



# Ranchers' Perspectives on Participating in Non-lethal Wolf-Livestock Coexistence Strategies

Carol Bogezi<sup>1\*</sup>, Lily M. van Eeden<sup>1,2</sup>, Aaron J. Wirsing<sup>1</sup> and John M. Marzluff<sup>1</sup>

<sup>1</sup> School of Environmental and Forest Sciences, University of Washington, Seattle, WA, United States, <sup>2</sup> School of Life and Environmental Sciences, The University of Sydney, Sydney, NSW, Australia

## OPEN ACCESS

### Edited by:

Ursula Münster,  
University of Oslo, Norway

### Reviewed by:

Annelie Sjölander Lindqvist,  
University of Gothenburg, Sweden  
Katherine Whitehouse-Tedd,  
Nottingham Trent University,  
United Kingdom

### \*Correspondence:

Carol Bogezi  
cbogezi@gmail.com

### Specialty section:

This article was submitted to  
Human-Wildlife Dynamics,  
a section of the journal  
Frontiers in Conservation Science

**Received:** 22 March 2021

**Accepted:** 14 September 2021

**Published:** 11 October 2021

### Citation:

Bogezi C, van Eeden LM, Wirsing AJ  
and Marzluff JM (2021) Ranchers'  
Perspectives on Participating in  
Non-lethal Wolf-Livestock  
Coexistence Strategies.  
*Front. Conserv. Sci.* 2:683732.  
doi: 10.3389/fcosc.2021.683732

Potential impacts to rural livelihoods by large carnivores, such as gray wolves (*Canis lupus*), increase economic liability and fear among residents, resulting in social conflicts over wildlife issues. Strategies have been developed to promote non-lethal predator management in rural communities, but there is limited understanding of why ranchers choose to participate in such programs. We conducted semi-structured interviews ( $n = 45$ ) of ranchers in Washington state, United States, asking open-ended questions to explore their perspectives on conflict mitigation. Interviews were analyzed using Grounded Theory. Ranchers mentioned five broad types of mitigation strategies: state agency intervention (i.e., calling the state agency in charge of wolf management to request either compensation or lethal wolf removal), biological measures (e.g., use of guard animals), physical measures (e.g., fences), human interference (cowboys and cowgirls), and indirect measures (e.g., husbandry practices). Motivations for participating in non-lethal mitigation strategies included previous positive interactions with wildlife agency officials, an understanding of the importance of wolves to the ecosystem, and clearly outlined guidelines on how to deal with wolf interactions. Barriers that hindered rancher participation included disdain for regulation both regarding the Endangered Species Act and the state's requirements for accessing damage compensation, which were perceived to be extensive and over-reaching. Negative attitudes toward wolf recovery included fear of wolves and perceived damage that wolves inflict on rural lives and livelihoods. Ranchers' motivations and perceived barriers for participating in mitigation strategies included sociopolitical and economic factors. Thus, we suggest that in addition to mitigating economic loss, wildlife managers address the intangible social costs that deter ranchers' participation in mitigation strategies through continued dialogue.

**Keywords:** wildlife coexistence, conservation social science, *Canis lupus*, non-lethal strategies, ranching, carnivores, qualitative interviews

## INTRODUCTION

Arguments to conserve large carnivores, such as wolves (*Canis lupus*), are often based on their ecological (Beschta and Ripple, 2009; Prugh et al., 2009; Wirsing et al., 2012; Newsome et al., 2015), intrinsic (Soulé, 1985; Vucetich et al., 2015), or cultural value (Nie, 2002; Naidoo and Adamowicz, 2005; Chan et al., 2012). Yet, these species may also disrupt rural livelihoods by increasing economic liability and creating fear among some residents, thereby inciting social conflict between those who wish to conserve biological diversity and those making a living in carnivore habitat (Redpath et al., 2013; Frank, 2016; Manfredo et al., 2017). In order to address this conflict, non-governmental organizations (NGOs) and government agencies tasked with wildlife management often reimburse rural residents for their losses and promote non-lethal strategies for mitigating carnivore impacts (Linnell et al., 2010; Ravenelle and Nyhus, 2017; van Eeden et al., 2018; Macon, 2020).

Previous studies have approached the topic of mitigation effectiveness through expert understanding of carnivore population ecology, and have recommended physical preventative strategies to reduce depredation (Karanth and Sunquist, 1995; Wagner and Conover, 1999; Graham et al., 2005), as well as quantifying costs (Muhly and Musiani, 2009) and compensating for the economic loss (Wagner et al., 1997; Dickman et al., 2011; Karanth et al., 2012). In addition to ecological methods, researchers have utilized interdisciplinary studies that engage sociology and psychology to understand the human-dimensions of interaction with wildlife and what would motivate ranchers to participate in various management measures (Manfredo, 2008; Kansky and Knight, 2014; Hill, 2015; Nyhus, 2016; Drinkhouse, 2018). Non-lethal approaches can reduce livestock damage (Kansky and Knight, 2014; Scasta et al., 2017; van Eeden et al., 2018) and reimbursing all or some of the costs associated with limiting carnivore-stock encounters (cost-sharing) is presented as one way to motivate ranchers to coexist with carnivores (Bruskotter, 2013; Drinkhouse, 2018; Frank et al., 2019). However, our understanding about rural people's perceptions of cost-shared mitigation strategies and why certain mitigations are adopted over others is limited (Dickman, 2010; Kansky and Knight, 2014). Studies that only recommend cost-sharing programs provide incomplete knowledge about why rural dwellers would or would not enroll in those cost-sharing programs and are therefore insufficient to increase participation in such programs. Here, we extend knowledge on rancher participation in non-lethal measures by investigating the perspectives of ranchers toward participating in cost-shared, non-lethal strategies. This study forms part of a broader project that seeks to increase participation in existing coexistence programs and determine the feasibility of establishing new programs (van Eeden et al., 2021a).

With the recent return of wolves to the state, ranchers in Washington, United States (U.S.), have once again come into conflict with a native carnivore. Wolves naturally returned to areas of Washington from Idaho, U.S., and British Columbia, Canada, after being extirpated for more than 70 years (Wiles et al.,

2011; please see Rashford et al., 2008 and Treves and Naughton-Treves, 2005 for a comprehensive history of wolf management in the western United States). Areas inhabited by wolves coincide with those supporting beef cattle ranching, so wolf recovery has been a source of contention because of livestock depredations. Some ranchers lease public lands to graze their livestock and large private ranches also provide open spaces that can be used by wildlife including wolves (Macon, 2020). Historically, ranchers sought to reduce predation risk by lethally removing carnivores (Treves and Naughton-Treves, 2005), but with the changing lifestyles and demographics of the U.S. population, killing of wolves is no longer preferred by the public as a wildlife management tool (George et al., 2016; van Eeden et al., 2021b). Real and perceived contention over lethal control have resulted in conflicts over approaches to wolf management and polarization of attitudes toward wolves (Mazur and Asah, 2013; Treves et al., 2005).

The Washington Department of Fish and Wildlife (WDFW) is responsible for recovering wolves in the state of Washington and as such discourages ranchers from killing wolves and encourages use of non-lethal mitigation strategies. To promote non-lethal strategies, WDFW invited ranchers to sign a Damage Prevention Cooperative Agreement for livestock protection (DPCA-L) that enrolls them in a cost-sharing program that would provide financial and technical resources for implementing non-lethal measures that prevent wolf depredations. WDFW established Damage Prevention Cooperative Agreements (DPCA) initially to help alleviate the crop damage that can be caused by elk and deer. With the recovery of wolves, in 2012 the same template of DPCA was adopted for livestock i.e., DCPA-L to alleviate damage that could be caused to livestock by wolves. The DPCA-L cost-share approach was to offset financial losses that ranchers may incur when they have wolves on their property. The tools the DPCA-L pay for include range-riders, sanitation programs (removing dead carcasses from ranch), specialized lighting, fencing and guard animals. Provisions of the DCPA-L are voluntary and are in addition to existing strategies that the WDFW is involved in with ranchers which includes compensation programs for livestock that have been preyed on by wolves, and wolf removal from some areas. DPCA differs from these other strategies in that it is proactive and invites ranchers to participate before they have any wolf damage on their property. Besides getting non-lethal preventative measures on the ground, one major purpose of the DCPA-L is to build connections and develop long-term relationships between WDFW and ranchers. In 2020, WDFW spent \$110,035 in reimbursements to 33 livestock producers under the DPCA-L (Washington Department of Fish Wildlife, 2021). In addition, WDFW compensates ranchers for damages owing to wolves (Washington Department of Fish Wildlife, 2018). Despite these efforts, many ranchers are reluctant to participate in this cost-shared program. For example, at the end of 2017 only 37 out of more than 8,420 livestock ranchers (Census of Agriculture, 2012) had signed a DCPA (Washington Department of Fish Wildlife, 2021).

We aimed to understand what affects ranchers' participation in cost-shared mitigation strategies intended to foster human-wolf coexistence, which is a key step in conserving wolves

(Manfredo and Dayer, 2004). Specifically, we addressed the following questions: (1) What do ranchers perceive about the current return of wolves to Washington? (2) What mitigation strategies are currently utilized by ranchers in Washington? (3) What motivates ranchers to use their mitigation strategies? (4) What discourages ranchers from participating in mitigation strategies? We then leveraged our understanding of what affects participation to suggest how to increase the adoption of mitigation strategies.

## METHODS

### General Approach

We used semi-structured interviews to explore ranchers' perspectives about mitigation strategies to coexist with wolves. Before the interviews, topics and questions to be discussed were preselected. During each interview, the wording of the questions and the order of asking the questions varied depending on how the interviewee was responding. We adopted a qualitative research design because we assumed that our understanding of wolf recovery and mitigation measures to increase human-wolf coexistence might differ from those of the ranchers who live and work locally on the landscape shared with wolves. The explorative nature of qualitative approaches can reveal the social context of ranchers' attitudes and motivations, allowing beliefs to emerge that would otherwise be missed by the researcher (Krueger and Casey, 2000; Schüttler et al., 2011). We used constructivist Grounded Theory (Charmaz, 2014) to relate the observed patterns in the responses to broader themes that better explained the data. Grounded Theory is a qualitative data analysis method with systematic guidelines for gathering and analyzing data to generate understanding from empirical data such as interviews (Charmaz, 2014). The analytic process consists of comparing, coding, developing, checking, and integrating the data into theoretical categories. Based on Charmaz (2014), we used an inductive data analysis process whereby we began with a wide range of individual interviews from which we formed patterns that provided the foundational understanding that we further analyzed to answer the research questions (more in section Recruitment and interviews on Data Analysis).

### Theoretical and Analytical Framework

To catalyze change for better carnivore conservation that aims to identify common interests, human dimensions of carnivore conservation have been promoted as one of the tools to better understand human-carnivore coexistence (Mattson and Clark, 2009). To effect lasting changes, however, scholars need to move beyond only social surveys and outreach/education programs and promote structural solutions that address the affected people's concerns, policy and governance-oriented professionals (Mattson and Clark, 2009; Dickman, 2010; Heberlein, 2012). Therefore, for this study we utilized qualitative interviews with ranchers in a geographic area where wolves had only recently recovered, and analyzed the interviews using Grounded Theory to examine ranchers' own words and frames of reference to explore what they participated in, as well as the conditions that motivated or constrained ranchers from participating in

non-lethal strategies to coexist with wolves. Although ranchers may differ in their attitudes about coexisting with wolves, studies suggest that both economic and social costs incurred in coexisting with a new predator on the landscape matter (Carter et al., 2020).

The narratives we analyzed were shaped by respondents and our interpretation of the narratives is shaped by literature on trust (Dietsch et al., 2021), risk perception (Carter et al., 2020) and group dynamics including culture and social identity (Manfredo et al., 2017). Trust is relevant in conflict resolution as it can build partnerships and facilitate processes whereas distrust leads to disagreements (Dietsch et al., 2021). Where ranchers have trustful relationships with wildlife agencies, they are more likely to participate in coexistence strategies, whereas with lack of trust there is little buy in for wolf coexistence strategies. Stakeholder groups like ranchers and hunters typically having lower agency trust than the general public, and such groups can be considered as kinds of social identities (Schroeder et al., 2021). Group dynamics and social identity in conflict resolution can cause individuals to take positions in contrast to the outgroups, consequently hindering successful debate and inhibiting conservation action (Dietsch et al., 2021). In the case of our research, with ranchers as one group and WDFW and conservation organizations as the other groups, ranchers could choose positions that are in contrast with the conservation agency and organizations because they are adhering to their ingroup dynamics.

### Recruitment and Interviews

We recruited ranchers by cold-calling from a list of contacts provided by the Washington Cattlemen's Association and Stevens County Cattlemen's Association. Over the phone, we briefly explained the study, and sought their participation to be interviewed at a place and time of their choosing. We then used a snowball method (Goodman, 1961) to recruit additional ranchers. We contacted some ranchers directly from information provided on their websites.

We developed a list of questions about wolves and mitigation strategies, and pre-tested the questions for relevance and appropriateness prior to implementation in the field (Kvale and Brinkmann, 2008) with two ranchers outside the study area in Idaho and Montana. Questions explored in this study were part of a longer interview script (**Appendix A**). This study was approved by the Institutional Review Board (IRB) at the University of Washington (Human Subjects Division study #45684).

Eligible participants read and signed an informed consent form (**Appendix B**) with the understanding that there was no monetary compensation for participation. We encouraged ranchers to participate in the interviews because their opinions would contribute to the discussion about wolf recovery and conservation in Washington. During the interviews, which were audio-recorded, we documented rancher demographic information including age, gender, and location by county. Other rancher characteristics noted included the size of the ranch, the type of operation, whether they graze on private or public land or both, whether they had experienced any wolf interactions by 2013, and finally whether their children would inherit the

ranching operations for the future. All rancher characteristics are summarized in **Appendix C**. Sampling continued until theoretical saturation was reached (Charmaz, 2014; Saldaña, 2015). Theoretical saturation is the phase during qualitative study in which the researcher has continued sampling and analyzing data until no new data appear, i.e., the new respondents are not giving any new information (Charmaz, 2014).

## Data Analysis

All interview recordings were transcribed verbatim (Poland, 1995) and analyzed with NVivo v.11 (QSR International Pty Ltd, 2014). Two researchers coded a sample of interviews to test inter-coder reliability of the interviews. Using the *Coding Comparison Query* in NVivo v.11, we determined the intercoder reliability *Kappa* coefficient for the data to be >96% across the two coders, so we proceeded to code the rest of the interviews.

We used the inductive data analysis process of Grounded Theory (Charmaz, 2014). Under this process, patterns of constructs based on either similarity or differences among respondents are grouped together into themes (Ryan and Bernard, 2003). During the initial coding we used the open-coding process whereby we read and re-read the text line-by-line to determine whether text was meaningful to our understanding of what motivates and constrains ranchers' participation in mitigation strategies. In the next round of analysis, we used the *Query tool* in NVivo to contrast the ranchers' coded responses to the research questions and to rancher demographic attributes (**Appendix C**). Querying the response codes enabled us to identify relationships, attempt to recognize logic to connect them, and realize emerging patterns from the data about what ranchers felt about wolves and mitigations to better coexist with wolves.

## RESULTS

We interviewed 45 ranchers in Washington state from the following counties: Kittitas ( $n = 11$ ), Okanogan ( $n = 7$ ), Spokane ( $n = 1$ ), Stevens ( $n = 18$ ), Walla Walla ( $n = 1$ ), and Yakima ( $n = 7$ ). The interviews ranged in duration from 35 to 159 min (**Appendix C**). Ten ranchers were below the age of 45, 12 between 45 and 55 years old, 14 between 55 and 65, and 9 above 65 years old. Eighty percent ( $n = 36$ ) were male. Most of the interviewees were at least third generation ranchers (29/45); eight ranchers each from first- and second-generation ranching families were interviewed. The themes that arose from the data included (i) ranchers' attitudes toward wolves were integral in selecting mitigation strategies they chose to implement, (ii) ranchers implemented carnivore mitigation strategies irrespective of whether they had wolves on their property or not, and (iii) past experiences with and trust of wildlife agency officials were identified as factors that motivated ranchers to participate in non-lethal mitigation strategies.

### Attitudes of Ranchers Toward the Current Return of Wolves to Washington State

Ranchers had a range of attitudes toward the return of wolves to Washington. Many ranchers were opposed to wolf recovery in Washington, citing various reasons including fear and the

inconvenience wolves would bring to their ranching lifestyles. Most ranchers felt that the return of wolves was an inconvenience that they wished they did not have to deal with but could tolerate wolves in wild areas unless they depredated their livestock. Some ranchers accepted that wolves were recovering in the wild in Washington and did not mind coexisting with them.

Among the ranchers we interviewed, those who said they were tolerant of wolves had small- to medium-sized ranch operations, and some of them were also ranching as a new profession in retirement. The few large operation ranchers who tolerated wolves had experienced wolf interactions on their ranches, whereas those who said they were intolerant of wolves never had direct experienced wolves on their ranches. Notably, we found that ranchers with large operations and who had been ranching for multiple generations and were dependent on ranching as their only source of income were least willing to participate in mitigation measures.

Ranchers mentioned that wolves were necessary for a well-functioning ecosystem, which helped inform their positive attitudes toward wolf recovery and participation in non-lethal mitigation strategies. Other ranchers cited the moral obligation of humans to restore extirpated biodiversity including wolves in the wild for intrinsic value that wildlife have. The quotations below depict the positive attitudes ranchers had toward wolves:

*"The reintroduction. Well [pause] that's pretty important to re-establish a natural ecosystem, but that can't be just the wolves you've got to have the elk and even the beaver...create an ecosystem in the creeks and river valleys... and when you restore the deer and the elk, the grazing animals will defeat it unless you have wolves to keep them dispersed and moving."* [Respondent 19, November 2013]

*"I think it is a good thing. They were here for many centuries I assume, and there is lots of habitat for them here and of course not as much as there used to be so I personally think that it is a good thing that wildlife exists in as many places as possible especially if it used to, and it is too bad that it was brought to such close to extinction from their normal land, due to probably more than just misunderstanding in our State than anything else."* [Respondent 1, August 2013]

The reasons ranchers mentioned for the negative attitudes toward wolf recovery included fear of wolves, and the perceived damage that wolves will have on their lives. Many ranchers did not like that the government was involved in wolf management. The following quotations portray the negative attitudes that ranchers held toward the return of the wolves in Washington state:

*"We cannot coexist! There's no coexistence. If somebody's trying to kill you, you cannot let them do that! You either kill him or he's going to kill you. That's what this wolf is going to do to us... knows why they brought them back."* [Respondent 34, November 2013]

*"...it's really about all of that government, you know, overshadowing everything. To me, that, there's nothing to do with the wolf itself"* [Respondent 39, November 2013]

## Mitigation Strategies That Ranchers in Washington Are Using: Motivations and Constraints

All ranchers we interviewed implemented some form of mitigation strategy to protect their livestock from predators. None of the ranchers interviewed reported practicing or knowing anyone who used lethal control to mitigate for wolf depredation. Ranchers mentioned five broad types of mitigation strategies that included: state agency intervention measures (e.g., calling WDFW), biological measures (e.g., use of guard animals), physical measures (e.g., fences), human interference (cowboys and cowgirls), and indirect measures (e.g., husbandry practices). The mitigation measures are not exclusive to each rancher; that is, a single rancher could discuss and participate in none, one or a combination of more than one of the strategies.

### State Agency Intervention

Most ranchers sought state agency intervention as their first line of reporting when faced with any suspected wolf sighting, interaction, or depredation by contacting the WDFW, the state agency in charge of wildlife including wolves. Eleven ranchers we interviewed had indeed contacted WDFW regarding wolves. State agency intervention mitigated conflict in two ways: first, the agency was expected to translocate or eliminate the offending wolf; and secondly, in case of a depredation the department provided compensation, in accordance with the state regulations and procedures, to cover their monetary loss. According to Washington State Law (WAC 220-440-170) commercial livestock owners who have worked with the WDFW to prevent depredation but continue to experience livestock losses or injury to livestock injured by bears, cougars or wolves are eligible for compensation using state funds. The claimant is required to submit to WDFW documentation that includes the commercial value of the lost livestock, an estimate of the percentage loss of value for the injured livestock and a completed claim form. WDFW investigated the claims and may have a forensics team confirm or give a probability that it is indeed it is a wolf depredation before proceeding with payments. For confirmed depredations by wolves, the rancher will be paid for verified losses on acreage of <100 acres. For ranches larger than 100 acres, the payment is twice the verified losses to account for the assumption that multiple animals are missing.

Some participants discussed compensation as one of the existing mitigation strategies; however, only one participant had actually received compensation, another had refused the compensation because he perceived that accepting the compensation was indicative of him accepting wolves, and the remaining interviewees never experienced any depredation that required compensation. Complexity of obtaining and the inadequacy of the compensation were common reasons ranchers avoided WDFW intervention after a wolf incident. Ranchers reported that the compensation value given for dead livestock was insufficient to cover the actual impact, for example weight loss caused by reduced grazing in the presence of wolves. Ranchers further cited regulatory burden and elaborate paperwork as deterrents to contacting WDFW. For example, in

response to suspected depredation, ranchers are required to file an account and treat the location as a crime scene.

Three ranchers had signed a Damage Prevention Cooperative Agreement for livestock (DPCA-L) with WDFW at least once since the DPCA-L's inception in 2012: two of those DPCA-Ls were active whereas one rancher had discontinued theirs. These ranchers engaged in state-led non-lethal strategies to leverage the Department's willingness to reduce ranchers' economic losses due to wolves. Some ranchers considered compensation an advantage because it covered the direct economic loss of livestock due to wolves and suggested some ways to improve it. To improve compensation ranchers suggested reducing the paperwork required for repeat depredations and streamlining the process so that ranchers do not have to wait too long before they receive compensation. Another suggestion was to change the compensation program to a wolf insurance plan so that ranchers who experience depredation apply for reimbursement from a private insurance company, like they do for all other incidents that arise in ranching. Furthermore, ranchers who signed the DPCA-L found it to be an advantage because it offered a step-by-step protocol that ranchers could follow to protect their livestock. Some ranchers referred to the depredation of cattle in Steven's County by the Wedge Pack in 2012 as an example of the advantage of reporting wolf incidents to WDFW because the Department eliminated this pack. By removing the pack, the ranchers perceived this as a sign that WDFW was to some extent attentive to the ranchers' plight and acted in the ranchers' favor. This act by WDFW was perceived by some ranchers as positive past experience with government.

On the other hand, some ranchers felt that enrolling in a formal agreement brought too much government regulation in their day-to-day affairs telling them how and when to manage their ranch, for example, by recommending the age at which ranchers should release their cows out to graze or what type of cowboy they should hire. Some ranchers felt that agreeing to the recommended non-lethal measures prescribed by the DPCA-L would reduce their ability to utilize lethal control when needed. Some ranchers noted that there were many endangered species negatively affecting the ways they managed their ranches and grazing lands (e.g., spotted frog, *Rana pretiosa*, and bull trout, *Salvelinus confluentus*) and that mitigation for wolves would encourage more restrictions and regulations on behalf of these other species, which could negatively affect the ranchers.

Previous working relationships between ranchers and state agency officials influenced reporting. Ranchers referred to past experiences where reported depredation incidents were either overlooked or ignored by WDFW officials. These past interactions produced a lack of trust of the WDFW and a reduction in reporting incidents. Some ranchers preferred working with local existing agriculture-related agencies such as the Farm Bureau, conservation districts or county commissioner's offices. The following quotations illustrate the perceptions ranchers held about reporting wolf incidents to WDFW:

*"This wolf management shouldn't come up from officials in the State, they all divert us all off to a side road every time. It's got to*

*be either individuals or small groups or better yet, far better is our county commissioners and our local elected officials take care of it.*" [Respondent 30, November 2013]

*"For ranchers to be willing to accept them (wolves), I think a compensation program where it would pay for any wolf kill. But that program and process has to be streamlined. Boom! Done. If there's paperwork and conversations then and a couple meetings and phone calls, it is just going to be more screwing around than I think most people would want to contend with. Certainly, more than I would want to contend with."* [Respondent 1; August 2013]

### Use of Guard Animals

Ranchers cited the use of guard dogs (*Canis lupus familiaris*) as their primary mitigation strategy. Three ranchers actively kept guard dogs or cattle dogs that were used to protect their livestock at all times, whereas others suggested that they would get a guard dog when wolves recolonize areas near their properties. Two ranchers also had llamas (*Llama llama*) or donkeys (*Equus asinus*), respectively, which acted as guard animals in case wolves ventured near their ranches.

Having guard animals was easy for ranchers because they often maintain these animals for a variety of ranch duties besides preventing wolf depredation (Scasta et al., 2017). However, the financial cost of purchase, training and maintaining new guard animals is substantial and borne entirely by the rancher (Gehring et al., 2010). Ranchers also feared that their dogs could hybridize with wolves, which would cause complexities in the local wolf population. Some ranchers were wary about the possibility of domestic stray dogs in the community forming packs with cattle dogs and together depredating smaller farm animals such as chickens and lambs, while others worried that wolves would kill their guard dogs.

### Physical Barriers (e.g., Fences)

Ranchers regularly constructed and modified fences to reduce predation by carnivores, such as coyotes (*Canis latrans*), and several believed that these structures would also help deter wolves. For example, one rancher constructed a modified fence to protect free-range chickens from predators by extending the fence-wire vertically and horizontally several feet underground; thus, the modified fence prevented canids from digging below the fence to prey on the chickens. Two ranchers who had sheep operations mentioned that they used fences effectively to graze their sheep while protecting them from predators. Other physical deterrents were often mentioned, such as having bells on cows that would frighten wolves and allow the rancher to better track their stock. Other mitigation measures that were suggested but not currently implemented by any of the interviewed participants included: fladry, Radio Activated Guard (RAG) boxes, and lethal control (Bangs et al., 2006; Shivik, 2006; Brown, 2011).

Ranchers were motivated to have physical barriers such as fences that are easy and effective for some types of livestock operations, such as chicken rearing and sheep herding. Most small- to medium-sized ranches already had fences in place, so it was easier for them to improve on the existing fences than build completely new fences. However, ranchers mentioned that implementing specialized fences to prevent negative interactions

with wolves would require increased operating costs and time incurred on the ranch, thereby reducing their already meager profits [We note here that the state of agriculture in Washington is good with the commercial crop and livestock products valued at \$7.9 billion (Washington State Department of Agriculture, 2019, <https://agr.wa.gov/>)].

### Human Interference (Cowboys, Cowgirls, and Ranch Hands)

Another mitigation strategy mentioned was the use of human interference, usually in the form of cowboys, cowgirls, and ranch hands, to monitor the livestock and keep wolves at bay. The primary purpose of human interference was focus on the wellness of the livestock and maintain smooth running of the ranch, while deterring wolves was the secondary role. Ranch hands rode on horseback, either daily or weekly depending on where the cattle were, to check on the livestock out in the grazing allotment(s), and as they ran the day-to-day affairs of the ranch, they kept wolves and other predators away from the livestock. Some ranchers occasionally hired a cowboy/girl to ride the ranch when they thought there might be predators on the land. The hired hands rode at least once to several times a week and regularly checked on the livestock to ensure that predators did not prey on them.

In addition to ranch hands, WDFW and NGOs offered range rider programs for which they solicited the ranchers' participation. A range rider is an individual who keeps a constant presence, either through riding a horse or driving an all-terrain vehicle (ATV), on a landscape where both wolves and livestock occur in order to reduce wolf-livestock conflicts (Parks and Messmer, 2016). If a rancher agreed to have a range rider on their ranch, WDFW would provide the range rider with real time locations of wolves so that the range rider could keep the wolves and cows apart. Two WDFW/NGO-supported range-rider programs were active among the ranchers we interviewed, while one rancher had discontinued the program on his ranch citing his reason for discontinuation as that he realized he could do his own riding sufficiently without external help whose intentions he did not trust.

Ranchers were motivated to use human interference as a mitigation strategy because it was already part of their cultural lifestyle and livelihood. However, some challenges to this strategy were noted, including the concern that some riders cannot be with the herd at night when wolves hunt, the difficulty of navigating forested mountainous landscapes, and the potential habituation of wolves to non-offending human presence. Ranchers with small operations stated that they did not need to ride because their operations were small enough for them to respond quickly by All-Terrain Vehicle (ATV) to the threat of a wolf on their livestock. Some ranchers despised the use of the term "range rider" rather than cowboy, perceiving this as an appropriation of the ranchers' culture by environmentalists.

Some ranchers stated that government-led programs including the range-rider program were less favored

than locally led ones because ranchers trusted their local organizations more than the state ones. For example, the rancher who quit the range-rider program mentioned that they had been on the WDFW DPCA-L program in 2012 but had decided to discontinue their participation in DCPA and thus give up access to wolf GPS-collar data in 2013 because they did not trust the intentions of the WDFW and did not want to work with them anymore (the rancher continued riding in the traditional way without GPS data guidance).

### Husbandry Practices

Seventeen ranchers mentioned that they employed specific husbandry practices that reduced the likelihood of depredation. For example, rotational grazing is a husbandry practice where cattle are temporarily constrained to a specific paddock of pasture for a period of time, and after grazing that paddock are moved to another paddock, eventually returning to the first paddock with newly grown pasture (Butterfield et al., 2006). This approach is different from where cattle freely graze the entire allotment without restriction (Butterfield et al., 2006). Keeping cattle in a smaller area enables the rancher to inspect their herd more frequently and monitor the conditions of their cattle more closely. Other ranchers waited until their calves reached an ideal heavier weight before releasing them to the summer grazing allotment in order to increase the calves' chances of defending themselves against wolf attacks, thereby reducing negative interactions with wolves. The ranchers mentioned that bigger older calves have a higher chance of surviving the wild allotment; they can run faster, and thus have a better chance of defending themselves against wolves than smaller calves. One rancher mentioned that he raises aggressive cow breeds that are able to defend themselves and their calves from wolves.

Ranchers were motivated to use husbandry practices focusing on the wellness of their livestock instead of confronting wolves, and ranchers seemed to be more willing to implement these measures than others. Some ranchers mentioned that as they increased vigilance over their livestock, it enabled them to remove the sick and injured animals and return them to the safety of the ranch, thereby reducing livestock losses (Parks and Messmer, 2016). For example:

*"... here [referring to the geographical area] if you want to be a good rancher in top rate with good animal husbandry you bet, a lot more time you spend with cattle. And in course of doing that you run out horse shoes, burning gasoline or diesel if you got a very big territory, and they are bothering you real bad you need extra men to be there with them"* [Respondent 31, November 2013]

*"I get nervous if I don't see them [livestock] for too long of a time, it's like, what are they doing, so, and with the wolves now it's just made us just a little bit more cognizant of showing up and making sure everybody's doing alright. To see if there's anybody weaker or slower and so cattle run and probably stepped in somewhere and had a hurt ankle, we kind of just look for that. And then if anybody is vulnerable then we'll try to get them. Our idea is either really keep a close eye on them and try to check those cattle closer or try to bring an animal that might look a little slower than the others, try*

*to bring them back a little closer to the house."* [Respondent\_49, November 2013]

Another way ranchers utilized their husbandry practices to increase human presence on their ranches was by engaging in farm tours and horseback trips on their property to increase customer involvement and thereby prevent wolf presence on their ranch. Ranchers who mentioned farm tours owned small to medium-sized farms and had regular farm tours for their clients as a private business venture not involved with the government. Their clients could participate in picking fruit or seeing how chickens and other livestock were managed on a day-to-day basis. Some ranchers regularly invited hunters on their ranch to hunt for deer and elk, and one participant invited recreationists to ride horses on their dude ranch. This mitigation practice allows ranchers to focus their attention on livestock and the ranching operations while the tourists increased human presence that deters predators. This improved the safety of the livestock against predators while earning extra income for the rancher.

### DISCUSSION

In this study we investigated ranchers' perspectives toward using non-lethal strategies to coexist with wolves. We found that ranchers expressed a range of attitudes toward wolf recovery, that they practiced an array of non-lethal strategies to protect their livestock from carnivores even in areas that had not yet been recolonized by wolves, and that both social and economic factors enabled and constrained adoption of mitigation strategies. The non-lethal strategies in which ranchers engaged included reporting incidences to the state agency in charge of wildlife, use of deterrents such as guard dogs, fences, and cowboys/girls, and utilizing custom livestock husbandry practices to reduce predation on their properties. We structured our findings in such a way that for every mitigation strategy reported, we outlined its motivations and constraints. Based on these motivations and constraints we first present two themes that arose from this study: (1) the situation of the ranchers when engaging with a non-lethal mitigation strategy to co-exist with carnivores and (2) the nature of the working relationship between ranchers and WDFW (the state agency in charge of wolves). We then offer some approaches that might be used to increase rancher participation in mitigation strategies, and finally discuss the limitations of our study and methods.

The typical rancher respondent in our study owns a cow-calf operation with one or more guard dogs on their property and rides on horseback several times a week to check on their livestock out on the allotment they lease. Under these circumstances, the time spent managing the day-to-day operations of their ranch preclude their ability to learn new mitigation strategies or new methods of ranching. As such, the most common motivation was familiarity with mitigation strategy to the rancher. This included, for example, owning dogs already or just adding a guard dog specific for defending against wolves or increasing the frequency of riding on horseback to increase human presence to deter wolves. Moreover, we did not record any constraints about husbandry practices as a mitigation

strategy. This finding could be because, for many ranchers, modification of husbandry practices entails little added time investment and social disruption given that no new people would have to be on the rancher's property as opposed to, for instance, joining a state or non-profit-run range rider program.

State agency intervention was the most ubiquitously sought form of wolf mitigation, presumably because it involves monetary aspects of compensation for all affected ranchers, technical and financial support for ranchers with active DPCA-L, and the help of agency personnel who work with the ranchers whenever needed to mitigate wolf conflicts. Ranchers also most often cited agency intervention as a constraint to their participation in mitigation, however, and few had enrolled in a DPCA-L. Our findings offer two explanations for why so few ranchers were willing to work with WDFW by way of these agreements. First, the reluctance of ranchers to enroll in a DPCA-L owed to the way these agreements operate. Namely, from the ranchers' perspective at least, these agreements do not add anything new to what the ranchers are currently doing in terms of mitigation measures. On the contrary, enrolling in DPCA-L would add regulatory and logistical burdens to ranchers who participate and potentially require measures that are time consuming and costly, such as fladry, thereby acting as a disincentive to enroll. Moreover, the benefits of compensation for depredated livestock are available to all ranchers, including those not enrolled in the DPCA-L as well as those who are not intentionally implementing any non-lethal measures. Therefore, there is no new benefit to incentivize enrollment into the program.

Second, ranchers' motivations and perceived barriers to participating in the DPCA-L program often involved sociopolitical factors. Namely, ranchers avoided participating in the DPCA-L program because they did not want government interference on their ranch or ranchers felt that they were giving up autonomy of managing their lifestyles and livelihoods. For example, the ranchers inferred that agreeing to coexist with wolves would add these carnivores to a growing list of endangered species that also includes bull trout and spotted frogs, thus increasing restriction on what they can do on their property or allotments consequently making them feel like they are losing any autonomy and control over their land. This perceived loss of autonomy resulting from accepting conservation of wildlife has been documented elsewhere including among farmers in South Africa (Terblanche, 2020) and points to the importance of acknowledging the context of soliciting participation from ranchers or farmers in order to achieve social sustainability of the conservation programs. Furthermore, Inskip et al. (2014) documented that people in the Sandarbans, Bangladesh, were more likely to retaliate and kill tigers (*Panthera tigris*) because of socio-psychological factors including values, history and ideologies, risk perceptions, and perceived failings of the local wildlife authorities than because of actual loss of livestock or damage to people. Addressing social and political barriers can be difficult because they are intangible costs (Kansky and Knight, 2014; Thondhlana et al., 2020). It is more common and easier for government agencies and NGOs to address quantifiable tangible costs like depredation damage through cost-sharing or compensation programs (Nyhus et al.,

2003). However, compensation only solves part of the problem, as it may not improve attitudes toward wolves and other large carnivores and is not the only factor that affects whether or not ranchers adopt mitigation measures (Naughton-Treves et al., 2003; Redpath et al., 2015). Moreover, it has been shown that intangible costs can cause significantly higher negative consequences for human-wildlife interactions than tangible costs (Kansky and Knight, 2014; Thondhlana et al., 2020). An example of intangible cost here is the perceived loss of group identity whereby ranchers felt that working with non-rancher groups to adopt non-lethal methods would imply that they are adopting new non-rancher otherwise outgroup cultures and therefore cause them to be ostracized by their neighbors. This intangible cost may reduce the effectiveness of tangible solutions like enrolling in the DPCA-L to receive cost-shared assistance to coexist with wolves. We acknowledge that the process of addressing intangible costs is difficult because doing so involves behavior change and political dynamics (Manfredo et al., 2017).

With these two explanations in mind, we suggest that, in addition to providing economic benefits through mitigation measures, wildlife managers should address the intangible costs that are more likely to deter ranchers' participation in mitigation strategies through dialogue and discussion. Since our data collection, WDFW has hired conflict specialists as staff in the field to create and encourage dialogue with ranchers over coexistence with carnivores specifically wolves. In complement to this, the WDFW can create avenues for dialogue on the different non-lethal measures that they are promoting or that ranchers are interested in enrolling in. Dialogue should be respectful, include mutual listening, and be inclusive of all views which could be approached through communicative framing (Dietsch et al., 2021). This should recognize and seek to address underlying ideological or identity differences that may shape trust in agency or attitudes toward a coexistence program (Schroeder et al., 2021).

In addition to compensation, WDFW could have an ongoing mediation process that relies on individuals or institutions trusted by both the public and the ranchers. Furthermore, it is imperative that WDFW attempt to keep open and regular communication with ranchers and rancher organizations because increasing the frequency of interaction could increase trust in the agency (Schroeder et al., 2021), which can consequently increase participation of ranchers in WDFW-led non-lethal strategies. We recommend investigating novel strategies such as performance payments (Zabel and Holm-Müller, 2008; Macon, 2020) and economic incentives such as premium prices on ranch products (Bogezi et al., 2019) that reward ranchers' efforts to coexist with wildlife. Zabel and Holm-Müller (2008) defined conservation performance payments as monetary or in-kind payments that a conservation agency makes to individuals or groups of individuals in exchange for achieving specific conservation outcomes. The payments are conditioned on achieving specific conservation outcomes, such as number of surviving offspring of a species of interest in a certain area. This recommendation aligns with Macon (2020), who proposed that through performance payments, agencies can ensure that they are accurately paying for achieving conservation goals instead



of the ex-post compensation, which pays for dead livestock and does not reward the landowner for living with carnivores. Such economic incentives could be generated from public or private sources and awarded to trusted rancher organizations for disbursement (van Eeden et al., 2021a). We further recommend that more work be done to understand the intangible costs ranchers could face as they engage in programs to coexist with wolves.

While not all ranchers opposed coexisting with wolves, many expressed a need for more local management of mitigation programs rather than a top-down approach from the state wildlife agency. An important way of addressing this concern would be to harness the strengths of group identity dynamics by encouraging and facilitating ranchers to form their own rancher groups or work with local actors, for example County Extension agents such as the agriculture extension, with whom they have a trusted and existing working relationship (van Eeden et al., 2021a). Accordingly, it would be helpful to categorize ranchers into relevant sub-groups based on geographic location of ranch, size of ranch operation, motivation for ranching (e.g., economics vs. identity), and marketing of the ranch products (e.g., calf sellers vs. niche beef sellers). Soliciting for participation through these subgroups has the potential to enable ranchers to enroll in programs that address their interests (Manfredo and Dayer, 2004; Macon, 2020) and thus spare agency resources that would otherwise be allocated to enrolling all ranchers in all programs. Encouraging such ranchers to self-organize could also promote greater adoption of mitigation measures (Brown, 2011). Participating in specific programs as a group provides a greater sense of community with others, thereby increasing participation (Berkes, 2004). Examples of such self-organized rancher groups include the Blackfoot Challenge and the Tom Miner Basin and Centennial Valley Associations in Montana, USA. These self-organized groups should be considered in decision-making about wolves as the basic governance unit that complements local and regional governing agencies because such multilevel authority can be more effective than top-down approaches in managing biodiversity in complex social-ecological systems (Scarlett, 2011; Ostrom, 2015). Thus, the wildlife agency partnering with institutions that ranchers trust may increase participation in non-lethal measures to better coexist with wolves. The Farm Bill, for example, uses local councils, conservation districts, and state technical committees to strengthen collaborative efforts (Scarlett, 2011). This collaboration arrangement could be applied to wolf and large carnivore conservation and implemented at local levels. For example, conflict specialists could act as the link to collaborate with Conservation Districts to see how to incorporate carnivore conservation on a case-by-case basis with existing conservation programs in which a rancher might already be participating.

This study also sheds light on new pathways that might be used to facilitate human-wildlife coexistence in rural areas. In addition to identifying effective mitigations to protect their livestock, for example, ranchers expressed the desire to educate non-ranching communities about the importance of ranches in preserving wild lands and their importance in the society. This need for increased respect and awareness of ranchers' work could

be leveraged as an opportunity to develop additional resource streams such as agritourism where urban dwellers can travel to farms and ranches to interact with ranchers to learn more about ranching and preservation of private wildlands through ranching. This would be a feasible option to test given that more than 25% (12/45) of the ranchers we interviewed either engaged in some form of farm tour experience on their property or they would consider participating.

The methods underlying our study suffered from several limitations. First, audio recordings have the advantage of acting as a validity check for the data collected and ensuring that interviewee responses have minimal distortion. However, they can have the limitation that they do not pick up on non-verbal cues. We therefore supplemented audio recording with taking notes whenever needed. Another limitation of audio recording is that in the beginning interviewees carefully chose their words because they were on record. We overcame this limitation by holding our interviews for long enough that as time passed the interviewee forgot about or ignored the recording and spoke more freely. Where possible we covered the recorder, usually located on top of the table, with a sheet of paper so that it is not distracting. Nevertheless, we acknowledge that being on record could have caused ranchers to conceal some information such as the use of lethal methods against the wolves. We chose to analyze the data that were received and not assume anything about the underlying intentions of the interviewees, however. Although ranchers expressed willingness to work with existing agricultural-related agencies to implement non-lethal strategies to coexist with wolves, caution should be taken that their actual enrollment may be low because there is a difference between what interview respondents say and what their actual behavior would be faced with the reality of the situation (Frank et al., 2019). We recommend that engaging ranchers who are working with other agencies could be more successful than trying to work with those who are not in any agriculture or natural resources state programs. While Grounded Theory allows to retain the richness and detail of the qualitative data, it comes with some criticisms as well-including that the three foundational school of the methodology have disagreements about the exact steps to be used to analyses the data. That GT either proposes no hypothesis formation or allows for successful modification of hypotheses formulated at the start of the process of empirical research (Goldthorpe, 2000) is less rigorous than scientific methods that use falsifiable hypotheses. Conclusions from GT are not generalizable as GT doesn't rely on causal or correlation factors but on constant comparison of the data collected in a single study thus making it hard to conceptualize beyond the study (Goldthorpe, 2000). In this qualitative study for which the interviewees were not randomly selected, it is not possible to generalize these results to all ranching populations. Generalizability is not the goal of qualitative research, however; rather, the focus is on transferability—the ability to apply findings in similar contexts or settings (Bloomberg and Volpe, 2016). We used purposeful sampling and snowballing to recruit ranchers to interview; this sampling method could have limited the variety of ranchers that we interviewed. We did not use stratification because rancher attributes are not mutually exclusive. For

example, many ranchers use both private and public lands but were categorized as public since part of their grazing land was public. Finally, this study was part of a larger study that investigated the social and economic feasibility of wolves in Washington state. The interview guide and consent forms in the appendix are those used for the larger study, while this study focused on study objective 1 of **Appendix A**.

In conclusion, we offer new insight into what motivations and constraints influence rancher participation in non-lethal measures to coexist with carnivores. Specifically, we show that both social and economic factors motivate as well as hinder ranchers' participation, thereby contributing to the evidence that conservation of and coexistence with wildlife requires addressing both tangible and social/intangible costs. By implication, as wildlife recovers and is restored in ecosystems, wildlife managers should make effort to maintain or restore social relations and trust through forging new collaborations across agencies and encouraging locally formed and led coexistence groups. Whereas, we focused on gray wolves, our results can be applied to other regional carnivore-human interactions, as well as those that occur nationally and internationally (van Eeden et al., 2018; Teixeira et al., 2020). Our findings are relevant more generally in Washington, for example, because ranchers repeatedly mentioned other predators when responding to questions about their perspectives on non-lethal mitigation strategies to co-exist with wolves. Furthermore, the mitigation strategies in which the DPCA-L encourages ranchers in Washington to participate are similar to those recommended in the literature, including deterrence measures such as guard dogs and human interference (Musiani et al., 2003; Linnell et al., 2010; Shivik, 2014; Young et al., 2015; Miller et al., 2016). Some of these strategies that have been used for centuries, such as fladry, guard dogs, and cowboys, are experiencing a renaissance since the recent recovery of predators both in Europe, the United States and elsewhere globally (Inskip et al., 2014; van Eeden et al., 2018; Frank et al., 2019; Teixeira et al., 2020). Finally, we emphasize the use of inter-disciplinary methods such as qualitative interviews to gain a deeper understanding of how to address social issues for the betterment of wildlife conservation.

## REFERENCES

- Bangs, E., Jimenez, M., Niemeyer, C., Fontaine, J., Collinge, M., Krsichke, R., et al. (2006). Nonlethal and lethal tools to manage wolf-livestock conflict in the northwestern United States. *Proc. Vertebr. Pest Conf.* 22, 7–16. doi: 10.5070/V422110170
- Berkes, F. (2004). Rethinking community-based conservation. *Conserv. Biol.* 18, 621–630. doi: 10.1111/j.1523-1739.2004.00077.x
- Beschta, R. L., and Ripple, W. J. (2009). Large predators and trophic cascades in terrestrial ecosystems of the western United States. *Biol. Conserv.* 142, 2401–2414. doi: 10.1016/j.biocon.2009.06.015
- Bloomberg, L. D., and Volpe, M. (2016). *Completing Your Qualitative Dissertation: A Road Map From Beginning to End, 3rd Edn.* Los Angeles, CA: Sage Publishing.
- Bogezi, C., van Eeden, L. M., Wirsing, A., and Marzluff, J. (2019). Predator-friendly beef certification as an economic strategy to promote coexistence between ranchers and wolves. *Front. Ecol. Evolut.* 7:476. doi: 10.3389/fevo.2019.00476
- Brown, P. D. (2011). *Wolves and livestock: a review of tools to deter livestock predation and a case study of a proactive wolf conflict mitigation program developed in the Blackfoot Valley, Montana* (Master of Science Thesis). University of Montana, Missoula, MT, United States.
- Bruskotter, J. T. (2013). *The predator pendulum revisited: Social conflict over wolves and their management in the western United States*. Bethesda, MD: Wildlife Society Bulletin. 37:674–9.
- Butterfield, J., Bingham, S., and Savory, A. (2006). *Holistic Management Handbook: Healthy Land, Healthy Profits*. Washington, DC: Island Press.
- Carter, N. H., Baeza, A., and Magliocca, N. R. (2020). Emergent conservation outcomes of shared risk perception in human-wildlife systems. *Conserv. Biol.* 34, 903–914. doi: 10.1111/cobi.13473
- Census of Agriculture (2012). U.S. Department of Agriculture National Agricultural Statistics Service. Available online at: [www.agcensus.usda.gov](http://www.agcensus.usda.gov) (accessed August 14, 2018).

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board (IRB) at the University of Washington (Human Subjects Division study #45684). The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

CB designed the study, collected, analyzed the data, and wrote the manuscript. All authors contributed to interpreting the data and editing the manuscript.

## FUNDING

LvE was supported by a scholarship from the Australian-American Fulbright Association. CB's doctoral research was funded by Wildlife Conservation Society, Wildlife Conservation Network, School of Environment and Forest Sciences, University of Washington Seattle, the USDA McIntire-Stennis Program, and the Bullitt Foundation.

## ACKNOWLEDGMENTS

This research forms the basis of a chapter of CB's doctoral dissertation. We are grateful to Dr. Stanley T. Asah for intellectual guidance in the study design, data collection, analysis and writing of this paper.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fevo.2021.683732/full#supplementary-material>

- Chan, K. M., Guerry, A. D., Balvanera, P., Klain, S., Satterfield, T., Basurto, X., et al. (2012). Where are cultural and social in ecosystem services? A framework for constructive engagement. *Bioscience* 62, 744–756. doi: 10.1525/bio.2012.62.8.7
- Charmaz, K. (2014). *Constructing Grounded Theory*. Los Angeles, CA: Sage Publications Inc.
- Dickman, A. J. (2010). Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. *Anim. Conserv.* 13, 458–466. doi: 10.1111/j.1469-1795.2010.00368.x
- Dickman, A. J., Macdonald, E. A., and Macdonald, D. W. (2011). A review of financial instruments to pay for predator conservation and encourage human-carnivore coexistence. *Proc. Natl. Acad. Sci. U.S.A.* 108, 13937–13944. doi: 10.1073/pnas.1012972108
- Dietsch, A. M., Wald, D. M., Stern, M. J., and Tully, B. (2021). An understanding of trust, identity, and power can enhance equitable and resilient conservation partnerships and processes. *Conserv. Sci. Pract.* 2021:e421. doi: 10.1111/csp2.421
- Drinkhouse, E. (2018). *What hinders the implementation of non-lethal wolf deterrents? A qualitative analysis of interviews with wolf management stakeholders* (MSc in Environmental Management Thesis), Duke University, Durham, NC, United States.
- Frank, B. (2016). Human-wildlife conflicts and the need to include tolerance and coexistence: an introductory comment. *Soc. Nat. Resourc.* 29, 738–743. doi: 10.1080/08941920.2015.1103388
- Frank, B., Glikman, J. A., and Marchini, S., (Eds.). (2019). *Human-Wildlife Interactions: Turning Conflict Into Coexistence, Vol. 23*. Cambridge: Cambridge University Press. doi: 10.1017/9781108235730
- Gehring, T. M., VerCauteren, K. C., and Landry, J. M. (2010). Livestock protection dogs in the 21st century: is an ancient tool relevant to modern conservation challenges? *BioScience* 60, 299–308. doi: 10.1525/bio.2010.60.4.8
- George, K. A., Slagle, K. M., Wilson, R. S., Moeller, S. J., and Bruskotter, J. T. (2016). Changes in attitudes toward animals in the United States from 1978 to 2014. *Biol. Conserv.* 201, 237–242. doi: 10.1016/j.biocon.2016.07.013
- Goldthorpe, J. H. (2000). *On sociology: Numbers, Narratives, and the Integration of Research and Theory*. Oxford: Oxford University.
- Goodman, L. A. (1961). Snowball sampling. *Ann. Math. Stat.* 32, 148–170. doi: 10.1214/aoms/1177705148
- Graham, K., Beckerman, A. P., and Thirgood, S. (2005). Human-predator-prey conflicts: ecological correlates, prey losses and patterns of management. *Biol. Conserv.* 122, 159–171.
- Heberlein, A. T. (2012). *Navigating Environmental Attitudes*. New York, NY: Oxford University Press. doi: 10.1093/acprof:oso/9780199773329.001.0001
- Hill, C. M. (2015). Perspectives of “conflict” at the wildlife-agriculture boundary: 10 years on. *Hum. Dimens. Wildl.* 20, 296–301. doi: 10.1080/10871209.2015.1004143
- Inskip, C., Fahad, Z., Tully, R., Roberts, T., and MacMillan, D. (2014). Understanding carnivore killing behaviour: exploring the motivations for tiger killing in the Sundarbans, Bangladesh. *Biol. Conserv.* 180, 42–50. doi: 10.1016/j.biocon.2014.09.028
- Kansky, R., and Knight, A. T. (2014). Key factors driving attitudes towards large mammals in conflict with humans. *Biol. Conserv.* 179, 93–105. doi: 10.1016/j.biocon.2014.09.008
- Karanth, K. K., Gopalaswamy, A. M., DeFries, R., and Ballal, N. (2012). Assessing patterns of human-wildlife conflicts and compensation around a central Indian protected area. *PLoS ONE* 7:e50433. doi: 10.1371/journal.pone.0050433
- Karanth, K. U., and Sunquist, M. E. (1995). Prey selection by tiger, leopard and dhole in tropical forests. *J. Anim. Ecol.* 64, 439–450. doi: 10.2307/5647
- Krueger, R. A., and Casey, M. A. (2000). *Focus Groups: A Practical Guide for Applied Research*. London: Sage.
- Kvale, S., and Brinkmann, S. (2008). *InterViews: Learning the Craft of Qualitative Research Interviewing*. Los Angeles, CA: Sage Publications Inc.
- Linnell, J. D. C., Rondeau, D., Reed, D. H., Williams, R., Altwegg, R., Raxworthy, C. J., et al. (2010). Confronting the costs and conflicts associated with biodiversity. *Anim. Conserv.* 13, 429–431. doi: 10.1111/j.1469-1795.2010.00393.x
- Macon, D. (2020). Paying for the presence of predators: an evolving approach to compensating ranchers. *Rangelands* 42, 43–52. doi: 10.1016/j.rala.2020.03.001
- Manfredo, J. M. (2008). *Who Cares About Wildlife? Social Science Concepts for Exploring Human-Wildlife Relationships and Conservation Issues*. New York, NY: Springer Press. doi: 10.1007/978-0-387-77040-6
- Manfredo, M. J., and Dayer, A. (2004). Concepts for exploring the social aspects of human-wildlife conflict in a global context. *Hum. Dimens. Wildl.* 9, 1–20. doi: 10.1080/10871200490505765
- Manfredo, M. J., Teel, T. L., Sullivan, L., and Dietsch, A. M. (2017). Values, trust, and cultural backlash in conservation governance: the case of wildlife management in the United States. *Biol. Conserv.* 214, 303–311. doi: 10.1016/j.biocon.2017.07.032
- Mattson, D. J., and Clark, S. G. (2009). The discourses of incidents: cougars on Mt. Elden and in Sabino Canyon, Arizona. *Policy Sci.* 45, 315–343. doi: 10.1007/s11077-012-9158-6
- Mazur, K. E., and Asah, S. T. (2013). Clarifying standpoints in the gray wolf recovery conflict: procuring management and policy forethought. *Biol. Conserv.* 167, 79–89. doi: 10.1016/j.biocon.2013.07.017
- Miller, J. R., Stoner, K. J., Cejtin, M. R., Meyer, T. K., Middleton, A. D., and Schmitz, O. J. (2016). Effectiveness of contemporary techniques for reducing livestock depredations by large carnivores: human-carnivore coexistence. *Wildl. Soc. Bull.* 40 806–815. doi: 10.1002/wsb.720
- Muhly, T. B., and Musiani, M. (2009). Livestock depredation by wolves and the ranching economy in the Northwestern US. *Ecol. Econ.* 68, 2439–2450. doi: 10.1016/j.ecolecon.2009.04.008
- Musiani, M., Mamo, C., Boitani, L., Callaghan, C., Gates, C. C., Mattei, L., et al. (2003). Wolf depredation trends and the use of fladry barriers to protect livestock in western North America. *Conserv. Biol.* 17, 1538–1547. doi: 10.1111/j.1523-1739.2003.00063.x
- Naidoo, R., and Adamowicz, W. L. (2005). Biodiversity and nature-based tourism at forest reserves in Uganda. *Environ. Dev. Econ.* 10, 159–178. doi: 10.1017/S1355770X0400186X
- Naughton-Treves, L., Grossberg, R., and Treves, A. (2003). Paying for tolerance: rural citizens' attitudes toward wolf depredation and compensation. *Conserv. Biol.* 17, 1500–1511. doi: 10.1111/j.1523-1739.2003.00060.x
- Newsome, T. M., Ballard, G. A., Crowther, M. S., Dellinger, J. A., Fleming, P. J., Glen, A. S., et al. (2015). Resolving the value of the dingbe in ecological restoration. *Restorat. Ecol.* 23, 201–208. doi: 10.1111/rec.12186
- Nie, M. A. (2002). Wolf recovery and management as value-based political conflict. *Ethics Place Environ.* 5, 65–71. doi: 10.1080/13668790220146465
- Nyhus, P., Fischer, H., Madden, F., and Osofsky, S. (2003). Taking the bite out of wildlife damage the challenges of wildlife compensation schemes. *Conserv. Pract.* 4, 37–43. doi: 10.1111/j.1526-4629.2003.tb00061.x
- Nyhus, P. J. (2016). Human-wildlife conflict and coexistence. *Ann. Rev. Environ. Resourc.* 41, 143–171. doi: 10.1146/annurev-environ-110615-085634
- Ostrom, E. (2015). *Governing the Commons*. Cambridge: Cambridge University Press. doi: 10.1017/CBO9781316423936
- Parks, M., and Messmer, T. (2016). Participant perceptions of range rider programs operating to mitigate wolf-livestock conflicts in the Western United States. *Wildl. Soc. Bull.* 40, 514–524. doi: 10.1002/wsb.671
- Poland, B. D. (1995). Transcription quality as an aspect of rigor in qualitative research. *Qual. Inquiry* 1, 290–310. doi: 10.1177/107780049500100302
- Prugh, L. R., Stoner, C. J., Epps, C. W., Bean, W. T., Ripple, W. J., Laliberte, A. S., et al. (2009). The rise of the mesopredator. *Bioscience* 59, 779–791. doi: 10.1525/bio.2009.59.9.9
- QSR International Pty Ltd (2014). *NVivo10 for Windows*. Available online at: [http://www.qsrinternational.com/products\\_nvivo.aspx](http://www.qsrinternational.com/products_nvivo.aspx) (accessed February 28, 2018).
- Rashford, B. S., Grant, J. M., and Strauch, B. A. (2008). “Economics of predator control to protect agriculture: the unanswered questions,” in *Western Economics Forum*, Vol. 7. (Lincoln: Western Economics Forum), 25–32.
- Ravenelle, J., and Nyhus, P. J. (2017). Global patterns and trends in human-wildlife conflict compensation. *Conserv. Biol.* 31, 1247–1256. doi: 10.1111/cobi.12948
- Redpath, S. M., Bhatia, S., and Young, J. (2015). Tilting at wildlife: reconsidering human-wildlife conflict. *Oryx* 49, 222–225. doi: 10.1017/S0030605314000799
- Redpath, S. M., Young, J., Evely, A., Adams, W. M., Sutherland, W. J., Whitehouse, A., et al. (2013). Understanding and managing conservation conflicts. *Trends Ecol. Evolut.* 28, 100–109. doi: 10.1016/j.tree.2012.08.021
- Ryan, G. W., and Bernard, H. R. (2003). Techniques to identify themes. *Field Methods* 15, 85–109. doi: 10.1177/1525822X02239569
- Saldaña, J. (2015). *The Coding Manual for Qualitative Researchers*. Los Angeles, CA: Sage Publications Inc.

- Scarlett, L. (2011). *America's Working Lands: Farm Bill Programs and Landscape Scale Conservation*. Available online at: [http://landscapeconservation.org/wpcontent/uploads/2018/01/scarlett\\_-\\_americas\\_working\\_lands.pdf](http://landscapeconservation.org/wpcontent/uploads/2018/01/scarlett_-_americas_working_lands.pdf) (accessed August 12, 2018).
- Scasta, J. D., Stam, B., and Windh, J. L. (2017). Rancher-reported efficacy of lethal and non-lethal livestock predation mitigation strategies for a suite of carnivores. *Sci. Rep.* 7:14105. doi: 10.1038/s41598-017-14462-1
- Schroeder, S. A., Landon, A. C., Fulton, D. C., and McInenly, L. E. (2021). Social identity, values, and trust in government: how stakeholder group, ideology, and wildlife value orientations relate to trust in a state agency for wildlife management. *Biol. Conserv.* 261:109285. doi: 10.1016/j.biocon.2021.109285
- Schüttler, E., Rozzi, R., and Jax, K. (2011). Towards a societal discourse on invasive species management: a case study of public perceptions of mink and beavers in Cape Horn. *J. Nat. Conserv.* 19, 175–184. doi: 10.1016/j.jnc.2010.12.001
- Shivik, J. (2014). *The Predator Paradox: Ending the War With Wolves, Bears, Cougars, and Coyotes*. Boston, MA: Beacon Press.
- Shivik, J. A. (2006). Tools for the edge: what's new for conserving carnivores? *BioScience* 56, 253–259. doi: 10.1641/0006-3568(2006)0560253:TFTEWN2.0.CO;2
- Soulé, M. E. (1985). What is conservation biology? *BioScience* 35, 727–734. doi: 10.2307/1310054
- Teixeira, L., Tisovec-Dufner, K. C., Marin, G. D. L., Marchini, S., Dorresteyn, I., and Pardini, R. (2020). Linking human and ecological components to understand human-wildlife conflicts across landscapes and species. *Conserv. Biol.* 35, 285–296. doi: 10.1111/cobi.13537
- Terblanche, R. (2020). *Ongediertes: a critical qualitative study of farmer-black backed jackal conflict and its management around the square kilometer array core site in the Northern Cape, South Africa* (Doctoral dissertation), Stellenbosch University, Stellenbosch, South Africa.
- Thondhlana, G., Redpath, S. M., Vedeld, P. O., van Eden, L., Pascual, U., Sherren, K., et al. (2020). Non-material costs of wildlife conservation to local people and their implications for conservation interventions. *Biol. Conserv.* 246, 108578. doi: 10.1016/j.biocon.2020.108578
- Treves, A., Lisa Naughton-Treves, L. I. S. A., and Shelley, V. (2013). Longitudinal analysis of attitudes towards wolves. *Conserv. Biol.* 27, 315–323. doi: 10.1111/cobi.12009
- Treves, A., and Naughton-Treves, L. (2005). "Evaluating lethal control in the management of human-wildlife conflict," in *People and Wildlife, Conflict or Coexistence?* eds R. Woodroffe, S. Thirgood, and A. Robinowitz (Cambridge: Cambridge University Press). doi: 10.1017/CBO9780511614774.007
- van Eeden, L. M., Bogezi, C., Leng, D., Marzluff, J. M., Wirsing, A. J., and Rabotyagov, S. S. (2021a). Public are willing to pay for gray wolf conservation that could support a rancher-led wolf-livestock coexistence program. *Biol. Conserv.* 260:109226. doi: 10.1016/j.biocon.2021.109226
- van Eeden, L. M., Eklund, A., Miller, J. R. B., López-Bao, J. V., Chapron, G., Cejtin, M. R., et al. (2018). Carnivore conservation needs evidence-based livestock protection. *PLoS Biol.* 16:e2005577. doi: 10.1371/journal.pbio.2005577
- van Eeden, L. M., Rabotyagov, S. S., Kather, M., Bogezi, C., Wirsing, A. J., and Marzluff, J. (2021b). Political affiliation predicts public attitudes toward gray wolf (*Canis lupus*) conservation and management. *Conserv. Sci. Pract.* 3:e387. doi: 10.1111/csp2.387
- Vucetich, J. A., Bruskotter, J. T., and Nelson, M. P. (2015). Evaluating whether nature's intrinsic value is an axiom of or anathema to conservation. *Conserv. Biol.* 29, 321–332. doi: 10.1111/cobi.12464
- Wagner, K. K., and Conover, M. R. (1999). Effect of preventive coyote hunting on sheep losses to coyote predation. *J. Wildl. Manag.* 606–612. doi: 10.2307/3802649
- Wagner, K. K., Schmidt, R. H., and Conover, M. R. (1997). Compensation programs for wildlife damage in North America. *Wildl. Soc. Bull.* 312–319.
- Washington Department of Fish and Wildlife (2021). Washington Department of Fish and Wildlife, Confederated Tribes of the Colville Reservation, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service (2021). *Washington Gray Wolf Conservation and Management 2020 Annual Report*. Ellensburg, WA: Washington Department of Fish and Wildlife.
- Washington Department of Fish and Wildlife (2018). Washington Department of Fish and Wildlife, Confederate Colville Tribes Spokane Tribe of Indians, USDA-APHIS, Wildlife Services, and, U.S. Fish and Wildlife Service. *Washington Gray Wolf Conservation and Management 2017 Annual Report*. Wenatchee, WA: Washington Department of Fish and Wildlife.
- Washington State Department of Agriculture (2019). Available online at: <https://agr.wa.gov/> (accessed on May 18, 2021).
- Wiles, G. J., Allen, H. L., and Hayes, G. E. (2011). *Wolf Conservation and Management Plan for Washington*. Olympia, WA: Washington Department of Fish and Wildlife
- Wirsing, A. J., Buskirk, S. W., Ripple, W. J., and Beschta, R. L. (2012). Wolves and lynx: plausible ideas make for testable hypotheses. *Wildl. Soc. Bull.* 36, 572–577. doi: 10.1002/wsb.183
- Young, J. K., Ma, Z., Laudati, A., and Berger, J. (2015). Human-Carnivore interactions: lessons learned from communities in the American West. *Hum. Dimens. Wildl.* 20, 349–366. doi: 10.1080/10871209.2015.1016388
- Zabel, A., and Holm-Müller, K. A. (2008). conservation performance payments for carnivore conservation in Sweden. *Conserv. Biol.* 22, 247–251. doi: 10.1111/j.1523-1739.2008.00898.x

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

**Publisher's Note:** All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Copyright © 2021 Bogezi, van Eeden, Wirsing and Marzluff. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.