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Case Study

Learning to live with wolves: community-based conservation in the Blackfoot Valley of Montana

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Abstract: We built on the existing capacity of a non-governmental organization called the Blackfoot Challenge to proactively address gray wolf (*Canis lupus*; wolves) livestock conflicts in the Blackfoot Valley of Montana. Beginning in 2007, wolves started rapidly recolonizing the valley, raising concerns among livestock producers. We built on an existing program to mitigate conflicts associated with an expanding grizzly bear (*Ursus arctos*) population and worked within the community to build a similar program to reduce wolf conflicts using an integrative, multi-method approach. Efforts to engage the community included one-on-one meetings, workshops, field tours, and regular group meetings as well as opportunities to participate in data collection and projects. Initial projects included permanent electric fencing of calving areas and livestock carcass removal to address the threat of grizzly bears and, later, wolves. Subsequently, we used intensive livestock and wolf monitoring provided by range riders in an attempt to reduce the frequency of encounter rates among wolves and livestock. Although we cannot claim causation from our effort, the results were encouraging. Confirmed livestock losses to wolves from 2006 to 2015 averaged 2.2 depredations per year across nearly 50 ranches on about 3,240 km^2 that were annually grazed by 16,000–18,000 head of livestock. Fewer than 3 wolves per year have been removed (2.4 wolves per year) due to these depredations for the same period as the population increased from 1 confirmed pack to approximately 12 packs. Our collaborative approach and prior experience with grizzly bears were key in building a proactive program to mitigate conflicts with wolves in a community that was confronted with adjusting to an increasing large carnivore presence over a short period.

Key words: *Canis lupus*, collaboration, community-based conservation, depredation, human–wildlife conflict, gray wolf, grizzly bears, livestock, mitigation, *Ursus arctos*

In landscapes where carnivores and people overlap, conflicts and human-caused mortality result. Because carnivores such as gray wolves (*Canis lupus*; wolves) are generalists and use a variety of habitats, population persistence may be more a consequence of human values, behaviors, and their land use practices (Boitani 2003). Wolves were largely eradicated in North America during the last century and have historically been a focus of extermination efforts and persecution (Fritts et al. 2003). By the middle of the twentieth century, wolves had been extirpated from the lower 48 states, with the exception of northern Minnesota and Isle Royale National Park (Mech 1995).

However, as general environmental awareness increased during the 1960s and 1970s, a host of natural resource protection legislation ensued, including the Endangered Species Act, which was instrumental in protecting wolves from human-caused mortality beginning in 1974. Federal recovery efforts led to reintroduction of wolves in Central Idaho and Yellowstone National Park during the mid-1990s and eventual recovery and state-level management in Idaho, Montana, and Wyoming (Bangs et al. 2009). While depredations on livestock were a primary reason behind historic eradication efforts, today this is still a core source of conflict in landscapes that have wolves and livestock.

With reintroduction of wolves and subsequent wolf population growth in Montana, conflicts

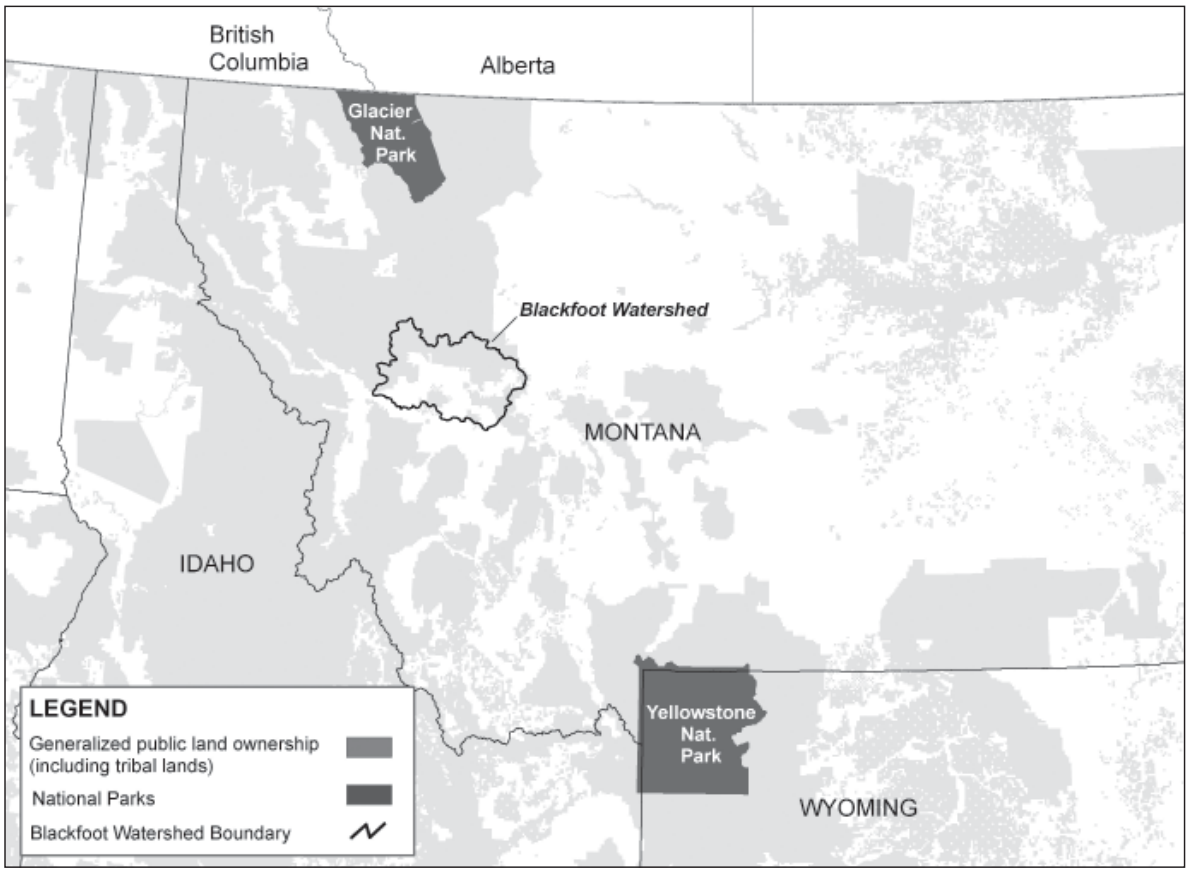

Figure 1. Location of Blackfoot Valley Watershed in western Montana.

continued to pose a challenge for those raising livestock. Often, private lands in livestock production in valley bottoms or foothills adjacent to public lands were problematic zones for wolves and livestock because wolves can easily access private agricultural land (Bradley and Pletscher 2005, DeCesare et al., in press). Repeated incidents with livestock typically lead to wolf removals. In these cases, outcomes are unfortunate for both those losing livestock and for the wolves themselves. One solution to breaking this cycle is to focus efforts on preventive measures that proactively address wolf–livestock conflict. This position implicitly recognized that long-term conservation and management of wolves in places like Montana will require some level of human acceptance, tolerance, and ultimately some changes in husbandry practices that help reduce the likelihood of depredations by wolves on livestock.

This case study, set in the Blackfoot Valley Watershed of west central Montana, describes the proactive response of an agricultural community to the rapid recolonization of wolves during 2007–2015 (Figure 1). We discuss how we addressed wolf–livestock conflict under the auspices of the Blackfoot Challenge (BC). The BC is a landowner-driven non-governmental organization (NGO) that has worked since the 1970s to enhance, conserve, and protect the natural resources and rural lifestyle of the Blackfoot Valley. By building on the existing capacity of the BC, we were able to employ a host of tools to reduce conflicts with wolves at a large scale that incorporated multiple wolf pack territories. This allowed us to work across public and private lands to leverage a community-level response that may have helped to keep confirmed livestock losses to wolves at low levels, <3 confirmed livestock depredations year, while the wolf population rapidly increased and eventually leveled off. In this case study, we describe the BC collaborative approach working with grizzly bears (*Ursus arctos*), identify projects that proactively addressed wolf–livestock conflict mitigation, provide initial results for these

efforts, and offer insights regarding lessons learned that may be applied in other areas where species conservation goals may collide with contemporary land uses.

The Blackfoot Challenge

The BC was incorporated as an NGO in 1993 and has worked to further stewardship of the watershed through an inclusive, collaborative process that focuses on common interest solutions. Committees and workgroups are issue and place-based and attract a diversity of stakeholders. Each author of this article has had personal investment and professional capacity in the BC and has recognized that partnership-based efforts can yield substantial conservation gains that have social, biological, and economic benefits to communities. The overarching goal of the BC is to provide a forum to encourage civil dialogue to support environmentally sustainable stewardship of the watershed through cooperation of private and public interests (Blackfoot Challenge 2017).

At the heart of this approach is the belief that effective partnerships and working relationships are based on trust, respect, credibility, and the ability to empathize across a diversity of values. While difficult to measure, these intangibles help build what Robert Putnam terms, "social capital," and have been benchmarks of the success of the BC (Putnam 2000). This has allowed the BC and partners to make major gains in land protection through conservation easements and ownership transfers, riparian and wetland restoration, invasive plant management, water quality and quantity improvements in the Blackfoot River, and wildlife conservation.

A collaborative approach

The BC has fostered a culture of collaboration largely through 2 important mechanisms—non-advocacy and a consensus-driven approach that is led and fostered by local landowners and residents. This has allowed the BC to act as the forum in the watershed for bringing people together around a variety of natural resource issues without taking a particular stance or position on issues. By being a non-advocacy and non-litigious organization, the BC has earned the trust and support of local residents who represent a diversity of values. And like much of the western landscape, the Blackfoot Valley Watershed contains a mix of public and private lands that are cherished and contested by both communities of place and communities of interest that desire resource use, recreation, and non-consumptive ecosystem services.

The BC has helped manage these often competing values championed by stakeholders by offering a robust, collaborative process that creates respectful forums and norms for addressing issues through information sharing and decision-making through consensus. To be clear, the BC is a process and a boots-on-the-ground organization. In a given year, the BC and scores of key partners are directly engaged in hundreds of projects from management of a community-owned forest, irrigation efficiency projects, and reintroduction of trumpeter swans (*Cygnus buccinator*) to hiring contract range riders to monitor livestock (Parks 2015, Parks and Messmer 2016, Blackfoot Challenge 2017). These examples represent the types of projects that stakeholders have wanted to take on and work through under the collaborative process of the BC.

The BC relies on 7 committees and respective work groups to address a range of natural resource issues. Each committee is chaired by a landowner to ensure that local values are represented. Another mechanism that has helped the BC work successfully with local, state, and federal land management agencies has been to invite key people from leadership positions from the various agencies to serve as board members and board partners. Committee membership is naturally driven by the specific natural resource issue and interests of stakeholders. For example, this has allowed representatives from Montana Department of Fish, Wildlife and Parks (FWP), the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and the U.S. Fish and Wildlife Service (USFWS) to take active roles in issues related to forestry, grazing management, or wildlife.

In many respects, the BC served as a parallel institution of governance within the watershed and was able to harness and engender the collective good will of stakeholders who were willing to take part in the process of collaboration. This capacity has been critical for addressing controversial issues such as grizzly bear population expansion onto

private agricultural lands and eventual wolf recolonization of the watershed that began in 2007. To understand how the community responded to wolves, we must begin with grizzly bears.

Building on existing capacity: how grizzly bears prepared the community for wolves

Grizzly bears began recolonizing the Blackfoot Valley Watershed in the late 1990s (Jonkel 2002). By 1998 and 1999, reported and verified grizzly bear conflicts were beginning to increase. The term conflict includes a variety of incidents that ranged from livestock losses to grizzlies, beehive damage, property damage, sanitation, to human–bear encounters. In 2001, a serious incident occurred: a hunter was killed from an encounter with a female grizzly bear with cubs. This event caused widespread concern among landowners and residents. By holding public meetings, FWP and the BC responded to this incident and led to the eventual formation of the BC's Wildlife Committee in 2001 (Wilson and Clark 2007). Approximately 45 committee members included landowners, ranchers, and residents from the Blackfoot Valley Watershed and managers from FWP, USFWS Montana Partners for Fish and Wildlife Program (FWS-Partners Program), USFS, Natural Resource Conservation Services, and Montana Department of Natural Resources and Conservation. Additional members included representatives from Defenders of Wildlife, The Nature Conservancy, Living with Wildlife Foundation, and a researcher from the University of Montana. The committee represented the respective landownerships and management jurisdictions in the watershed both public and private, resulting in a regular dialogue among various stakeholders who represented communities of place and communities of interest (Wilson and Clark 2007).

Participants at that time believed that building on the existing capacity of the BC was a pragmatic way to approach the problem of an expanding grizzly bear population and that an inclusive and participatory approach to working with ranchers, landowners, conservation groups, and agencies would facilitate a more positive response to grizzlies. It was apparent to us that a partnership-based approach would be needed to respond to increasing conflicts with grizzly bears and that significant decision-making power would need to be in the hands of those landowners and ranchers who confronted daily realities of living with bears (Wilson et al. 2014).

We embarked on 5 methodological phases in this effort. First, FWP met with the BC to see if there was interest in creating a formal committee that directly engaged local community members in wildlife management (Wilson et al. 2014). Subsequently, the BC agreed to form the Wildlife Committee with the understanding that the initial focus would respond to grizzly bears. Second, the BC conducted a survey of ranchers, outfitters, and small "hobby" ranch operators in 2002 and 2003 to get a better understanding of their perspectives of grizzly bears and possible ways to coexist with them. Third, these data helped us orient to the problem as perceived by residents whose livelihoods could be impacted by grizzly bears (Wilson et al. 2014). This enabled us to co-generate goals that focused on 3 core issues important to stakeholders: 1) protecting human safety, 2) protecting private property from bear damage, and 3) protecting rural livelihoods.

Fourth, we used geographic information systems (GIS) to map and analyze land use practices, bear attractants, and other relevant features in the watershed with 35 active ranchers in the Blackfoot Valley Watershed (Wilson et al. 2005, Wilson and Clark 2007). The FWP provided data on verified and reported grizzly bear conflicts and observations (1998–2004) that we then used to analyze and prioritize where in the landscape to focus conflict mitigation efforts. This was critical for understanding the scale at which bear conflicts were playing out and helped stakeholders literally see that it would take the collective response of dozens of ranchers and hundreds of residents to address conflicts at the biological scale of grizzly bear foraging bouts and seasonal bear home ranges. In other words, 1 rancher attempting to do the right thing was unlikely to produce long-lasting results at a broad scale that would result in community-wide gains and benefits for bears.

Finally, we brought this information back to the community and worked collectively to address problems over the next decade, namely through continued GIS mapping and monitoring of boneyards and calving areas,

electric fencing of high-risk calving areas, and eventual phase out of boneyards using livestock carcass removal. Conflict reduction efforts focused on the middle portion of the Blackfoot Valley Watershed where there were the highest densities of bears and more historical conflicts.

According to FWP Region 2 data, there has been a 74% reduction in reported and verified human–grizzly bear conflicts in the project area from 2003 to 2013 and a downward trend in known grizzly bear mortalities. This occurred while the overall grizzly bear population in the Northern Continental Divide Ecosystem has expanded at approximately 3% per year (Kendall et al. 2009, Mace et al. 2012, Costello et al. 2016). Compared to other monitoring units with significant portions of private land in the demographic monitoring area of FWP, grizzly bear mortalities that are caused from repeated conflicts with people in the Blackfoot Valley Watershed currently remain at the lowest levels across the Northern Continental Divide Ecosystem (Costello et al. 2016). The reduction in human–bear conflicts and bear mortality had several important outcomes: 1) an increased level of trust and credibility generated among stakeholders as projects produced results, 2) a positive economic impact on livestock producers by minimizing livestock losses to grizzlies, and 3) an impression of overall improvement in community-level acceptance of grizzly bears in the watershed.

Building trust and credibility among stakeholders takes patience and is a reciprocal process. During the early years of this effort (2001–2006) ranchers and residents had concerns about numbers of grizzly bears and whether FWP managers were adequately sharing information about bear activity and behavior. Conversely, conservation groups and other stakeholders on the Wildlife Committee were concerned about the potential for poaching of bears. The Wildlife Committee provided an inclusive forum that humanized wildlife agencies and NGOs through face-to-face meetings among people. Our bear conflict reduction work during 2001–2006 helped build professional working relationships among ranchers, wildlife managers, NGOs, and residents throughout the watershed. The FWP management specialists readily shared biological information on grizzly bears with the community. Their reports became a critical part of regular meeting updates and helped to reduce anxiety about human safety, bear numbers, densities, and habitat use. Ranchers were also willing to share information about their operations and bear activity they observed, making the overall picture of grizzly bear use in the Blackfoot Valley Watershed much clearer for all stakeholders.

During this same period, wolves were recolonizing parts of Wyoming, Idaho, and Montana with steady population growth recorded in all 3 states (Sime et al. 2007). Although grizzly bears were the initial focus of the Wildlife Committee, wolves began to enter conversations as livestock depredations occurred in other valleys in Montana, particularly those close to Yellowstone National Park. There was general acknowledgment and concern by all stakeholders that it was simply a question of when wolves would find their way to the Blackfoot Valley Watershed and establish territories. With this in mind, we worked to expand and refine ongoing projects and develop new projects, anticipating the arrival of wolves.

Livestock protection: permanent electric fences around calving areas

Spring calving/lambing is a time of high risk for livestock, as the young are small and more vulnerable to predation. The first calving area fences in the Blackfoot Valley Watershed were built in 2001 as a proven method to non-lethally deter grizzly bears from newborn calves. Currently, there are 13 calving area fences constructed on 8 individual ranches. Fences were constructed using funds from public and private foundations, FWP and the FWS-Partners Program, which provided ranchers with substantial cost savings on the capital investments.

We designed fences at that time to be both grizzly bear and wolf resistant using a combination of fencing guidelines from FWP, the USFS, and the Province of Alberta where ranchers had longtime experience using electric fences to protect livestock from grizzlies and wolves. Ranchers contributed to the costs through their in-kind donations of labor to prepare sites and remove old fences. At first, some ranchers were concerned that electric fences would require excessive maintenance or would be susceptible to ungulate damage.

In some cases, ranchers were unfamiliar with the technical aspects of electric fencing, and the adoption of this new technology challenged norms such as their pride in their self-reliance regarding routine work like fixing barbed wire fences (Wilson et al. 2014). Over time, ranchers maintained most of the electric fences and in only a few cases did fences fall into disrepair.

Reducing attractants: boneyards and livestock carcass removal

Livestock carcasses and carcass dumping areas, known as boneyards, can be an attractant for wolves and grizzly bears and bring them into closer proximity to livestock production areas, thereby increasing risk of depredations (Chavez and Gese 2006, Wilson et al. 2006). Phasing out boneyards and regular carcass removal was designed to remove the cows (*Bos* spp.), calves, sheep (*Ovis aries*) ewes, and other livestock that naturally die during the calving and lambing season (mid-February through mid-May) so that carcasses would not be found by foraging grizzly bears and other carnivores.

Cow-calf ranches in this part of Montana consist of winter feeding, centralized and spatially fixed operations, irrigated hay production, and docile breeds of cattle (Dale 1960, Jordan 1993). The calving season typically overlaps with the emergence of grizzly bears from their dens in the early spring. Bears routinely visit calving areas, and the traditional practice of depositing dead livestock into boneyards (carcass dumps) can lead to chronic livestock–grizzly bear conflicts (Wilson et al. 2006).

We were also aware that general patterns of livestock depredations by wolves in the western United States peaked in early spring and fall each year (Musiani et al. 2005). Coupled with electric fencing to protect newborn calves, we felt that it would be wise to expand our carcass program because there was emerging evidence that livestock carcasses could attract wolves (Chavez and Gese 2006).

Our initial efforts to remove livestock carcasses generated an additional concern because ranchers did not want to have numbers of livestock deaths on their ranches disclosed to neighbors for fear of being stigmatized as neglecting animal husbandry (Wilson et al. 2014). This concern was mitigated by establishing centralized drop-off locations where ranchers could bring carcasses for pick up.

Participation steadily increased in the program in the early 2000s. Today, the program covers nearly 4,860 km^2 across 4 western Montana counties and annually has 110–120 ranches actively participating. More than 7,500 carcasses have been removed since 2003, with approximately 600 carcasses removed annually. Livestock carcasses are composted at multiple facilities in the region. The Montana Department of Transportation, a key partner in the effort, has successfully used the compost byproduct on a variety of revegetation projects.

Composting of livestock carcasses has proven to be a highly effective disposal method. The practice has been widely applauded by the ranching community as a more appealing method of disposal than past practices of depositing carcasses on boneyards on their properties or removing carcasses to nearby landfills. The program relied on a mixture of public and private funding and in-kind and cash donations from partners and the ranching community to make the service virtually free to the ranching community.

Community participation: winter wolf surveys, 2008–2012

By 2007, the first wolves established a territory in the Blackfoot Valley Watershed. Although the arrival of wolves was anticipated, community members were anxious about numbers of wolves, pack sizes, and rumors began to spread. There was talk of hundreds of wolves beginning to use the watershed. To further concerns, the first confirmed livestock depredations were recorded in the watershed in 2008 by Wildlife Services (WS), a division of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service. The rumors that were circulating surfaced during our Wildlife Committee meetings and in one-on-one, informal conversations with members of the Wildlife Committee.

These first depredations fueled rumors about overall numbers of wolves and created another point of entry for FWP and the Wildlife Committee to address wolves and the emergent perception that the "valley was being overrun by wolves," a refrain commonly heard in informal settings. To address this perception

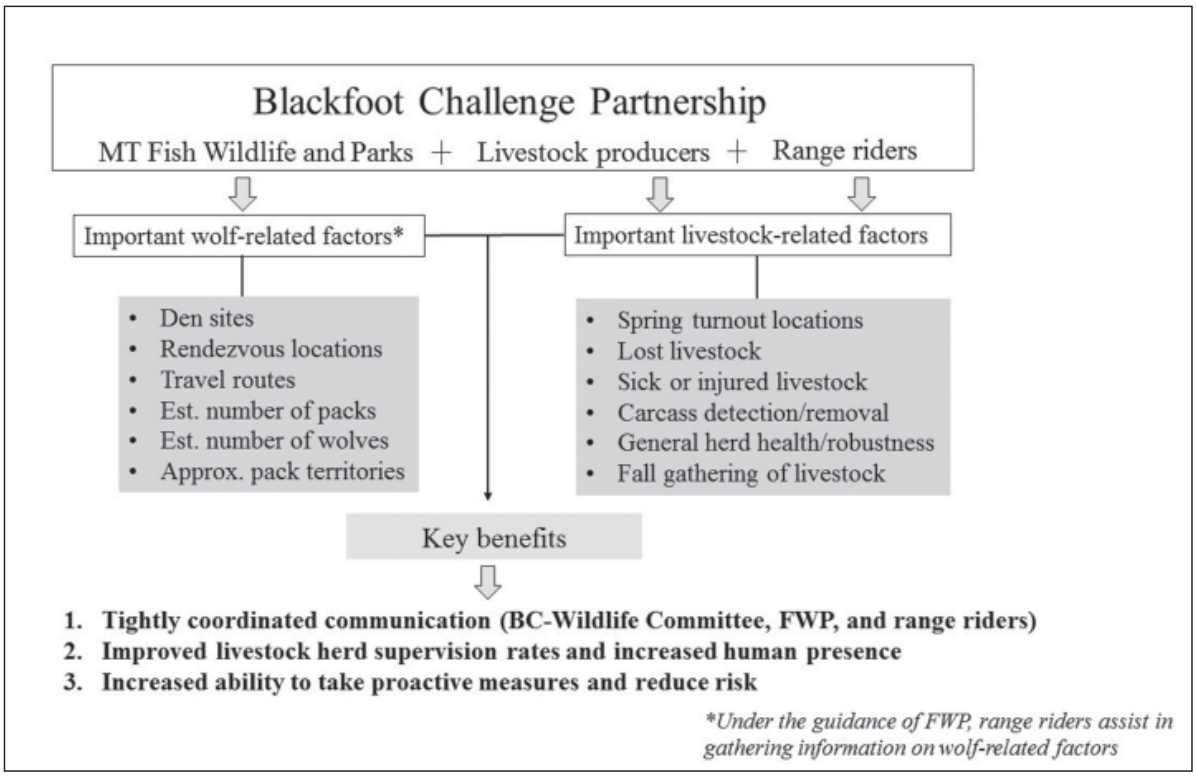

Figure 2. Conceptual framework for understanding roles and responsibilities of range-rider effort within the Blackfoot Challenge (BC) collaborative, 2007–2015, Blackfoot Valley Watershed.

and with the guidance of FWP, we asked the community for their direct participation in conducting an annual winter wolf survey to generate a better collective understanding of wolf numbers, distribution, and activity within the watershed. We felt that a way to address the fear that wolves were generating was to invite the community into the field to help document the growth of the wolf population and to learn about wolf sign and activity patterns.

Through the Wildlife Committee, we asked permission from dozens of ranchers to conduct a winter tracking survey across their lands. We also surveyed public lands adjacent to private ranch lands likely to contain wolves. Winter surveys were conducted over the period of 2–3 days in late January during optimal tracking conditions. We enlisted volunteer crew leaders from FWP, FWS-Partners Program, USFS, BLM, and researchers from the University of Montana to organize volunteers to cover a large portion of the watershed thought to have wolves. As the effort developed, >100 volunteers took part annually over the next 4 years. Volunteers used track identification guides and standard data collection forms to document all wolf sign and observations. The completed forms were reviewed by FWP wolf management specialists, who produced a report that was widely disseminated in the community. The report estimated the number of wolf packs, total wolf numbers, and their approximate distribution.

An important benefit from this collaborative effort was that the co-generation of data on wolf activity with community members helped dispel rumors that there were large numbers of wolves in the watershed. Participants could see for themselves actual wolf tracks, sign, and better understand how wolves and respective wolf packs used the landscape. The collaboration during winter surveys was an opportunity for FWP and community members to share knowledge about wolves, behavior, and general ecology. Much like the learning process that took place 5 years earlier with grizzly bears, the information sharing from FWP and community members increased trust and credibility and the believability of information about wolves among stakeholders.

Livestock and wolf monitoring using range riders, 2008–2015

Livestock herd supervision has been practiced

for centuries throughout the world and is considered a preventive tool to help reduce livestock losses to carnivores, including wolves (Boitani 2003). Researchers have found that the spatial distributions of predator and prey species vary with human activity levels (Hebblewhite et al. 2005, Muhly et al. 2011). Prey species were more prevalent in areas with high human activity, and predator species including wolves avoided high human use areas—hence, the rationale for increasing herd supervision rates by using range riders. Ranchers in the Blackfoot Valley Watershed were supportive of this logic and welcomed additional human presence using range riders as a possible tool to reduce problems with wolves (Figure 2).

Another tool that we were aware of was fladry (Figure 3). This is a type of fencing that uses interspersed flagging attached to a line or cord to create a psychological avoidance response (novel stimuli) in wolves and has been shown to be an effective way to deter wolves when strung around livestock pastures (Musiani et al. 2003). Electrified fladry, using a line of poly-wire, reinforces a fear response in wolves by adding an electric shock (Lance et al. 2010).

With the arrival of wolves in 2007 and subsequent depredations, several ranchers were justifiably concerned, particularly those whose private lands and public grazing allotments fell within the newly established territory of the Elevation Mountain Pack. The Wildlife Committee addressed this development and discussed the use of more intensive livestock monitoring using a range rider. We approached a highly respected family ranch whose operation was within the wolf pack territory, and they agreed to collaborate. By the summer of 2008, the Wildlife Committee and the cooperating ranch provided funds to hire a family member from the ranch and an assistant range rider to pilot test the first range rider effort in the watershed. Using a volunteer agreement with FWP, each range rider was trained in the use of ground-based, very high frequency telemetry (Figure 4).

Livestock were checked daily by the range rider throughout the grazing season (May 1 to October 31) on public grazing allotments on horseback, all-terrain vehicles, and a truck. There were no known livestock depredations by wolves on this ranch for that first season.

Figure 3. Fladry fences were also used to create a psychological avoidance response (novel stimuli) in wolves (*Canis lupus*). Electrified fladry, using a line of poly-wire, reinforces a fear response in wolves by adding an electric shock. The fladry spooling system depicted above was developed by rancher Jim Stone (*photo courtesy of S. Wilson*).

Figure 4. An important aspect of the range rider effort was the capture and radio-collaring of adult wolves (*Canis lupus*) by FWP in areas with known packs. By knowing the location of the radio-collared wolf, range riders could more regularly maintain a human presence in targeted areas to help discourage livestock depredations by wolves and to improve assessment of livestock condition and vulnerability to wolves (*photo courtesy of T. Parks*).

This initial effort was important for several reasons. First, by starting with a respected ranch family and hiring a local family member who was highly competent and well known in

the community, there was a favorable response from the ranching community that range riders could be considered a useful tool. Second, FWP and the BC earned credibility from the ranching community by responding to the perceived threat of wolves in a timely manner. And third, the early adoption of a range rider by a respected and traditional family ranch ultimately helped to accelerate use and acceptance of the tool across multiple ranches at larger scales over the ensuing years.

By start of the 2009 grazing season, anticipating an increase in wolf numbers, the FWP and Wildlife Committee hired a new range rider and 2 assistant range riders. The next several years were important for developing and deepening the partnership and collaboration among FWP, range riders, and the livestock community under the BC auspices.

Through regular meetings of the Wildlife Committee, care was taken to identify key roles and responsibilities among FWP, range riders, and cooperating ranchers for each 6-month season (May 1 to October 31). This helped to maximize our collective focus on relevant wolf-related factors and livestock-related factors related to risk of livestock depredations by wolves. This was essential as wolf numbers continued to rise and the range riders increasingly found themselves having to make targeted decisions about where to focus their efforts.

By 2010, FWP had documented 5 wolf packs in the watershed, and by 2011, the number of confirmed packs had doubled to 10 packs (Sime et al. 2011, Hanauska-Brown et al. 2012). The wolf population in the watershed leveled off in 2012 with approximately 12–13 packs with 45–50 individuals (Bradley et al. 2014). At this time, range riders generally began to understand where wolf pack territories were likely to be established and which specific livestock herds and pasture locations were at more or less risk. On a given year from 2007 to 2015, range riders and assistants worked closely with 15–18 ranchers to seasonally monitor 650–800 cow/calf pairs. Range riders were in direct contact with another 40–50 livestock producers and ranchers and produced a bi-weekly wolf report that was e-mailed to another 150 interested stakeholders and posted on the BC website.

In addition to increasing human presence and livestock herd supervision rates as a means to deter potential wolf depredations, range riders took regular proactive or risk prevention actions in cooperation with participating ranchers that included the following: 1) delayed pasture use when wolves were present, 2) detection and recovery of lost livestock, 3) detection and removal of sick/injured livestock, 4) detection and removal (when possible) of naturally occurring livestock carcasses, 5) detection of livestock carcasses from predation for investigation by WS for possible compensation by the state of Montana, 6) general herd health surveillance, 7) deployment of fladry when needed, and 8) assisting producers with fall gathering and assessment of cause of death for possible missing livestock.

Results

Wildlife Services provided reports to FWP regarding confirmed livestock losses to wolves. Initial results for the period of 2007 to 2015 suggested that livestock losses to wolves have been low while the wolf population increased exponentially for the same period (Coltrane et al. 2015). Annual confirmed livestock losses (calves and sheep) to wolves were 2.2 livestock per year. Less than 3 wolves per year have been removed (2.4 wolves per year) due to these depredations for the same period (Figure 5). While we do not claim cause and effect from our combined efforts of electric fencing to protect calves, livestock carcass removal, or range riders and the low levels of livestock losses to wolves, our proactive and preventive efforts appeared helpful. It was encouraging that as wolf numbers steadily increased from 2007 to 2015, we did not observe a commensurate spike in wolf–livestock conflict. As wolf numbers appeared to stabilize, livestock losses to wolves and the need to remove wolves for depredations have remained low.

The range rider effort in the Blackfoot Valley Watershed was well supported by the livestock community and invested stakeholders. While increased herd supervision rates and human presence may help reduce the frequency of encounter rates between livestock and wolves and subsequent depredations, this metric is difficult to measure without rigorous pre- and post- quasi-experimental design. Nonetheless, we have observed that among the benefits of

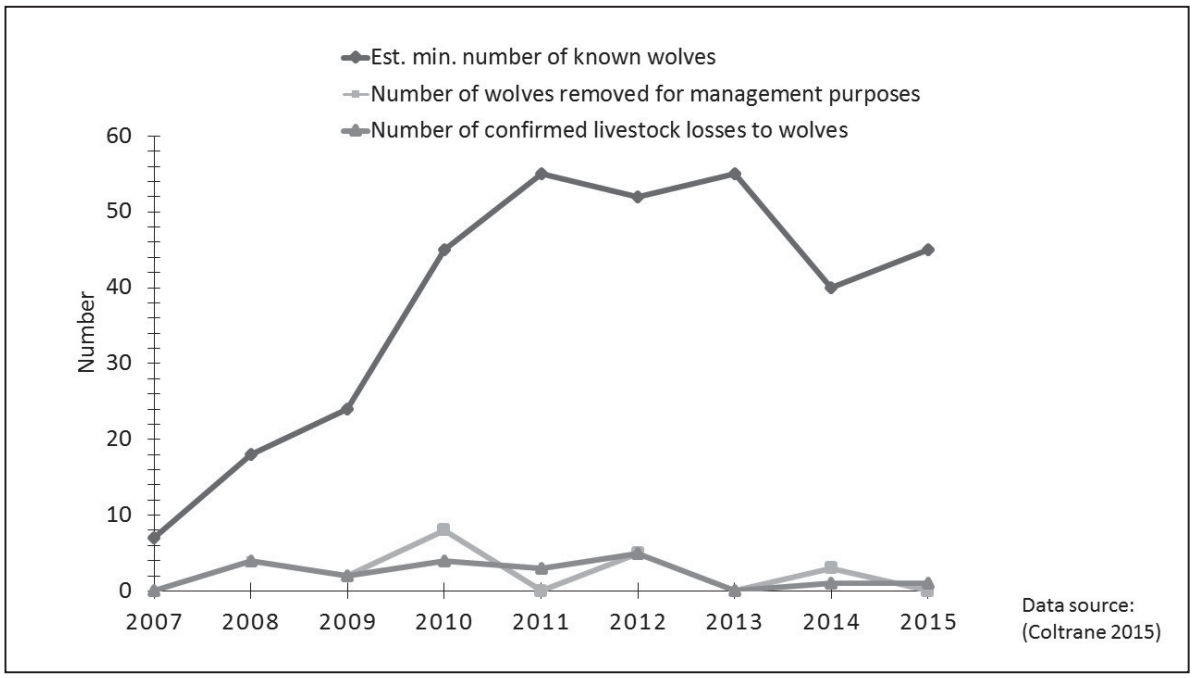

Figure 5. Estimated minimum number of known grey wolves (*Canis lupus*) in the Blackfoot Valley Watershed, wolves removed for management purposes, and confirmed livestock losses to wolves in Blackfoot Valley Watershed, 2007–2015.

this effort has been increased communication among stakeholders about wolf activity, wolf pack locations, and the proactive actions that range riders and ranchers collectively take when there is more information available about livestock herd vulnerability.

A researcher who conducted extensive interviews with participating ranchers in the range rider program found similar responses by participants involved in the effort (Parks 2015, Parks and Messmer 2016). We also heard directly from ranchers involved in the effort that range riders helped them feel supported by FWP and the Wildlife Committee, and that having more intensive livestock herd monitoring reduced their anxiety about wolves and potential livestock losses. Additionally, range riders were helpful in detecting livestock killed from natural causes and not from predators—an important way to reduce the chances that wolves or other carnivores were blamed for suspected losses.

Lessons learned

There is no one-size-fits-all approach to living with large carnivores like grizzly bears and wolves. However, we have learned as a general lesson that there are 4 foundations from which to foster collaboration and build partnerships to address human–carnivore coexistence. These are: 1) there must be some coordination of resources, 2) efforts should be informed by science, 3) stakeholder values must be incorporated, and 4) a decision-making process must be present to rationally discuss the issues, make decisions, and implement actions in a participatory manner with stakeholders (Burnett 2013, Wilson et al. 2014, Wilson 2016).

The existing capacity of the BC was critical for coordinating stakeholder values, developing collective goals, and bringing the biological and technical skills of key wildlife managers and local knowledge of landowners and ranchers together to effectively implement projects. Second, as was the case for both grizzly bears and wolves, we relied on existing research and the latest science and management to help inform different strategies and projects to systematically and proactively address the presence of wolves. Third, throughout all of our work, keen attention was paid to respecting and incorporating all stakeholder values from those who lived and worked in the watershed to those who from outside the area but who also had keen interest in conservation of the watershed and its wildlife. And fourth, the BC process was critical for managing and integrating these different

values using a non-advocacy and consensus-driven process through the inclusive forum of the Wildlife Committee. This inclusive and creative forum for decision making fostered direct participation of ranchers and landowners in the projects described in this case study.

Conclusions

We recognize that there are ecological and management factors that should be acknowledged when interpreting the above results. These included abundant ungulate populations, small wolf pack sizes likely due to hunting and trapping seasons (2009, and 2011 to the present), seasonally livestock-free areas for several wolf packs, and difficult hunter and trapper access due to private land patterns in the Blackfoot Valley Watershed. All of these factors likely contribute to low levels of livestock depredations and may help maintain a population of wolves in the watershed.

The efforts described in this article are based on a spirit of collaboration and partnerships. The trust, credibility, and reservoir of BC social capital was instrumental in generating an inclusive process that allowed stakeholders to work together to successfully respond to and live with wolves. Having the means to manage and integrate a diversity of values was essential for being able to employ a host of tools for living successfully with wolves in the American West.

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