Frank, and J. Seidensticker. 2010. People and wild felids: conservation of cats and management of conflicts. 161-195 in Macdonald, D.W. and A.J. Loveridge. Oxford University Press, New York, New York, USA.

Madhusudan, M.D. 2003. Living amidst large wildlife: livestock and crop depredation by large mammals in the interior villages of Bhadra Tiger Reserve, South India. *Environmental Management*, 31:466-475.

Manfredo, M.J. and A. A. Dayer. 2010. Concepts for exploring the social aspects of human–wildlife conflict in a global context. *Human Dimensions of Wildlife* 9:1-20.

Mapes, L. V. 2017, July 29. State's wolf kill turns up the heat in Washington cattle country. The Seattle Times Company. <https://www.seattletimes.com/seattle-news/environment/states-wolf-kill-turns-up-the-heat-in-washington-cattle-country/>.

Marcotty, J. 2017, August 11. Wisconsin tradition – hunting bears with dogs – comes under attack by wolf advocates. Star Tribune. <http://www.startribune.com/a-wisconsin-tradition-hunting-bears-with-dogs-comes-under-attack-by-wolf-advocates/439739523/>.

Maryland Department of Natural Resources. February 2017. Black Bear Education Trunk Curriculum Guide. Maryland Department of Natural Resources. Annapolis, MD, USA.

Mauz, I., Kränge, O., and K. Skogen. 2008. Cry Wolf!: Narratives of Wolf Recovery in France and Norway. *Rural Sociology* 73:105-133.

Meador, R. 2012, December 17. Are Minnesota's wolf-harvest rules more 'conservative' than Wisconsin's? <https://www.minnpost.com/earth-journal/2012/09/are-minnesotas-wolf-harvest-rules-more-conservative-wisconsins/>.

Meador, R. 2012, December 17. Are Minnesota's wolf-harvest rules more 'conservative' than Wisconsin's? MinnPost. <https://www.minnpost.com/earth-journal/2012/09/are-minnesotas-wolf-harvest-rules-more-conservative-wisconsins/>.

Millar, M. 2013, January 7. Hunting Wolves in Wisconsin. <https://www.hubbardresearch.com/hunting-wolves-in-wisconsin/>.

Minnesota Department of Natural Resources. January 5 2012. Minnesota Department of Natural Resources Wolf Briefing January 5, 2012. Minnesota. USA. Monroe, R. 2016, August 15. Bears Chow Down on \$20,000 Worth of Maryland Corn -. <https://baltimorefishbowl.com/stories/bears-chow-20000-worth-maryland-corn/>.

- Morrison, K., R. Victurine, and C. Mishra. 2009. Lessons learned, opportunities and innovations in human wildlife conflict compensation and insurance schemes. USAID. Wildlife Conservation Society, Bronx, NY, USA.
- Naughton-Treves, L. 1998. Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology* 12:156–168.
- Naughton-Treves, L., R. Grossberg, A. Treves. Dec 2003. Paying for Tolerance: Rural Citizens' Attitudes toward Wolf Depredation and Compensation. *Conservation Biology*. Vol 17, No 6. Pp 1500-1511
- Neuland, D. 2016, March 11. Wildlife and habitat benefit from annual waterfowl, black bear stamp design contests. https://www.fredericknewspost.com/archive/wildlife-and-habitat-benefit-from-annual-waterfowl-black-bear-stamp/article_70c26142-ba72-53fa-a632-98de0dd25df6.html.
- Northeast Black Bear Technical Committee. August 2012. An Evolution of Black Bear Management Options. Wildlife Restoration, Pennsylvania Game Commission. Richmond, VA, USA.
- Nyhus, P. J. 2016. Human-Wildlife Conflict and Coexistence. *Annual Review of Environment and Resources* 41:143-171.
- Nyhus, P., H. Fischer, F. Madden, and S. Osofsky. 2006. Taking the bite out of wildlife damage: the challenges of wildlife compensation schemes. *Conservation*, 4:37-43.
- Nyhus, P., Osofsky, S., Ferraro, P., Madden, F., & Fischer, H. 2005. Bearing the costs of human–wildlife conflict: the challenges of compensation schemes. 107-121 In R. Woodroffe, S. Thirgood, & A. Rabinowitz, editors. *People and Wildlife, Conflict or Co-existence?* Cambridge University Press, Cambridge, United Kingdom.
- Nyhus, P.J. and J. Ravenelle. 2017. Global patterns and trends in human–wildlife conflict compensation. *Conservation Biology* 31:1247-1256.
- O'Brien, E. 2018, January 15. Montana Ranchers Can Now Seek Compensation For Mountain Lion Predation. <https://www.mtpr.org/post/montana-ranchers-can-now-seek-compensation-mountain-lion-predation>.
- Ohrens O., Treves A., Bonacic C. 2016. Relationship between rural depopulation and puma-human conflict in the high Andes of Chile. *Environmental Conservation* 43:24–33.
- Ouellet, N. 2018, November 29. FWP Suggests New Regional Strategy For Monitoring Mountain Lions. <https://www.mtpr.org/post/fwp-suggests-new-regional-strategy-monitoring-mountain-lions>.

- Paul, B. 2016, January. Wolf Depredation. <https://www.wolf.org/wolf-info/basic-wolf-info/wolves-and-humans/wolf-depredation/>.
- Paul, W. 2005. Management of Wolf-Livestock Conflicts in Minnesota. USDA, APHIS, Wildlife Services, Grand Rapids, MN, USA.
- Powell, J. A. 2018. The Role of Government. Haas Institute of Berkeley. Predators Eat Away Montana Livestock Loss Board Budget. 2018, December 25. .
<https://www.northernag.net/predators-eat-away-montana-livestock-loss-board-budget/>.
- Robinson, J. 2012, October 31. Another impact of Washington's wolves: Skinny cows.
<https://www.knkn.org/post/another-impact-washingtons-wolves-skinny-cows>.
- Rollins, K. and H.C.Briggs. 1996. Moral hazard, externalities, and compensation for crop damages from wildlife. *Journal of Environmental Economics and Management*, 31:368-386.
- Rondeau, D and E. Bulte. 2007a. Wildlife damage and agriculture: a dynamic analysis of compensation schemes. *American Journal of Agricultural Economics*, 89:490-507.
- Rondeau, D and E. Bulte. 2007b. Compensation for wildlife damages: Habitat conversion, species preservation and local welfare. *Journal of Environmental Economics and Management*, 54:311-322.
- Rondeau, D and E. Bulte. 2012. Why Compensating Wildlife Damages May be Bad for Conservation. *Wildlife Management*, 69:14-19.
- Ruid D. et al. (2009) Wolf–Human Conflicts and Management in Minnesota, Wisconsin, and Michigan. In: Wydeven A.P., Van Deelen T.R., Heske E.J. (eds) *Recovery of Gray Wolves in the Great Lakes Region of the United States*. Springer, New York, NY
- Ruid, D. B., W. J. Paul, B. J. Roell, A. P. Wydeven, R. C. Willging, R. L. Jurewicz, and D. H. Lonsway, 2009. Wolf-Human Conflicts and Management in Minnesota, Wisconsin, and Michigan. *Recovery of Gray Wolves in the Great Lakes Region of the United States*. DOI: 10.1007/978-0-387-85952-1_18
- Sawyers, M. A. 2016, August 14. How bears ate more than \$20K in Maryland crops in 2015.
<https://www.baltimoresun.com/news/maryland/bal-ap-maryland-bears-crop-damage-2015-20160814-story.html>.
- Sawyers, M. A. 2016, August 14. How bears ate more than \$20K in Maryland crops in 2015.
<https://www.baltimoresun.com/news/maryland/bal-ap-maryland-bears-crop-damage-2015-20160814-story.html>.
- Schick, T. 2017, December 6. Is the Northwest's approach to wolves destined to fail? *Crosscut*.
<https://crosscut.com/2017/12/northwest-wolves-lethal-approach-ranchers-oregon-washington>.

- Schmitt, K. 2016, June 28. Wisconsin wolves kill 17 sheep. <https://www.gohunt.com/read/news/wisconsin-wolves-kill-seventeen-sheep#gs.5ka1a7>.
- Schwerdtner, K. and B. Gruber. 2007. A conceptual framework for damage compensation schemes. *Biological Conservation*, 134:354-360.
- Schwing, E. 2017, November 2. New Era For Washington Wolves? State Wildlife Officials Think So. <https://www.knkx.org/post/new-era-washington-wolves-state-wildlife-officials-think-so>.
- Servello, F. A., T. L. Edwards, B. U. Constanin. Coyote Managing Coyote Problems in Kentucky. Thesis. University of Kentucky College of Agriculture. Lexington, Kentucky, USA.
- Siekmann, L. 2014, May 14. Program offers compensation for crop, livestock producers experiencing wildlife damage. Wisconsin Farm Bureau Federation. <https://wfbf.com/ag-newswire/program-offers-compensation-for-crop-livestock-producers-experiencing-wildlife-damage/>.
- Smith, D.W. and E. E. Bangs. 2009. Reintroduction of Wolves to Yellowstone National Park: History, Values and Ecosystem Restoration. Pages 126-145 in M. W. Hayward and M.J. Somers, editors. *Reintroduction of Top-Order Predator*. Blackwell Publishing Ltd. Hoboken, NJ USA.
- Smith, P. A. 2017, June 10. State's gray wolf population increases to record high. Milwaukee. <https://www.jsonline.com/story/sports/outdoors/2017/06/10/states-gray-wolf-population-increases-record-high/382215001/>.
- Smith, P. A. 2018, June 6. Smith: With at least 900 wolves in the state, it's time to gauge public attitudes again. Milwaukee. <https://www.jsonline.com/story/sports/columnists/paul-smith/2018/06/06/dnr-should-survey-public-over-wisconsin-wolf-population-tolerance/675167002/>.
- Soulsbury, C.D. and P.C. White. 2015. Human-wildlife interactions in urban areas: a review of conflicts, benefits and opportunities. *Wildlife Research*, 42:541-553.
- Staedter, T. 2016, September 1. Washington Wolf Cull Won't Save Livestock: Study. Seeker. <https://www.seeker.com/washington-wolf-cull-wont-save-livestock-1993960060.html>.
- Ternet M. A., July 2006. Management and Biology of Black Bears in Pennsylvania Ten Year Plan (2006-2015). Bureau of Wildlife Management, Pennsylvania Game Commission. Harrisburg, PA, USA.
- Thirgood, S., R. Woodroffe, and A. Rabinowitz. 2005. The impact of human–wildlife conflict on human lives and livelihoods. 13–26 in Woodroffe, R., Thirgood, S. & Rabinowitz, A.,

- editors. *People and wildlife: conflict or coexistence?* Cambridge University Press, Cambridge, United Kingdom.
- Thomas, J. W., and D.E. Toweill, eds. 1982. *Elk of North America: ecology and management*. Stackpole Books, Harrisburg, Pennsylvania. 698 pp.
- Tilseth, R. 2017, August 16. Several dogs in pursuit of bear were "thrown to wolves" over the weekend in Wisconsin's north woods.
<https://wolvesofdouglascountywisconsin.com/2017/08/16/several-dogs-in-pursuit-of-bear-were-thrown-to-wolves-over-the-weekend-in-wisconsins-north-woods/>.
- Timmins A. A. November 2014. *New Hampshire Black Bear Assessment 2015*. New Hampshire Fish and Game Department. Concord, NH, USA.
- Treves, A., R. L. Jurewicz, L. Naughton Treves, and D. S. Wilcove. 13 November 2008. The price of tolerance: wolf damage payments after recovery. *Springer Science+Buisness Media*. Volume: DOI 10.1007/s10531-009-9695-2
- Treves. A., R. R. Jurewicz., L. Naughton-Treves., R. A. Rose., R. C. Willging., and A. P. Wydeven. 2002. Wolf depredation on domestic animals in Wisconsin, 1916-2000. *Wildlife Society Bulletin*. Pp 231- 241.
- Trophy GameSelection Management/Research Branch. July 20 2007. *Wyoming Black Bear Management Plan*. Wyoming Fish and Game. Cheyenne, WY, USA. United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service(APHIS), Wildlife Services. November 2016. *Final Environmental Assessment Predator Damage Management in Idaho*. Idaho Department of Fish and Game, Idaho Department of Agriculture, Idaho Department of Lands, Nez Perce Tribe, Shoshone-Bannock Tribes, United States Department of Agriculture Forest Service, United States Department of the Interior Fish and Wildlife Service, United States Department of the Interior Bureau of Land Management. Boise, Id, USA
- United States Department of Agriculture (USDA), Animal and Plant Health Inspection Services, Wildlife Services. April 2015. *Environmental Assessment Mammal Damage Management in West Virginia*. West Virginia Department of Natural Resources. D.C., USA.
- United States Department of Agriculture (USDA). 2017. *Wisconsin Wildlife Damage Abatement*
- United States Department of Agriculture [USDA]. January 2016. *Integrated Wildlife Damage Management of Coyotes and Feral Dogs in Pennsylvania*. USDA, Animal and Plant Health Inspection Service Wildlife Services, Pennsylvania Game Commission, Pennsylvania Department of Agriculture. Philadelphia. PA. USA

- United States Department of Agriculture. Management of Coyote, Red Fox, Feral Dog, Wolf-Hybrid, and Exotic Carnivore Predation on Livestock in the State of Ohio. USDA, APHIS, WS. D.C., USA.
- Upadhyay, S. 2013. Challenges of compensation schemes for human-wildlife conflict mitigation. Norwegian University of Life Sciences, As, Norway.
- US Fish and Wildlife Service. July 2018. Gray Wolves in Washington State Questions and Answers. US Fish and Wildlife Service. D.C. USA
- USDA [United States Department of Agriculture]. 2016. USDA-APHIS-Wildlife Services Wisconsin Wildlife Damage Abatement and Claims Program - 2016 Summary Report.
- USDA, APHIS. D.C. United States of America. Utah Black Bear Advisory Committee. January 4 2011. Utah Black Bear Management Plan V. 2.0 2011-2023. Utah Division of Wildlife Resources. Salt Lake City, UT, USA.
- Valentine, P. W. 1995, November 6. A COMEBACK SOME JUST CAN'T BEAR. WP Company. https://www.washingtonpost.com/archive/local/1995/11/06/a-comeback-some-just-cant-bear/b39108d2-d995-4a57-a639-62e2886c7946/?noredirect=on&utm_term=.cfad4c804093.
- Verburg, S. 2017, June 9. Wolf numbers rise again as payouts for hunting dog deaths hit new record. https://madison.com/wsj/news/local/govt-and-politics/wolf-numbers-rise-again-as-payouts-for-hunting-dog-deaths/article_82b151e6-eda4-5ee9-aa9c-3b5d2ef67868.html.
- Voyles, K. Z. 2013. Spatiotemporal Tendencies of Human-Black Bear conflict and the Effect of Current Conflict Mtigation Strategies in Wisconsin. Thesis. University of Wisconsin-Madison. Madison, WI, USA.
- Wamsley, L. 2019. Trump Administration Seeks To Take Gray Wolf Off Endangere Species List. NPR.
- Watve, M., P. Kajol, B. Abhijeet, and P. Pramod. 2016. A theoretical model of community operated compensation scheme for crop damage by wild herbivores. *Global Ecology and Conservation*, 5:58-70.
- Weisberg, L., J. Brown, and J. V. Brown. 2017, September 9. Clashes with wolves: Wisconsin wildlife is hounded with unbearable cruelty. https://www.wisconsin gazette.com/news/clashes-with-wolves-wisconsin-wildlife-is-hounded-with-unbearable-cruelty/article_742d5ff6-93ef-11e7-97bb-8391663a1b10.html.
- Weiss, A. 2018, September 9. Washington's wrong-way approach to managing wolves. The Seattle Times Company. <https://www.seattletimes.com/opinion/washingtons-wrong-way-approach-to-managing-wolves/>.

- Weiss, A., C. Bachman, L. Smith. 12 September 2018. Wolf Supporters to Rally Friday in Olympia Against State's Killing Campaign Wildlife Agency That Has Shot 19 Endangered Wolves OKs New Killings. Center for Biological Diversity.
https://www.biologicaldiversity.org/news/press_releases/2018/wolf-09-12-2018.php
- WEST VIRGINIA CODE. 2019. .
<http://www.wvlegislature.gov/wvcode/ChapterEntire.cfm?chap=20&art=2&ion=22A>.
- West Virginia Division of Natural Resources. 2017. West Virginia Division of Natural Resources Annual Report 2016-2017. Department of Commerce Communications. Charleston, WV, USA.
- White, R., K. Marshall, and A. Fischer. 2007. Conflicts between humans over wildlife management: on the diversity of stakeholder attitudes and implications for conflict management. *Biodiversity and Conservation* 16:3129–3146.
- Wilson, S.M., E.H. Bradley, and G.A. Neudecker. 2017. Learning to live with wolves: community based conservation in the Blackfoot Valley of Montana. *Human–Wildlife Interactions* 11(3):245–257.
- Wisconsin Department of Natural Resources. August 2014. Public Attitudes towards Wolves and Wolf Management in Wisconsin. Wisconsin DNR Bureau of Science Services. Madison. Wisconsin. USA.
- Wisconsin Department of Natural Resources. October 27 1999. Wisconsin Wolf Management Plan. Wisconsin Wolf Advisory Committee. Madison. Wisconsin. USA.
- Wisconsin wolf population approaching 1,000. (n.d.).
<https://www.wbay.com/content/news/Wisconsin-wolf-population-approaching-1000-427416443.html>.
- Woodroffe R., Ginsberg J.R. 1998. Edge effects and the extinction of populations inside protected areas. *Science* 280:2126–2128
- Wydeven A.P. et al. (2009) History, Population Growth, and Management of Wolves in Wisconsin. In: Wydeven A.P., Van Deelen T.R., Heske E.J. (eds) *Recovery of Gray Wolves in the Great Lakes Region of the United States*. Springer, New York, NY
- Wyoming Fish and Game Department. 2017. Wyoming Gray Wolf Monitoring and Management 2017 Annual Report. USDA, US Fish & Wildlife Service, National Park Service, Wyoming Game & Fish Department, Eastern Shoshone Tribe, Northern Arapaho Tribe. Cheyenne. Wyoming. USA
- Wyoming Fish and Game Department. 2018. Wyoming Gray Wolf Monitoring and Management 2018 Annual Report. USDA, US Fish & Wildlife Service, National Park Service,

Wyoming Game & Fish Department, Eastern Shoshone Tribe, Northern Arapaho Tribe.
Cheyenne. Wyoming. USA

Wyoming Game and Fish Department. 10 October 2018. Testimony of John Kennedy Deputy
Director Wyoming Game and Fish Department. Wyoming Game and Fish Department.
Cheyenne, WY, USA

Wyoming Game and Fish Department. 2015. 2014 Annual Report. Wyoming Fish and Game.
Cheyenne, WY, USA.

Yoder, J. 2000. Damage abatement and compensation programs as incentives for wildlife
management on private land. USDA: APHIS.

Young J.K., Z. Ma, A. Laudati, and J. Berger. 2015. Human–carnivore interactions: lessons
learned from communities in the American West. *Human Dimensions of Wildlife*
20:349–366.

2012 West Virginia Code :: CHAPTER 20. NATURAL RESOURCES :: ARTICLE 2.
WILDLIFE RESOURCES. :: §20-2-44b. Bear damage stamp; proceeds to be paid into
bear damage fund; purposes, etc. 2019. [https://law.justia.com/codes/west-
virginia/2012/chapter20/article2/20-2-44b/](https://law.justia.com/codes/west-virginia/2012/chapter20/article2/20-2-44b/).

2012. Nuisance Wildlife. Ohio Department of Natural Wildlife Division of Wildlife.
<http://wildlife.ohiodnr.gov/species-and-habitats/nuisance-wildlife>

2014. Nuisance Wildlife/. Kentucky Department of Fish and Wildlife Resources.
<https://fw.ky.gov/Wildlife/Pages/Nuisance-Wildlife.aspx>

2015. Wolf Numbers in Minnesota, Wisconsin and Michigan (excluding Isle Royale) -
1976 to 2015. US Fish and Wildlife Service.
https://www.fws.gov/midwest/wolf/population/mi_wi_nos.html.

2017. Access/Depredation Fee. Idaho Fish and Game.
<https://idfg.idaho.gov/licenses/access-depredation-fee>

2018. Wolf Depredation Reports in 2018. Wisconsin state Government.
<https://dnrx.wisconsin.gov/wdacr/public/depredation/2018>

2019. Compensation Rules for Depredation Incidents. Washington Department of Fish
and Wildlife. [https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-
wolf/compensation](https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf/compensation)

2019. Damaging and nuisance wildlife. Wisconsin DNR.
<https://dnr.wi.gov/topic/wildlifehabitat/damage.html>

2019. Facts on Wolves in Washington. Western Wildlife Outreach.
<http://westernwildlife.org/facts-on-wolves-in-washington-state/>
2019. Gray Wolf Conservation and Management. Washington Department of Fish and Wildlife. <https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf>
2019. Gray Wolf Conservation Management Plan. Washington Department of Fish and Wildlife. <https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf/management-plan>
2019. Gray wolf factsheet. Wisconsin DNR.
<https://dnr.wi.gov/topic/wildlifehabitat/wolf/facts.html>
2019. Gray wolf in Wisconsin. Wisconsin DNR.
<https://dnr.wi.gov/topic/wildlifehabitat/wolf/>
2019. Gray Wolf Updates. Washington Department of Fish and Wildlife.
<https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf/updates>
2019. <https://docs.legis.wisconsin.gov/statutes/statutes/29/XII/889>.
2019. Livestock Loss Board. Montana Department of Livestock.
<http://liv.mt.gov/Attached-Agency-Boards/Livestock-Loss-Board>
2019. Management of Wolves. US Department of the Interior.
<https://www.doi.gov/ocl/management-wolves>
2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife. <https://wdfw.wa.gov/publications/02062>
2019. Wildlife Damage Abatement and Claims Program. Wisconsin DNR.
<https://dnr.wi.gov/Aid/WDACP.html>
2019. Wolf Advisory Group. Washington Department of Fish and Wildlife.
<https://wdfw.wa.gov/about/advisory/wag>
2019. Wolf Conservation and Management Plan. Washington Department of Fish and Wildlife. <https://wdfw.wa.gov/publications/00001>
2019. Wolf Natural History. Washington Department of Fish and Wildlife.
<https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf/about>
2019. Wolves and Livestock. Washington Department of Fish and Wildlife.
<https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf/wolves-livestock>
2019. Wolves in Wyoming. Wyoming Game and Fish Department.
<https://wgfd.wyo.gov/Wildlife-in-Wyoming/Large-Carnivore/Wolves-in-Wyoming>

2019-2020 Black Bear and Migratory Game Bird Stamp Winners Named. (n.d.).
<https://news.maryland.gov/dnr/2019/03/21/2019-2020-black-bear-and-migratory-game-bird-stamp-winners-announced/>.

4 May 2019. Wisconsin Annual Wolf Damage Payment Summary. Wisconsin DNR.
<https://dnr.wi.gov/topic/wildlifehabitat/wolf/documents/WolfDamagePayments.pdf>

APPENDIX A: ADDITIONAL BACKGROUND MATERIAL

Drivers of Human-Wildlife Conflict

Human-wildlife conflict (HWC) does not occur in a vacuum, but is rather the result of complex interactions between natural environments and human societies, and has equally complex outcomes. Without understanding the root issues and drivers of HWC, there cannot be any significant steps toward remediating that conflict.

Conflict arises when humans and wildlife interact, and such interactions are increasing as wildlife habitat shrinks and fragments due to human population growth, urbanization, and expansion of agricultural land. Especially around protected areas, urbanization is projected to increase by 67% over the next 50 years in the United States (Zlotnik 2004). As a result of habitat loss and fragmentation, wildlife densities therefore increase near developed areas, and animals come into greater contact with humans (Woodroffe, Thirgood, and Rabinowitz 2005; Skogen, Mauz & Krangle 2008). Human-wildlife conflict is also exacerbated when predators have less access to viable prey and resources, and are driven to riskier behavior around people (Woodroffe, Thirgood, and Rabinowitz 2005; Skogen, Mauz & Krangle 2008).

Not only is the proximity between humans and wildlife due in part to human activities, but is also sustained through laws that protect wildlife and have allowed some species to re-establish self-sustaining populations through reintroduction and natural recolonization.

Finally, conflict between social groups about wildlife management and complicated by mistrust and resistance between groups, contributes to HWC. This conflict between people is often caused and exacerbated by perceptions of power imbalance and social vulnerability (Skogen, Mauz and Krangle 2008).

Human-Wildlife Conflict Within the United States

Human-wildlife conflict is highly dependent on human experience, which changes significantly based on geographic location. Looking at conflict, then, first requires an understanding of the historic culture and society around wildlife in the United States that contributes to the conflict seen today.

One way we can look at human-wildlife conflict and compensation schemes is by considering the history of the United States has changed who we value in our society and how that has resulted in a shift in the political seats of power. Opinions about wildlife and perception of wildlife conflict are influenced by cultural norms, identity, emotional experiences with wildlife, previous experiences with government, political ideology, socioeconomic status and personal values (Teel et al. 2003). In the United States, different forms of HWC can be understood primarily, albeit simplistically, through the historical differences between urban and rural residents and associated social, political, and cultural factors. It is important to note that “urban” and “rural” are not binary and is not the only distinction by which HWC can be critically evaluated. Like all things, there is a spectrum of people with variation in beliefs and values. Yet, there are important correlations between urban and rural residents and political ideologies, personal values, socioeconomic status (Teel et al. 2003). These patterns make “urban” and “rural” valuable generalizations to make within the context of this research.

The connection to land as an income source shows patterns in views of wildlife. Those who work with and on the land directly are more likely to live in more rural regions and emphasize the use-value in wildlife when compared to their “urban” counterparts (Teel et al. 2003). The people who work in rural areas, such as farmers and ranchers, are also linked to areas with lower levels of urbanization, income, education level, and lessened socioeconomic and residential mobility (Manfredo, Teel, and Bright 2003). Though these trends do not imply that all individuals who live in rural areas are farmers, it does provide some insight into a connection found between geographic location and beliefs about wildlife. These patterns demonstrate that the generalized difference between urban and rural residents can be of socio-economic class, politics, values, and cultural norms - all factors that influence perception and attitudes toward wildlife and HWC.

Occupation and political patterns have relatively clear relationships with geographic location, both of which contribute to perception of wildlife (Teel et al. 2003). In addition to those two, factors like personal values, cultural norms, and perceptions of social vulnerability also contribute towards attitudes about wildlife. Because these factors are not as easily tracked, they are better understood within the context of U.S. history. The history of agriculture, farming, and ranching in the United States has had a formative role in shaping relationships with wildlife and between urban and rural communities. The agrarian ideal of the yeoman farmer, which placed cultural value upon individuals who invested their time and effort into getting valuable resources

out of their land, has been central to visions of American identity since its founding (Jefferson 1781). During westward expansion, yeomen, and frontiering, was a view of wildlife (especially carnivores) as pests. This negativistic attitude towards wildlife led to government sponsored policies that encouraged the elimination of animals like wolves, foxes, and bears (Nyhus 2016, Conover 2002). Thus, hunting and use values of wildlife embedded themselves into American culture as a reflection of an individualism, masculinity, wealth, independence, and patriotism (Cronon 1995; Friedmann and McMichael 1989). However, in the 1950's, manufacturing took over as the dominant industry, focusing on mass markets and mass production in urban centers (Friedmann and McMichael 1989). This shift in industry employment didn't just show a change in income source, but also a shift in cultural values and seats of political power.

It is important to note that during the shift to mass markets and manufacturing there was also a noticeable shift in attitudes toward wildlife, especially in urban areas. Though policies like the Lacey Act (1900) and Migratory Bird Act (1918) existed in the very early 20th century, the mid-20th century brought some of the most powerful wildlife and environmental protection acts still around today, including the Clean Air Act (1963), Wilderness Act (1964), Marine Protection Act (1972), and Endangered Species Act (1973), among others.

These protective policies, accompanied with the intentional reintroduction and protection of potentially damaging wildlife, could be seen by rural residents as a contradiction to their values and history and as a threat to their worldview and lifestyle (Nyhus 2016, Young et al. 2015; Bruskotter, Schmidt, and Teel 2007). The reduction of land management agency from states is demonstrative of how urban movements can impact rural communities and how feelings of power imbalances can be present. Also during the 1950's was a shift in U.S. public land management towards focus on managing for public recreational use and national government involvement (Merrill 2002).

The shift of economic and social power to urban centers was demonstrated through the environmental legislation introduced. This focus on urban centers followed a two hundred year tradition of valuing American occupation and domination of the wilds and the West. Generations of farmers, ranchers, and other rural residents, who had use-value for wildlife, could no longer manage wildlife with as much agency as they had previously. A perception of power imbalance between people is a key aspect of human-human conflict that drives HWC. Wildlife policy on management and including policy surrounding compensation schemes, is more often supported by

non-rural residents with non-use values for wildlife (Skogen, Mauz & Krange 2008). Though the laws and enforcement for wildlife protection are more heavily supported in more urban areas, the conflict and damages disproportionately affect residents in more rural areas (Skogen, Mauz & Krange 2008). Since damage is often felt by rural landowners but wildlife protection policy is enforced by non-local urban “elites”, feelings of resentment, resistance, and perceptions of power imbalance can develop (Morrison, Victurine, and Mishra 2009).

APPENDIX B: FULL RESULTS TABLES AND TOTALS

(attached as Excel file due to size)

APPENDIX C: FULL TABLE OF UPDATES FROM WAGNER ET AL. 1997

(attached as Excel file due to size)