

**Addressing Local Policy Preferences for Wolf Conflict Management:  
A Case Study of a Rural Community in Northwest Wyoming**

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**Abstract**

In rural areas, as well as the wildland-urban interface, development often overlaps with wildlife habitat. Conflicts between people and wildlife are not uncommon. Policymakers may face challenges in successfully instituting management plans and policies that adequately address human concerns while also maintaining healthy wildlife populations. Wolf management efforts in the Northern Rockies exemplify the challenges for managers in mitigating conflicts between people and wolves, particularly in communities that overlap with wolf ranges. Efforts at instituting community-based conservation efforts are sometimes successful in bridging the gap between citizens and decision-makers. This research investigates the views of property owners on wolf management and conflict mitigation in a rural community of northwest Wyoming located on the eastern border of Grand Teton National Park. A mailed survey posed questions that assessed residents' tolerance for living in an area frequented by wolves as well as policy preferences for wolf management and conflict resolution. Results indicate that tolerance levels for living with wolves are somewhat polarized, and both intensive management (e.g., lethal control) as well as more collaborative approaches indicative of community-based conservation efforts, such as education and outreach, may help to ameliorate conflicts. Challenges and opportunities for incorporating property owners' perspectives into wolf policy are considered, particularly as they relate to reducing conflict.

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## Introduction

In 1995, the U.S. Fish and Wildlife Service (USFWS) reintroduced grey wolves (*Canis lupus*) into Yellowstone National Park. Wolves had been extirpated in the lower 48 states by the early part of the twentieth century; the last wolf pack was shot in Yellowstone National Park in 1926 (National Park Service, n.d.). After the passage of the Endangered Species Act (ESA) in 1973, gray wolves were listed as an endangered species. Under the mandate of the ESA, the USFWS was directed to assemble a recovery team to analyze options for population recovery. Two decades of work on a recovery plan culminated in the reintroduction of the wolf to two recovery areas: Yellowstone National Park in 1995, and central Idaho in 1996. Wolves were considered an “experimental, non-essential” population under section 10(j) of the ESA, though still listed as an endangered species. The endangered species listing of the wolf and the subsequent reintroduction ensured that Yellowstone National Park became a safe haven for wolves to recover and thrive. By 2002, wolves moved south and east into Yellowstone’s neighbor, Grand Teton National Park, as well as on to other federal and private lands in Wyoming. Their expansion was not unexpected as wolves are fecund, and are considered habitat generalists (Oakleaf et al., 2006). Specific habitat requirements for wolves are governed predominantly by the presence of prey populations, which are predominantly wild ungulates. In the Northern Rockies, these prey species include elk (*Cervus elaphus*), moose (*Alces alces*), mule deer (*Odocoileus hemionus*), and occasionally bison (*Bison bison*) or beaver (*Castor Canadensis*) (Arjo, Pletscher, & Ream, 2002; Peterson & Ciucci, 2003). However, livestock are also present on both federal and private lands outside of the parks and provide an easy and vulnerable food source for wolves (Bangs & Shivik, 2001).

In the Northern Rocky Mountain Wolf Recovery Plan, the USFWS set forth a goal of ten breeding pairs in each of the three recovery areas (southwest Montana, central Idaho, and the Greater Yellowstone Ecosystem, much of which falls in northwestern Wyoming) for three consecutive years (U.S. Fish & Wildlife Service, 1987).<sup>1</sup> Wolf populations met the original biological objectives in 2002. The first delisting rule for the Northern Rocky Mountains Distinct Population Segment (DPS) was published in 2008, and a volley of litigation ensued, with the status (i.e., listed or not listed) of the wolf under scrutiny. By 2012, wolves in the three recovery states of Montana, Idaho, and Wyoming were delisted and management was turned over to state game and fish agencies (with the requirement that the USFWS would oversee and monitor state management for five subsequent years). However, a lawsuit contesting

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<sup>1</sup> Given the vagueness of the original definition of a breeding pair as two wolves “capable of producing offspring,” the 2009 delisting rule redefined it as a pack containing at least one adult male and female, as well as two or more pups, on December 31 of a given year (50 CFR Part 17, 2009, p. 15130).

the decision of the USFWS to delist wolves in Wyoming lingered, and in September of 2014, a U.S. District Court decision in Washington, D.C., returned Wyoming's wolves to the endangered species list and federal management resumed (Case 1:12-cv-01833-ABJ, 2014).

Despite this most recent lawsuit, wolf recovery has been lauded as a success by the USFWS (Ashe, 2013). However, decisions over management continue to be closely watched by stakeholders and citizens holding a spectrum of beliefs on how wolves should be managed. Management policy is primarily directed by litigation decisions and negotiations between the U.S. Fish and Wildlife Service and state game and fish agencies. However, at least in Wyoming, little systematic research has inquired as to the wolf management preferences of local citizens, particularly in areas frequented by wolves. In these areas, the potential for human-wildlife conflict (HWC) is exacerbated. HWC is defined by the World Parks Congress as “[occurring] when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife. These conflicts may result when wildlife damage crops, injure or kill domestic animals, or threaten or kill people” (World Parks Congress, 2004, p. 259). If conflict remains unchecked or unaddressed, it can escalate into a deeper social conflict between people about how to manage wildlife (Madden, 2004). Managing conflict between people and carnivores is critical to long-term conservation goals (Treves & Karanth, 2003). Understanding how property owners perceive conflict and prefer it to be addressed can potentially help managers in developing appropriate policies to target conflict mitigation and reduction. Wolves have returned to the Northern Rockies, and given this fact, it is prudent to better understand how to address the inevitable conflicts that can and will continue to occur between wolves and human interests.

This paper presents a summary of literature on the role of local input on management and policy decisions, particularly as related to addressing conflict with polarizing wildlife species such as wolves. The central research question asks how can local policy preferences be acknowledged and addressed in the policy process surrounding wolf management. Results of a survey mailed to property owners in two small and neighboring communities in Teton County, WY, Buffalo Valley and Pacific Creek (see Figure 1) are reported. Survey questions assessed respondents' tolerance of living with wolves, experience of conflicts, and preferred approaches for addressing conflict with wolves. Finally, challenges and opportunities for incorporating these data sourced from local property owners into policy and management decisions are discussed.

## Using Social Knowledge in Management and Policy Decisions

Social science research can play a beneficial role in wildlife management decisions, particularly in the case of the gray wolf in the Northern Rockies, but it has been under-utilized (Bruskotter, Toman, Enzler, & Schmidt, 2010). Nearly twenty years ago, following the reintroduction of wolves into Yellowstone, Fritts et al. wrote: “The comments [from public input on the Environmental Impact Statement] reflected the strong polarization that has plagued management of wolves and were consistent with our belief that most wolf recovery issues have more to do with deeply held personal values about government, influences of people living outside the region, people’s relationships to nature and the political role of special interest groups, than with wolves themselves” (Fritts et al., 1997, p. 11). Following this observation, it is clear that a better understanding of values and beliefs – even if they are rigid – may improve efforts to develop policy and management that is socially palatable. Even so, beliefs and values are not easily accepted as legitimate sources of knowledge due to their inability to be quantified or ground-truthed. Despite some efforts to incorporate local knowledge or policy beliefs into wildlife management decisions, scientific and technical expertise are typically prioritized (Lute & Gore, 2014). Perspectives and knowledge from local communities who live in close proximity to a resource, such as wildlife, can help augment and complement scientific research used in management decisions (Berkes, Colding, & Folke, 2000). Finding effective and long-term ways to address management issues can be improved by understanding the values and beliefs of those directly affected by the presence of large carnivores (Mattson, Byrd, Rutherford, Brown, & Clark, 2006).

Fischer (2000) posits that when “formal academic knowledge works in a dialectical tension with the popular knowledge of ordinary citizens [it can] produce a deeper contextual understanding of the situation” (p. 179). In this case, knowing the policy preferences as well as experiences of local residents can benefit managers in developing ways to address residents’ concerns regarding living in a place with wolves in tandem with advancing conservation goals. It is important to acknowledge that incorporating local policy and conflict mitigation preferences may prove especially challenging, however, as conflict over wolves and wolf management is firmly entrenched in fundamental social and political tensions over values (Nie, 2003). Watters, Anderson, & Clark (2014) advocate for “attention to social and community identities” as well as “cross-cultural dialogue” (p. 88) in addressing conflicts over wolf management. These approaches suggest the engagement of local citizens in the policy process would be of long-term benefit to carnivore management. Furthermore, this engagement may help to address notions of power disparity, where “carnivore skeptics, regardless of social position, claim that ‘the power elites’ do not respect local knowledge. Politicians, managers, biologists, and conservationists are frequently perceived

as one alliance that possesses a great deal of power” (Skogen & Thrane, 2007, p. 22). This perception can alienate local citizens who may not have a clear and effective way of engaging in discussions over management and policy decisions.

Community-based conservation (CBC) is one approach to create buy-in and include local stakeholders, particularly in rural areas, in conservation-related decisions. CBC has two primary objectives: “to enhance wildlife/biodiversity conservation and to provide incentives, normally economic, for local people” (Campbell & Vainio-Mattila, 2003, p. 421). However, it has also been critiqued as a means of “diluting the conservation agenda” (Berkes, 2004, p. 622). In the case of conservation of large, charismatic carnivores, community-based conservation efforts in the United States can be challenging to implement given the national attention and resources focused on ensuring the sustainability of these species. Specific to wolves, impacts of their presence are local, but there is a broader, national interest in decisions over their management. This tension between local preferences and national interests in wolf conservation precludes the adoption of a traditional CBC effort. As Berkes (2004) notes,

After all, “communities” do not conserve or despoil; at least, they do not act as simple, isolated agents. Rather, they are embedded in larger systems, and they respond to pressures and incentives. It may be more useful to rethink community-based conservation as shorthand for environmental governance and conservation action that starts from the ground up but deals with cross-scale relations. To ground conservation effort, we need a more nuanced understanding of the nature of people, communities, institutions, and their interrelations at various levels. (Berkes, 2004, p. 628).

Examples exist where the direct involvement of locals in management helped to reduce conflicts, though few of these have been in the western United States with large carnivores. Wilson and Primm (2004) found that including local residents in the research and planning process through small-scale projects can help facilitate buy-in to policy and management schemes. Their goal was to foster coexistence, or living with wildlife in a way that conserves both species and ecosystems as well as supports and fosters human endeavors (T. W. Clark, Rutherford, & Casey, 2005). In their work in the Blackfoot Valley, Montana, efforts at mitigation reduced conflicts between bears and people to near zero in part due to the collection of information from local citizens on how and where these incidents of livestock depredation or beehive raiding occurred (Primm & Wilson, 2004). These types of efforts can be resource intensive for managers, but in this case, a local organization, the Blackfoot Challenge, stepped in to shoulder many of the responsibilities necessary for a successful community-based conservation effort.

Typically, however, state and federal managers are responsible for the management of carnivores and conflict mitigation. Often, trust in the managers responsible for dealing with management and conflicts is

weighed heavily as a proxy for acceptance; the greater the trust in the managing agency, the more likely that the species will be accepted by the public. Furthermore, communicating both the benefits and risks associated with a species should also lead to increased tolerance (Bruskotter & Wilson, 2014). Researchers in Sweden also recognize the importance of trust in negotiating large carnivore management decisions, including trust among interested individuals and stakeholder groups, in addition to management agencies (Sjölander-Lindqvist, Johansson, & Sandström, 2015). Echoing Watters et al (2014), Sjölander-Lindqvist et al. (2015) argue for expanding representation and participation in decision processes, better communication, and facilitated leadership as well as the use of ecological, social, cultural and economic knowledge. In summary, finding ways to integrate local citizens, particularly in places where large carnivores and human land use overlap, may help to alleviate acrimony over management decisions and mitigate potential conflicts.

### **Attitudes towards Wolves**

Public attitudes towards wolves and wolf reintroduction have been assessed in numerous studies over the past several decades (e.g., Bath & Buchanan, 1989; Bruskotter, Schmidt, & Teel, 2007; Houston, Bruskotter, & Fan, 2010). Prior to their reintroduction to Yellowstone National Park in 1995, research assessed attitudes of Wyoming residents and interest groups (including Defenders of Wildlife, the Wyoming Wildlife Federation, and the Wyoming Stockgrowers' Association) towards wolf reintroduction and found that factors such as education, group membership, and geographic proximity to the target wolf restoration zone influenced attitudes (Bath & Buchanan, 1989). A meta-analysis of 38 studies on attitudes towards wolves found that people who lived “closer” to wolves in terms of livelihood or rural residency, and thus were more likely to have direct encounters, exhibited less favorable views of wolves. Individuals who lived in urban areas or supported environmental groups, on the other hand, held stronger support for wolves (Williams, Ericsson, & Heberlein, 2002). Similarly, research in Norway found that rural sheep farmers hold negative views towards wolves (Kaltenborn & Bjerke, 2002). Generally, attitudes towards wolves appear to be determined by cultural, rather than demographic or “structural,” factors, such as urban/rural residence, and respondents who exhibited negative attitudes towards wolves also tended to trust informal knowledge sources over institutional (Skogen & Thrane, 2007).

The level of knowledge an individual holds about a certain species can play a role in affecting attitudes. In a survey of residents living within Abruzzo Lazio and Molise National Park in Italy, researchers found that affect, or emotional attachment, to a species played a more significant role in predicting positive

attitudes towards the presence of large carnivores compared to knowledge or risk perception. Residents were not strong supporters of lethal control, or removal of animals to reduce conflicts (Glikman, Vaske, Bath, Ciucci, & Boitani, 2012). In Utah, where wolves have not yet established a significant population, researchers surveyed rural and urban residents from across the state. Overall, survey respondents preferred non-lethal methods of wolf control to lethal; furthermore, the self-reported affiliation of the respondents with particular interest groups predicted support for lethal or non-lethal measures (Bruskotter, Vaske, & Schmidt, 2009). Longitudinal survey research in Utah on resident attitudes towards wolves found that they had not changed over time and were generally positive, while recognizing that wolves have still not established themselves in the state and that reintroduction or re-establishment could prove divisive (Bruskotter et al., 2007).

Understanding attitudes towards large carnivores is certainly important, but the crux appears when trying to create policy that acknowledges and accounts for the diversity in values and beliefs about wolves. Assessing and integrating policy preferences of local residents, to the degree that they are deemed to be acceptable, may help to find both creative and sustainable ways to manage conflicts. This research asks how tolerance for wolves varies across property owners in a rural community, as well their preferred methods for addressing management and conflict. The underlying premise is that local knowledge and policy preferences can provide insight to managers who are tasked with ensuring a sustainable wolf population and addressing inevitable conflicts.

### *Hypotheses*

Based on the literature above regarding rural/urban attitudes (Bruskotter et al., 2009) as well as general views of wolf reintroduction (Fritts et al., 1997), it is expected that resident views may vary among part-time and full-time residents, the latter of whom are full-time rural residents and are more likely to have economic interests that could be affected by wolves:

*H1: Full-time residents in the Buffalo Valley/Pacific Creek will be less tolerant of living in close proximity to wolves due to the rural nature of the area, while part-time residents are more likely to be more tolerant.*

Conflicts are considered one of the central issues to address in order to achieve conservation goals for wildlife (Treves & Karanth, 2003), as well as to reduce socially-divisive discourse over wolf management ((T. W. Clark et al., 2005; Madden & McQuinn, 2014; Madden, 2004). Understanding how residents define and experience conflicts, and then how they prefer them to be addressed, may help managers who are working to improve coexistence and mitigate conflicts:

*H2: Residents who have experienced a conflict with a wolf will be less likely to exhibit tolerance for wolves and will be more likely to prefer more intensive conflict mitigation measures, such as lethal control.*

*H3: Residents who have not experienced conflicts will be more likely to prefer more collaborative methods of addressing conflicts between people and wolves.*

Finally, based on the literature regarding trust in agencies (Bruskotter & Wilson, 2014; Sponarski, Vaske, Bath, & Musiani, 2014), as well as the preference for state management by “localists,” or those individuals with values traditionally associated with the Old West (e.g., ranching, hunting) (Wilmot & Clark, 2005), it is posited that:

*H4: The preferred entity for dealing with conflicts in a rural community will be the state management agency, Wyoming Game & Fish (WGF) Department.*

## **Methods**

This study employed a survey of residents and property owners in two rural and adjacent communities in northwest Teton County, Wyoming, on their experiences with wolves and preferences for management and conflict mitigation. Questions were informed by the author’s previous research, including semi-structured, in-person interviews on wolf policy and management with engaged citizens as well as representatives of non-governmental organizations (NGOs), government agencies, and private interests in this region. The survey questions were also reviewed by several experts and non-experts in wolf management prior to distribution for question clarity, thoroughness, and terminology.

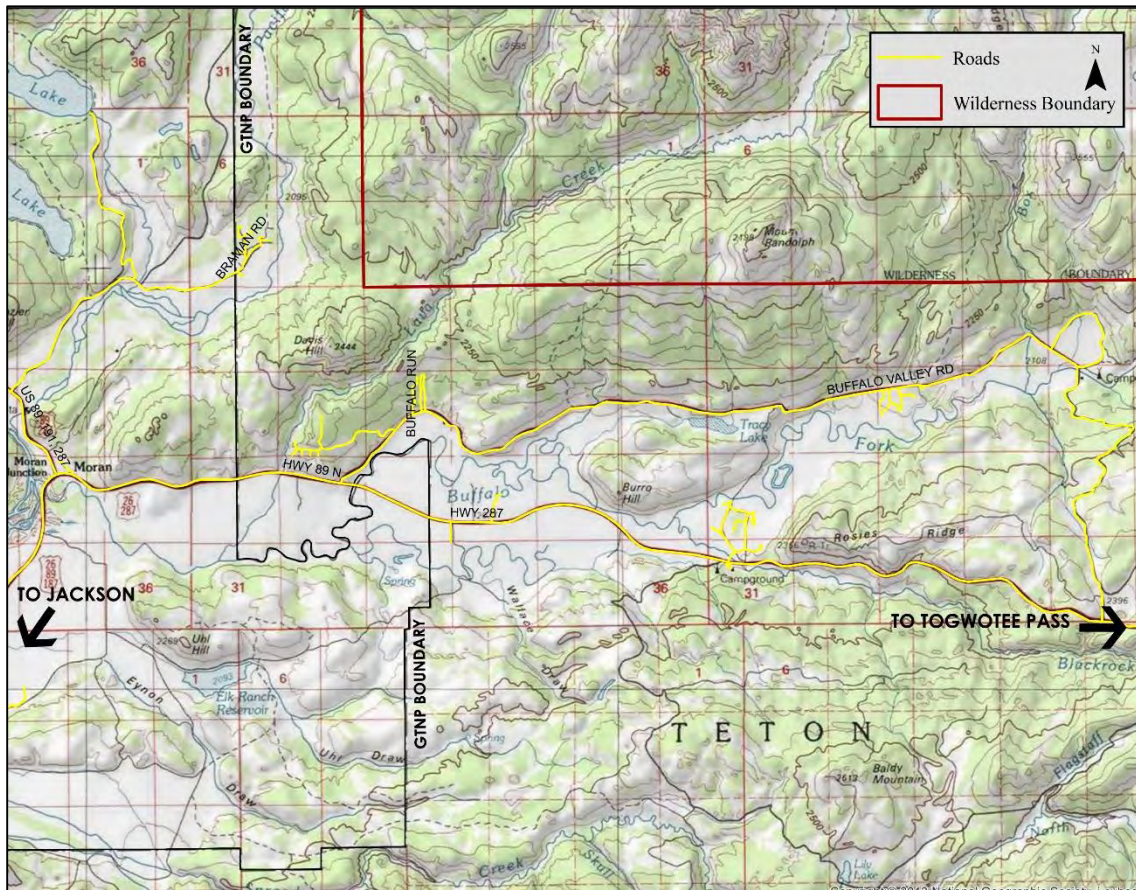
### *Case Study Community*

The Buffalo Valley is a remote community in northwest Wyoming, approximately 40 miles north of Jackson, WY and 50 miles northwest of Dubois, WY. A swath of private land parcels sits on either side of the Buffalo Fork of the Snake River, surrounded by public lands that are managed by either the National Park Service (Grand Teton National Park) or the U.S. Forest Service (Blackrock Ranger District of the Bridger-Teton National Forest; Figure 1). Pacific Creek is a smaller subdivision approximately two miles due north of the Buffalo Valley, or six miles driving. It is included here given its proximity to the Buffalo Valley and the presence of a subdivision here surrounded by public lands. Teton County, WY, Geographic Information System (GIS) maps indicate there are ~240 individual parcels of land in the Buffalo Valley and Pacific Creek (<http://maps.greenwoodmap.com/tetonwy/mapserver/>), ranging in size from less than one to several hundred acres. This area is unique in that the potential for conflict between wolves and people is diverse. Land use includes livestock and hunting outfitters, which are more common



areas of focus in conflict reduction due to the potential or real economic impacts of wolves. However, rural land development here, with established subdivisions where dogs and children play, adds another dimension to conflict management and a broader range of potentially affected stakeholders. The communities here are comprised of full-time and part-time residents. Associated business development is relatively sparse, with two gas stations, a restaurant and motel, several guest ranches, and smaller livestock operations. The area was selected for study due to the clearly delineated geographic boundaries, the size, and the presence of a suite of wildlife species endemic to this area, including ungulates such as elk, moose, and mule deer, as well as the three apex predators native to Yellowstone: grizzly bears (*Ursus arctos horribilis*), mountain lions (*Puma concolor*), and wolves. Two wolf packs, the Pacific Creek Pack and the Phantom Springs Pack, were known to frequent this area in 2014, the most recent year for which data is available (U.S. Fish and Wildlife Service et al., 2015; Wyoming Game & Fish Department et al., 2015).

Figure 1: Map of Buffalo Valley



### *Survey*

In mid-August 2015, I mailed a survey (Dillman, Smyth, & Christian, 2009) to property owners in the Buffalo Valley using the publicly-accessible Teton County GIS server to identify recipients based on land ownership of private parcels. The survey included a letter of invitation, a paper copy of the survey, and a map where participants were asked to identify places where they had seen wolves. Relevant survey questions are included in Appendix 1. Recipients returned their responses via a postage-paid envelope. There was also the option to fill out an identical version of the survey created online using Qualtrics survey data collection software (2015).

Survey questions focused on four categories: tolerance for wolves, conflict experiences, conflict management preferences, and demographic variables. Respondents were asked to report their tolerance of living in an area with known wolf packs on a Likert scale of one (extremely tolerant) to five (not at all tolerant). Respondents were then asked whether they had experienced a conflict with wolves, and the details of this conflict. Types of conflict that could be selected included livestock and hunting issues as well as those that would be more likely to occur in residential areas, including death or injury to household pets and horses as well as threats to safety or well-being, such as encountering a wolf in one's yard or on a walk. Methods to address conflict were compiled based on existing practices and efforts by NGOs and managers. Respondents could check all methods that they preferred.

In the past eight years, wolf management in Wyoming has flip-flopped between state and federal management, depending on the status of wolves under the Endangered Species Act. At this point, many residents (though not all) likely have familiarity with management structures under both agencies. With this in mind, I asked respondents to choose no more than two agencies or alternative leaders (collaborative effort, community group, NGOs, private citizens) who they feel would be best suited to lead efforts to reduce conflicts.

Recipients had approximately six weeks to complete the survey. Surveys were mailed to 174 property owners in the Buffalo Valley and Pacific Creek, Wyoming, in August of 2015. Given budgetary constraints, no reminders were sent, although several reminder posters were hung in community areas (post office, gas station) in the area. Four undeliverable mailings were returned, for a total potential respondent pool of 170 distributed surveys. Sixty-six surveys were completed and returned. Seven respondents submitted their surveys online; one respondent returned responses via email. The response

rate was 38%.<sup>2</sup> Once the survey responses were received, responses were recorded in Microsoft Excel (2013) spreadsheets, with qualitative notes transcribed as well. Data were analyzed using STATA (2015). Chi-square ( $\chi^2$ ) tests of independence were used to determine if relationships existed between categorical variables. Fisher's exact test (given that several cell values had frequencies of less than two) was used in order to look more closely at collaborative preferences and tolerance. I collapsed tolerance into two bins, more (including extremely, very, and moderately tolerant categories) and less (slightly and not at all categories) for the purposes of the chi-square and Fisher's exact tests.

Several of the methods to address conflict that respondents could select focused on human-centered tactics that focused on modifying or informing people's behaviors (in contrast to wolf-centered approaches, such as lethal control or non-lethal deterrents). These options included: educating residents and visitors on what to do in the event of a wolf encounter, such as with dogs; using communication methods, such as listservs or homeowners' associations, to share knowledge of wolf activity; improving coordination among state and federal managers; and enlisting the help of non-governmental organizations to address conflict areas. These methods are all somewhat linked to the concept of improved collaboration and participation in the policy process. I created an additive variable, "collaboration," in order to further explore how these preferred methods are correlated with experience of conflict. I then developed an ordered logistic regression model in an effort to better understand the factors that predict support for the new variable "collaboration." Independent variables tested included experience (conflict, sighting), opinions/beliefs (tolerance and support for lethal control) and demographics.

## **Results**

### *Demographics*

Demographic characteristics of respondents, including age, gender, residency status (part-time/full-time), length of time spent at one's property annually, and time of year when the property is visited, are presented in Table 1.

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<sup>2</sup> It is possible that additional individuals could have taken the survey based on the reminder posters hung in the community and therefore affected the response rate. However, given the low frequency of online responses, I think the effect on response rate is negligible.

Table 1: Demographics of Respondents

Variable	Categories of Responses					Totals	
Age	18-44	45-64	65+				
	2%	40%	58%			100%	
	(1)	(24)	(35)			(60)	
Gender	Male	Female					
	61%	39%				100%	
	(38)	(24)				(62)	
Residency	Full-time	Part-time					
	33%	67%				100%	
	18	37				(56)	
Length of Time	< 1 year	1-5 years	6-10 years	> 10 years			
	2%	11%	3%	85%		100%	
	(1)	(7)	(2)	(55)		(65)	
Time of Year	Winter	Spring	Summer	Fall			
	13	14	26	15			
			1 wk-1				
Amt of Time/Year	Weekends	< 1 wk	mo	1-3 mos.	3-6 mos.	> 6 mos.	
	2.7%	5.4%	18.9%	32.4%	32.4%	8.1%	100%
	(1)	(2)	(7)	(12)	(12)	(3)	37

### Tolerance

Out of 65 responses, 20 respondents (30.8%) reported being not at all tolerant or slightly tolerant of living in an area with known wolf packs, while 30 respondents (46.1%) indicated that they were extremely or very tolerant of living with wolves. The remaining 15 (23.1%) identified themselves as moderately tolerant (Figure 2). Qualitative comments illustrate the diversity of views on wolves in this area:

*I am happy to see wolves restored to the Yellowstone Ecosystem. Too much emphasis is placed on keeping elk numbers artificially high so that [Wyoming] Game & Fish [Department] can issue high numbers of tags to hunters. There needs to be much more acceptance that predators are a natural and necessary part of this ecosystem.*

*I know my parents see them ... with some regularity and that's an amazing change from when I was growing up... I hope I can someday show my kids these amazing animals.*

*I have no problem with having wolves in the Buffalo Valley, but they definitely have had an impact on the moose & elk population there. I also worry about my dog.*

*Adding another top lone predator to the ecosystem was a very poor decision. Mtn. lions, bears, man. All top lone predators. To add the fourth was based on junk science and the net result has no other option than to reduce the elk, deer, moose pop. There were wolfs (sic) in this ecosystem prior to the introduction of the packs in Yellowstone. There were no established packs. A poor decision.*

These examples illustrate a range of perspectives – from being wholly supportive, to supportive with reservations, to resentful of the reintroduction 25 years ago and critical of the science used to support that decision. This latter perspective was illustrated by other respondents as well.

Residence status was tested against tolerance using a chi-square ( $\chi^2$ ) test of independence. In this case there was no significant difference in tolerance between part-time and full-time residents ( $n=54$ ,  $\chi^2=0.837$ , ns; Table 2). This result contrasts with an oft-heard assumption that reintroduction was forced upon local residents by outsiders, as expressed by this survey respondent:

*Why can't Wyo take care of wildlife here and not the people Washington and California. {sic}*

Table 2: Residence Status & Reported Tolerance

	<b>Tolerance</b>	<i>Not at All</i>	<i>Slightly</i>	<i>Moderate</i>	<i>Very</i>	<i>Extremely</i>	<b>Total</b>
<b>Residency Status</b>	<i>Part-Time</i>	7	3	10	7	9	36
	<i>Full-Time</i>	5	1	4	2	6	18
	<b>Total</b>	12	4	14	9	15	54

$\chi^2(df = 4) = 1.4429, ns$

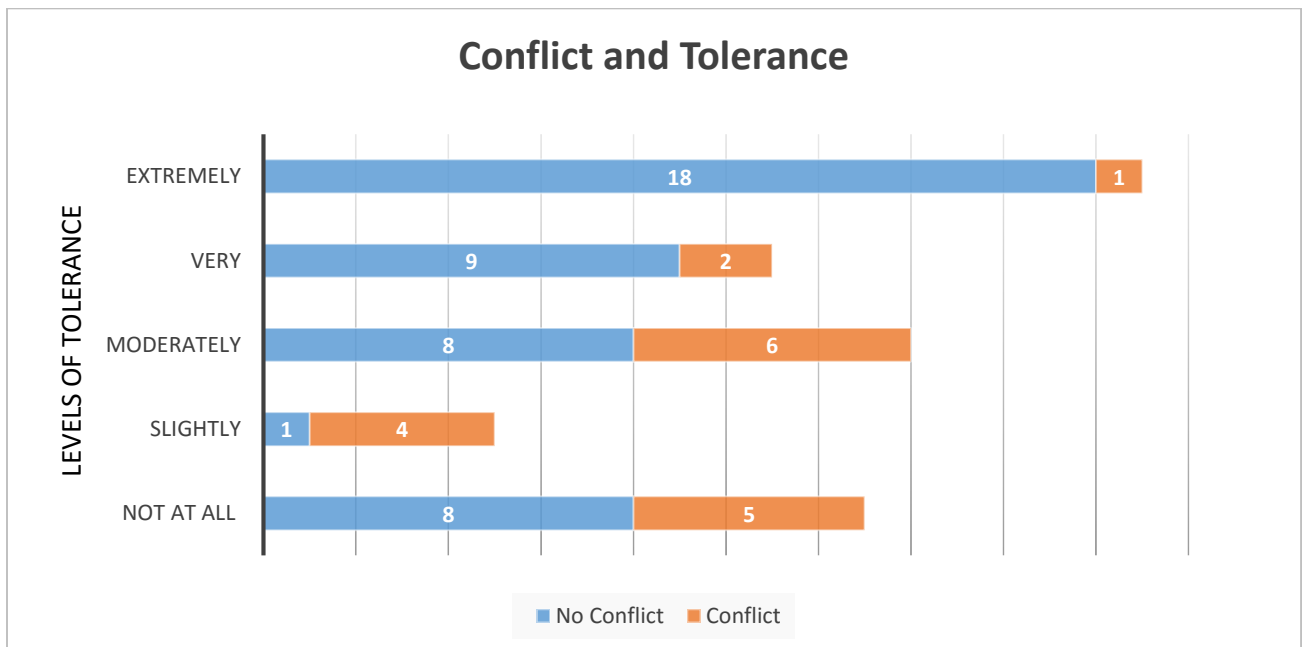
In sum, H1, which states that *full-time residents in the Buffalo Valley/Pacific Creek will be less tolerant of living in close proximity to wolves due to the rural nature of the area, while part-time residents are more likely to be more tolerant* was not supported by the data.

### Conflicts

Nineteen respondents (28.8%) reported having experienced a conflict. Types of conflicts included: livestock depredation (n=3), decreased hunting opportunity for clients (n=2), unsuccessful personal hunt

(n=4), death or injury to a horse (n=3), death or injury to a dog (n=2), and threat to personal security or well-being (n = 8). Of the 19 respondents, 14 answered the question about their willingness to work with government agencies or NGOs to reduce the threat of conflict. Eight indicated that they would be “very willing”; the additional six respondents split evenly between somewhat (n = 3) or not at all (n = 3) willing to do so. Figure 2 displays the tolerance levels reported by all respondents, segmented by experience of a conflict. Of note, which will be discussed in more depth below, those who reported being “moderately tolerant” were nearly evenly split in terms of reporting a conflict (Figure 2).

Figure 2: Tolerance for Wolves in the Buffalo Valley/Pacific Creek



Qualitative data provided additional insight on the challenges inherent in defining a conflict. The following comments were made by individuals who indicated that they had not had a conflict with wolves:

*No conflicts but numerous encounters. I do a lot of hiking in the wilderness areas and have had several encounters with packs. No problems - my dog hikes with me.*

*Not conflict but my neighbor had 7-9 in his yard about 100 yards from my property. Not safe for my grandkids or our pets.*

*Several instances of wolves along Buffalo Fork River tributary of the Snake. Also, we've found dead moose along the river that we attribute to wolves.*

In contrast, respondents who indicated that they had experienced a conflict with wolves provided the following comments:

*Pack surrounded our house for two weeks - wolves have been by our house several times. They stand and stare at you.*

*Saw wolf in back part of property*

*The wolves have killed all of the moose.*

*No longer see moose.*

Here, similar circumstances (seeing wolves on property or otherwise; concerns with moose population) were viewed both as conflicts and non-conflicts by the respondents.

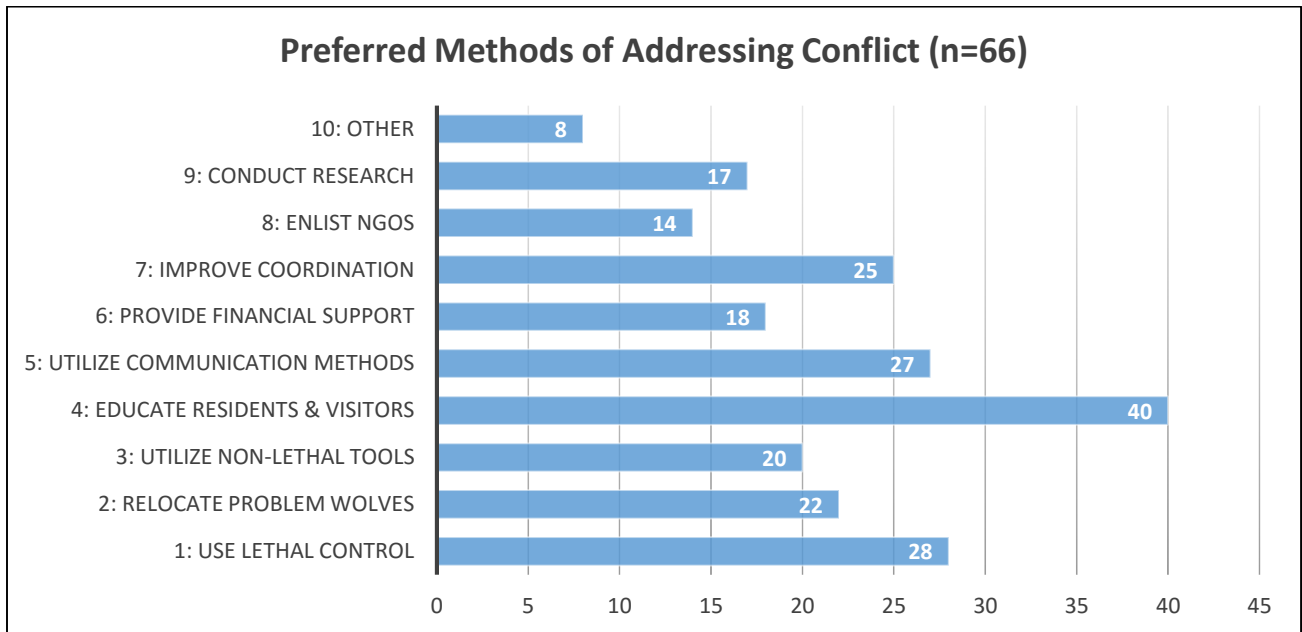
The number of “traditional” conflicts (n = 10), in the form of livestock depredation/horse encounter or failure to harvest an elk (assuming the individuals who reported the failure to harvest an elk held tags for this area) marginally surpassed the number of respondents reporting “threat to well-being” (n = 8) as a conflict. Respondents’ comments to threat of well-being included:

*Perhaps the greatest problem - no peace of mind*

*Threat to horses and cattle*

Moving beyond the experience of a conflict, respondents were asked to choose their preferred method(s) of addressing issues with wolves (Figure 3). The preferred method to address conflict selected most frequently was “educate residents and visitors on how to react in the event of a wolf encounter, such as with dogs” (60.6%, n=40; Figure 2). “Use lethal control” was the second-most frequently selected (42.4%, n=28). The utilization of non-lethal tools, such as fencing or rubber bullets, was selected by 30.3% (n=20) of respondents, which is fewer than the number that expressed that they were extremely or highly tolerant (n=30) of living with wolves.

Figure 3: Preferred Methods of Addressing Conflict



Not surprisingly, respondents with less tolerance for wolves exhibited a preference for lethal control more so than those with higher tolerances (Fisher's exact = 0.00). Those respondents who had experienced a conflict also preferred lethal control ( $\chi^2 = 5.4122$ ,  $df = 1$ ,  $p < 0.05$ ). Furthermore, approximately one third of the respondents ( $n=9$ ) who preferred lethal control did not select any other methods of reducing conflict. Additional comments from these respondents included:

*I believe these are laughable - except it's not funny (in reference to methods listed in addition to lethal control)*

*Shoot on sight any time day or night*

Other respondents provided alternative perspectives on lethal control:

*Shoot some not all. This helps maintain {sic} respect. We do not need to waist {sic} \$ on programs to that do not work. Wolves need to know what territory is not theirs.*

*[Use lethal control] only when absolutely necessary.*

These responses acknowledge that there are places where wolves may cause problems and that lethal control is an option, though the specific conditions under which would be deemed necessary (as articulated by the second respondent) need further exploration. In sum, H2, which states that *residents who have experienced a conflict with a wolf will be less likely to exhibit tolerance for wolves and will be*



more likely to prefer more intensive conflict mitigation measures, such as lethal control, holds true based on the results of the Fisher’s exact test and chi square test of independence reported above.

Table 3 shows the results of the correlation between the additive variable “collaboration” with experience of conflict (-0.1580, ns) and tolerance (0.5505, p<0.001). Preference for collaboration does appear to be significantly related to tolerance (Fisher’s exact = 0.00) in that those respondents who had a higher “collaboration preference” score also exhibited higher tolerance for wolves.

The strong preference for education and outreach efforts (n=40, 60.6%) warrants further consideration. Of those individuals who indicated moderate tolerance (n=15), 11 (73.3%) selected education and outreach as a means of addressing conflict. This finding indicates managers, community organizations, or NGOs may have the potential to work to address the concerns of those residents in the moderate category in order to preemptively address their concerns.

*Table 3: Correlation between Experience of Conflict, Level of Tolerance, and Preference for Collaboration and Test of Significance between Collaboration and Tolerance*

	<b>Conflict</b>	<b>Tolerance</b>	<b>Collaboration</b>
Conflict	-		
Tolerance	-0.3616**	-	
Collaboration	-0.1580	0.5505***	-

Note: N's range from 62-66 due to missing data. For conflict, 0=no conflict, 1 = conflict.

\*\*\*p<0.001, \*\*p<0.01

	<b>Collaboration Score</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Total</b>
<b>Tolerance</b>	<i>Less</i>	15	0	4	1	0	20
	<i>More</i>	6	9	11	12	7	45
	<b>Total</b>	21	9	15	13	7	65

*Fisher’s exact = 0.00*

The results of the ordered regression model indicate that demographic variables do not predict support for collaborative approaches, nor do experiences with wolves, whether negative (conflict) or passive (sighting). Only two variables appeared significant: low tolerance and support for lethal control. Conflict did not appear as a significant predictor variable in the correlation test or in the regression analysis. This result is probably due in part to the larger number of “moderately” tolerant respondents who reported having experienced a conflict. Regression results are displayed in Table 4.

Table 4: Ordered Logistic Regression for Tolerance

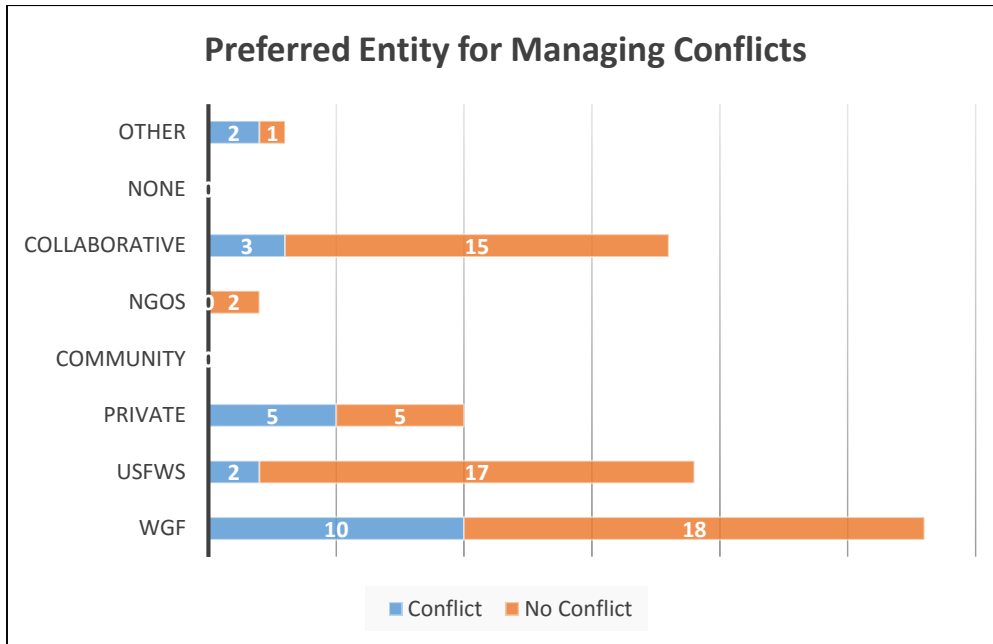
Collaborative Tactics	Coef.	Std. Err.	z	P<z	95% CI	
<i>Experience</i>						
Conflict	-0.6054568	0.9810299	-0.62	0.537	-2.52824	1.317326
WolfSight	-0.4107944	0.6681825	-0.61	0.539	-1.720408	.8988192
<i>Opinions</i>						
Tolerance						
Slightly Tolerant	3.277856	1.474276	2.22	0.026**	.3883293	6.167383
Moderately Tolerant	1.449636	1.095684	1.32	0.186	-.6978656	3.597137
Very Tolerant	0.9021389	1.30526	0.69	0.489	-1.656124	3.460402
Extremely Tolerant	1.901581	1.343279	1.42	0.157	-.7311977	4.534361
Pref. Lethal Control	-2.052354	1.092962	-1.88	0.06*	-4.19452	.089811
<i>Demographics</i>						
Residence Status						
(ref: part-time)	-0.8990988	0.6998749	-1.28	0.199	-2.270828	.4726307
Length of Residency						
(ref: <10 years)	0.6250984	0.8069136	0.77	0.439	-.9564232	2.20662
Gender (ref: male)	-0.4361961	0.6678585	-0.65	0.514	-1.745175	.8727825
Age (ref: <65)	-0.4069164	0.6774133	-0.6	0.548	-1.734622	.9207893
<i>Number of obs: 49</i>						
<i>LR chi2(df=11) = 24.03</i>		<i>** p&lt;0.05</i>				
<i>Prob &gt; chi2 = 0.0126</i>		<i>* p&lt;0.1</i>				
<i>Pseudo R2 = 0.1558</i>						
<i>Log likelihood = -65.094082</i>						

In sum, H3, which states that *residents who have not experienced conflicts will be more likely to prefer more collaborative methods of addressing conflicts between people and wolves* is indirectly supported. Conflict is not correlated with collaboration; however, those individuals reporting higher tolerance did support collaboration.

### Conflict Managers

The Wyoming Game & Fish Department was the most frequently selected entity to manage conflicts with wolves (44.4%) with the USFWS and collaborative efforts as the second and third most frequently selected managers (30.2% and 28.6%, respectively). Results are displayed in Figure 4.

Figure 4: Preferred Entity for Managing Conflicts



Hypothesis 4 states: *The preferred entity for dealing with conflicts in a rural community will be the state management agency, Wyoming Game & Fish Department, which was supported.* The frequency with which respondents selected collaborative efforts, even among those who had experienced conflicts, was unexpected, however, and deserves further attention.

## Discussion

The importance of gathering and integrating local property owners' policy preferences when making management decisions for wildlife, particularly in communities living with challenging species such as wolves, should not be undervalued. Locals can provide information on locations, activities, migrations, interactions, and conflicts with wildlife. Furthermore, they may act as ambassadors beyond their communities for not only wolves and other wildlife, but also for management decisions and actions. However, in the Buffalo Valley and Pacific Creek, tolerance for living with wolves is polarized. Residents who were more tolerant of wolves preferred collaborative approaches to conflict management, while those expressing less tolerance supported lethal control. It may be necessary for managers to implement a multi-faceted approach to addressing real and perceived conflict in order to address local concerns.

### *Tolerance*

It was expected that full-time residents are more likely to have economic interests (such as livestock or hunting outfitting businesses) and thus may be expected to be less tolerant of wolves (Williams et al., 2002). Furthermore, previous research indicates that rural residents tend to be less supportive of wolves (Kaltenborn & Bjerke, 2002; Williams et al., 2002). However, residence status (part-time v. full-time) does not appear to be correlated with tolerance in the study area. It is possible that the divergence between the data in this case and previous research could be resolved by investigating whether primary residence of less tolerant part-time residents is rural or urban, and assessing their primary occupation. Nonetheless, there still exists polarity among respondents on the tolerance scale, which makes creating management policies difficult for decision makers, as it is nearly impossible to satisfy all constituents while still ensuring that the wolf population meets biological targets.

### *Nature of Conflict*

Experience of a conflict does seem to strongly influence residents' tolerance levels, though there was disparity among perceptions of what constitutes a conflict. Reported conflicts did fit within the broader definition of the World Parks Congress (2005), but certainly encompassed issues broader than livestock and hunting opportunity, which are most commonly heard. Furthermore, similar circumstances (seeing wolves on property or otherwise; concerns with moose population) were viewed both as conflicts and non-conflicts by the respondents. Conflict itself is a construct of individual beliefs, and efforts by managers or conservation groups to "reduce conflicts" and increase tolerance should be aware of how conflict is construed by local citizens. Other research in central America found that attitudes towards and tolerance of pumas (*Puma concolor*) and jaguars (*Panthera onca*) are more closely related to stakeholder affiliation, rather than experience of a conflict (Soto-Shoender & Main, 2013). Though the survey did not ask questions on affiliation, this effect may be present here as well.

Qualitative data provided more insight as to the difficulties in assessing tolerance. Those individuals whose beliefs are firmly anti-wolf are more likely to report conflicts and take a broader view of what a conflict is. These views were clearly articulated in concluding comments in the survey:

*Social solutions (like your study) will not solve the conflicts. Wolves, like griz, are used to leverage the environmental agenda to lock up our public lands. Wolves and griz are to blame for livestock reductions on [Forest Service] & GTNP, locking up motorized use (close [roads]), the downturn of Forest Health (timber sales), the attack on trapping and hunting, and **other attacks on private land ownership and personal freedoms**. The solution is to manage predators (scientifically) in concert with all resource*

*values (hunting, forest health, fire, recreation, all wildlife, livestock grazing, etc.) That is not going to occur as long as this kind of research keeps **making wolves as a warm and fuzzy surrogate for an environmental movement**. Rather than using biological science to manage wolves in concert with all other resources and resource uses. In short, as long as the general public uses emotion and the social media (and studies like yours) to make wolf decisions, then there will always be conflict. When 10% of the population who have no clue, are allowed to manage the rest of us, no solution. [sic, emphasis added]*

*The wolf reintroduction plan was a bad idea and was done so in a way that was **wreckless and unfair to the private sector of the state of Idaho, Wyoming and Montana**. We as livestock owners will always be **at risk** and will continue to have problems with wolves preying or attempting to prey on our newborn calves in the spring. [sic, emphasis added]*

These comments illustrate that tolerance for wolves is predicated on broader beliefs regarding the role of government and private property, and perhaps less so on the actual animal, as Fritts and Bangs (1997) observed as well. One respondent remarked:

*I rarely see wolves or wolf signs. Have never had a conflict with a wolf. But I have had conflict with wolf haters. Am puzzled by the extreme and inflexible attitudes of the anti-wolf crowd. Seems to be tied in with the “tea party” anti-government philosophy.*

Mattson (2014) remarks “...symbolic projections by participants, whether of their identities or worldviews, often have a strong inflammatory effect on conflict in management of large carnivores. Gains in the common interest are likely to be made by refocusing participants on solving practical problems that are of limited scope and scale” (Mattson, 2014, p. 51). This suggestion, of course, assumes that those individuals espousing extreme views would be willing to participate in a more public process, and that an appropriate “refocusing project” could be identified.

Regardless, the Endangered Species Act, through the Northern Rocky Mountain Wolf Recovery Plan, requires a minimum number of wolves outside of Yellowstone and Grand Teton National Parks (U.S. Fish & Wildlife Service, 1987). Comments reflecting long-standing resentment towards wolves as a proxy for federal government intervention are valid but not constructive. Despite polarizing views on wolves, the Endangered Species Act mandates that they are here to stay. Therefore, finding ways to minimize conflicts is essential.

### *Managing Conflict*

Those respondents who experienced a conflict and/or displayed lower tolerance for living with wolves preferred lethal control as a means of controlling conflict – while those who expressed medium to high tolerance did not select lethal control nearly as frequently. Researchers have assessed the efficacy of lethal control as a means to address livestock conflict<sup>3</sup> with mixed results, depending on pack size, number of wolves removed, timing, and other variables (Bradley et al., 2015; Poudyal, Baral, & Asah, 2016; Wielgus & Peebles, 2014). In some situations, the removal of wolves associated with livestock depredations may reduce the future likelihood of recurrence (Bradley et al., 2015). However, it is important to point out that these studies do not address the social side of lethal control, in that it may be seen as evidence that the managers are “doing something” to address a conflict. Thus, utilizing lethal control judiciously to address confirmed livestock depredations, particularly on private property, is likely necessary in order to address the concerns of some residents – even if it is unpalatable to others.

The interpretation of conflict as a threat to personal safety or well-being alludes to the stress and psychological impacts to people of having predators on the landscape. However, there is a lack of research evaluating how fear can be mitigated through management actions (Johansson et al., 2012). The challenges for managers in addressing residents’ fear may require more skills and tools beyond those traditionally deployed to address conflicts. The Buffalo Valley and Pacific Creek may be an appropriate place to test small-scale, localized efforts to address this type of psychological conflict, particularly as residents seem to be supportive of education and outreach efforts. Importantly, data should be collected before and after these interventions in order to assess their success (Baruch-Mordo, Breck, Wilson, & Broderick, 2011).

Non-lethal tools are increasingly researched (Lance, Breck, Sime, Callahan, & Shivik, 2010; Shivik, 2006, 2014) and in vogue particularly with environmental NGOs seeking to reduce conflicts (typically between livestock and wolves). Their relative lack of popularity among respondents as a means to address conflict may reflect that they are used to address livestock conflicts and are not typically used in residential areas and so they may not have been familiar to respondents.

Finally, the lack of significant correlation between conflict and preferences for collaborative approaches was somewhat unexpected. This result bears further exploration, as it appears that experience of a conflict

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<sup>3</sup> Livestock depredation is the most likely scenario in which wolves would be lethally controlled in Wyoming; however, in 2012, several wolves frequenting subdivisions on the outskirts of Jackson, WY, were removed due to their apparent loss of fear of people (Hatch, 2012). In other states, particularly Idaho, wolves have been lethally controlled due to their apparent impacts on elk herds.

does not preclude willingness or preference for more human-centered strategies to address or mitigate residents' concerns.

### *Managing Agency*

Based on respondents' preferences, whether the managing agency is the USFWS (if wolves remain on the Endangered Species List) or the Wyoming Game & Fish Department (if they are delisted), there should be clear communication strategies to engage citizens both actively (e.g., through social media, HOA meetings) and passively (e.g., with website information, publications). Communication about the hazards and risks of wildlife species has been posited to affect positive attitudes towards that species (Bruskotter & Wilson, 2014). In particular, information about wolves should be shared readily within the community when possible, particularly if wolf packs are in close proximity to livestock or residential developments. Though there are obvious risks with this approach, including poaching or disturbance by wolf-watchers, it could serve to build trust between the managing agency and the residents, which has also been identified as a key component for carnivore management (Reed, 2008; Sjölander-Lindqvist et al., 2015; Sponarski et al., 2014). Given that many survey respondents preferred a "collaborative" approach to dealing with conflicts, communication, trust, and acknowledgement of local residents' concerns and knowledge is paramount. Managers already have working relationships with livestock operators and outfitters, but perhaps less so with property owners and residents who do not derive direct income from public lands. Finding ways to engage with residents who do not have overt economic interests is critical. Community-based conservation efforts, particularly as re-imagined by Berkes (2004) as cross-scale efforts at improving governance, where the local community works with the managing agency to secure palatable and sustainable outcomes to conflict, as well as to empower residents to act appropriately in the case of a wolf encounter, could benefit both wolves and people in this area. Unfortunately, Wyoming Game & Fish has been critiqued as "enforcing top-down views of problems and solutions" and having "an autocratic image and a distant, out-of-touch relationship with the public" (Taylor & Clark, 2005, p. 44). Institutional barriers could be a significant hurdle, as a community effort working on a species of national interest needs multi-scalar support.

There are other managing agencies that could be engaged in such a community-based effort, however. In research surveying residents of a national park in central Italy, researchers found that using a more inclusive management decision approach, where locals and managers could engage in dialogue over options, could improve relations between the community and the park. They also noted the importance of outreach to residents in order to increase their knowledge of wolves (Glikman et al., 2012). These recommendations could be explored here, given the proximity of the Buffalo Valley and Pacific Creek to

Grand Teton National Park, where the challenges of managing wolf packs which travel between these two areas are acute.

## **Conclusion**

Addressing conflict is multi-faceted, and necessitates broadening our understanding of what constitutes a conflict. Additionally, the “toolbox” for dealing with conflict should be expanded beyond lethal management and even non-lethal approaches, which tend to focus on addressing issues between wolves and livestock. At the community scale, diverse strategies of conflict mitigation, such as communication and education, need to be implemented and evaluated for their efficacy in addressing conflicts related to fear and threats to personal security.

This area is unique geographically, ecologically, and socially, given the human presence along with robust wolf populations. Over time, if community capacity and communication is supported, and preventative measures can be designed efficiently and effectively, conflicts between residents and wolves and with other wildlife species, may be sustainably addressed.

## **Future Research<sup>4</sup>**

This project focuses on a small, rural community in northwest Wyoming. It provides initial data on tolerance and views on conflict management for wolves in the area, and it would be worthwhile to expand the survey to residents across Teton County, WY, which includes the town of Jackson. The unique aspect of the Buffalo Valley, however, is the proximity of residents to wildlife, including wolves. Wolf sightings within Town of Jackson limits are relatively rare. Nonetheless, given its position as a major gateway to two National Parks, and a population that values and uses its public lands, it would be beneficial to understand how residents in the broader community view conflicts and the preferred means to address them. In particular, as wolves may be present in areas heavily used by locals for recreation, understanding the local level of knowledge in dealing with conflicts may help target policies to mitigate issues before they become significant problems.

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<sup>4</sup> This project will be continued in summer 2016 with in-depth semi-structured GIS-based interviews on residents' knowledge of wolf and prey dispersal and movements as well as land use.



## Appendix 1: Survey Questions

1. What is your tolerance for living and/or working in close proximity to wolves?  
(Extremely/Very/Moderately/Slightly/Not at All Tolerant)
2. Have you experienced a conflict with wolves in the Buffalo Valley or Pacific Creek? (Yes/No)
  - a. If yes, describe your experience in a couple of words.
  - b. What was the nature of the conflict(s)? Select all that apply.
    - Livestock depredation (killing)
    - Decreased hunting opportunity for your clients
    - Unsuccessful personal hunt (e.g., unfilled elk tag)
    - Death or injury to a horse
    - Death or injury to a dog
    - Death or injury to another pet
    - Feeling of threat to your personal security or sense of well-being
    - Other: \_\_\_\_\_
  - c. When & where did these conflicts occur?
  - d. How willing are you to work with government agencies or non-profit organizations to reduce the threat of conflict with wolves? (Very/Somewhat/Not Willing)
3. Do you have comments on wolf conflicts that you have experienced and/or your willingness to help resolve them?
4. What are the best ways to address conflicts between people & wolves in the Buffalo Valley/Pacific Creek areas? Check all that apply.
  - a. Use lethal control.
  - b. Relocate problem wolves.
  - c. Utilize non-lethal tools, such as guns with rubber bullets to scare wolves or electric fencing to protect livestock and pets.
  - d. Educate residents and visitors on how to react in the event of a wolf encounter, such as with dogs.
  - e. Use communication methods, such as listservs or homeowners' associations, to share knowledge of wolf activity.
  - f. Provide financial support to businesses affected by wolves
  - g. Improve coordination among state and federal managers
  - h. Enlist the help of non-governmental organizations to address conflict areas.
  - i. Conduct more research on wolves.
  - j. Other: \_\_\_\_\_
5. Do you have comments on other methods or approaches to reducing conflicts?
6. Who should take the lead in managing conflicts between people and wolves?
  - a. Wyoming Game & Fish Department (state agency)
  - b. U.S. Fish and Wildlife Service (federal agency)
  - c. Private landowners
  - d. Community groups
  - e. Non-profit organizations
  - f. Collaborative effort among agencies/groups
  - g. None of the above
  - h. Other: \_\_\_\_\_

7. How long have you lived or owned property in the Buffalo Valley or Pacific Creek areas?
  - Less than 1 year (1)
  - 1 – 5 years (2)
  - 6 – 10 years (3)
  - More than 10 years (4)
8. In what year were you born?
9. What is your gender? (Male/Female)
10. Are you a full-time or part-time resident of the Buffalo Valley? (Full-time/Part-time)
  - a. If yes, what time of year do you visit your property?
  - b. If yes, in a typical year, how much time do you spend at your property?
    - Weekends (1)
    - Less than one week (2)
    - Between one week and one month (3)
    - One – three months (4)
    - Three – six months (5)
    - More than six months (6)
11. Please provide any additional information you would like to share below.

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