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Original Article

Participant Perceptions of Range Rider Programs Operating to Mitigate Wolf–Livestock Conflicts in the Western United States

MOLLY PARKS,[1,2] *Jack H. Berryman Institute, Utah State University, 5230 Old Main Hill, Logan, UT 84322, USA*
TERRY MESSMER, *Jack H. Berryman Institute, Utah State University, 5230 Old Main Hill, Logan, UT 84322, USA*

ABSTRACT As gray wolf (*Canis lupus*) populations have expanded in the western United States, wolf depredation of domestic livestock has increased. Concomitantly, wildlife managers are seeking management tools to mitigate wolf–livestock conflicts and enhance stakeholder support for conservation efforts. Range Rider Programs (RRPs) have emerged as a nonlethal management strategy that advocates the use of increased human surveillance of livestock herds in areas occupied by wolves to reduce wolf–livestock conflicts. However, little information is available about the scope of contemporary northern Rocky Mountain (NRM) RRPs or participant perceptions about the potential for the programs to mitigate these conflicts. We conducted semistructured phone and personal interviews with 51 participants from 17 RRPs in Montana, Oregon, and Washington during January to April 2014 and October 2014 to January 2015 to develop a typology of NRM RRPs and assess participant perceptions of current programs. Although the RRPs we studied varied in context, program focus, and scale, they shared similar organizational components that included a sponsor; collaboration among several organizations; a funding mechanism; a structure that included a supervisor, the landowner(s), and the range rider(s); and a mechanism for stakeholder feedback. We identified 3 unique RRP versions based on the primary focus of the programs: 1) livestock monitoring, 2) wolf surveillance, and 3) livestock herding. Although participants identified a number of benefits (e.g., increased information about wolf activity, extra herd supervision, rapid carcass identification), they also identified challenges that affected program sustainability. Challenges pertaining to trust and open communication were inherent in several programs; however, the lack of stable funding was viewed as a major threat to program sustainability. The final challenge to RRPs' sustainability was the largely unproven success of this strategy. © 2016 The Wildlife Society.

KEY WORDS *Canis lupus*, gray wolf, livestock depredation, nonlethal management, Range Rider Program, species conservation, wolf–livestock conflicts.

The reintroduction of gray wolves (*Canis lupus*; wolf) into the northern Rocky Mountains (NRM) ecosystem has increased rancher concerns about depredation and sublethal effects on domestic livestock (Fritts et al. 2003, Bangs et al. 2005). Though direct losses from wolf depredation of livestock are a primary concern for ranchers, indirect effects on livestock in areas inhabited by wolves may include decreased weight gain (Ramler et al. 2014). Wolf–livestock conflicts, both perceived and real, can reduce tolerance for wolf conservation, presenting economic and political challenges for management agencies (Fritts et al. 2003, Naughton-Treves et al. 2003, Meadow et al. 2005, Heberlein and Ericsson 2008).

Further exacerbating rancher and other stakeholder concerns is the dynamic environment surrounding the legal status of the wolf under the federal Endangered Species Act and thus, its management in the NRM. There have been several shifts in wolf management authority between federal protection and state management in response to litigation (U.S. Fish and Wildlife Service [USFWS] 2014). These fluxes in policy have polarized opinions of wolf conservation (Treves and Bruskotter 2011) because some stakeholders may perceive it eliminates their participation in wolf management and diminishes the increased feeling of control rural residents may experience when wolves are delisted (Houston et al. 2010).

As the NRM wolf populations expand, wildlife managers, ranchers, and stakeholders are seeking new tools to mitigate

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[1]*E-mail: brown.s.molly@gmail.com*
[2]*Present address: 19600 Leo Hansen, Florence, MT 59833, USA*

the potential effects of wolves on livestock (Bradley and Pletscher 2005). To address both wolf conservation and damage to livestock, wildlife managers implement both lethal and nonlethal management strategies to mitigate conflicts (Bangs et al. 2006). Although a wide variety of lethal and nonlethal tools have been implemented to reduce the effects of wolves on livestock, conflicts still remain (Sime et al. 2007, Harper et al. 2008). Lethal control has not been singularly effective and faces increased scrutiny from many stakeholders (Bangs et al. 2005, Bradley et al. 2015).

Bradley et al. (2015) reported that wolf pack size was the best predictor of a recurrent depredation event, with the probability of a wolf–livestock depredation event recurring within 5 years increased by 7% for each animal left in the pack after a lethal management response. Their research suggested that to effectively reduce wolf–livestock depredations would require a management focus that reduced pack size. However, as the number of wolves left in a pack declines, they noted the likelihood that the pack would meet federal criteria focused on population-recovery goals decreases.

Nonlethal options are often limited by cost and the scale of landscape on which they are needed (Shivik 2004). Bradley and Pletscher (2005) compared pastures where wolf depredation of domestic cattle (*Bos taurus*) was reported in Montana and Idaho, USA, to adjacent pastures where no depredation was reported. Pastures where depredation occurred tended to be larger, had more cattle, and were located farther from residences than pastures without depredations. They recommended increased husbandry of livestock in areas occupied by wolves as a potential strategy to mitigate depredations.

The Range Rider Program (RRP) has been identified as an example of a nonlethal tool that may function on a large enough landscape to reduce wolf–livestock encounter rates through increased livestock husbandry and herd supervision. Herd supervision is an ancient concept for increasing herd productivity and reducing risks from predators (Bollig et al. 2013, LaRocque 2014). Although RRPs in the western United States are incorporating animal husbandry techniques to mitigate wolf–livestock conflicts, the programs are relatively new and lack formal evaluation. Little is known about the structure, application, benefits, and challenges of the RRP nonlethal strategy (Fig. 1).

Although a rigorous scientific evaluation of RRPs' effectiveness in reducing wolf–livestock depredation is needed, participant perceptions regarding program benefits and challenges may provide stakeholders with important insights regarding the sustainability of RRPs as a nonlethal management option to mitigate wolf–livestock conflicts. Our objective was to first develop a typology describing the scope and operational structure of the RRPs in the NRM. Second, we were interested in documenting RRP participant perceptions regarding potential program benefits and challenges. Our results may facilitate development of experimental research to evaluate the effect of range riders on mitigating wolf–livestock interactions.

Figure 1. Range rider in Montana conducting radio telemetry to monitor wolf activity around livestock.

STUDY AREA

A list of known RRPs in the NRM was developed through communications with an RRP coordinator from the longest running program in Montana. The coordinator provided information to structure our evaluation and facilitated access to all of the RRP coordinators in the NRM (Singleton and Straits 2010). This information facilitated the development of the list of contemporary RRPs in Idaho, Montana, Oregon, and Washington (USA). The RRP efforts identified in Idaho monitored domestic sheep (*Ovis aries*), while the Montana, Oregon, and Washington RRPs monitored domestic cattle. To reduce variability in RRPs from differences in livestock species, and because sheep management typically incorporates herders on account of historical coyote (*C. latrans*) depredations (Shivik 2004), Idaho RRPs were not included in this study.

We subsequently identified 17 cattle-based RRPs in the NRM, all of which were included in this study (Table 1). This list included 10 programs from Montana. Because Montana exhibited the largest wolf population (USFWS 2014, Bradley et al. 2015), more RRPs were operating in the state. Five programs from Washington and 2 programs from Oregon also were included in the study. The Washington and Oregon study areas had smaller wolf populations and the RRP efforts were generally more limited in scope and duration (USFWS 2014).

Each of the Washington RRP efforts were funded and coordinated by the same 2 groups (a nongovernmental organization [NGO] and the state agency), although the programs were geographically separated. Similarly, 2 efforts in Montana were operated by the same NGO and also geographically separated. Furthermore, the coordination duties and leadership changed for one RRP in Oregon halfway through the program period, changing the program focus and creating 2 unique RRPs. Thus, the range of cattle RRPs incorporated in our study reflected the contemporary status of wolf recovery efforts in the NRM.

Table 1. Typology of Range Rider Programs (RRP) operating in the Montana, Washington, and Oregon (USA) that were evaluated during the 2014–2015 RRP research program, Utah State University, Logan, Utah, USA. N/A, not applicable.

Programs		Ranch characteristics			RRP operation			Wolves		
RRP timeframe	**Years operated**	**No. head**	**No. ha**	**Grazing land type**	**No. ranches**	**No. riders**	**Coordinators[a]**	**Federal wolf status**	**No. wolf packs**	**Collars[b]**
Current RRPs: ≥3 yr	2008–present	15,000	8,000–20,000	Public, private	10–12	2–3	NGO, state, CBO	Listed, delisted	13	VHF
	2011–present	15,000	20,000–40,000	Public, private	7	1	2 NGO, state, CBO	Delisted	1–2	NO
	2012–present	N/A	>40,000	Public, private	35	1	State, CBO	Listed	2	GPS
	2012–present	1,500	20,000–40,000	Public	1	1	NGO, state	Listed	1	GPS*
Current RRPs: 1–2 yr	2013–present	1,500	4,000–8,000	Public, private	5	2–3	3 NGO, state	Delisted	1	NO
	2013–present	900	8,000–20,000	Public	1	1	NGO, state	Listed	1	GPS*
	2013–present	300	200–2,000	Private	1	1	NGO, state	Listed	1	GPS
	2014–present	>2,500	4,000–8,000	Public, private	2–5	1	NGO, CBO	Delisted	0–1	NO
	2014–present	200	8,000–20,000	Public, tribal	1	3 P/T	NGO, state	Listed	1	GPS**
	2014–present	300	8,000–20,000	Public	1	1	NGO, state	Listed	1	GPS**
Past RRPs: no longer operating	2003–2007	2,000	4,000–8,000	Private	1	1	NGO, state, CBO	Listed	1	VHF
	2004–2008	2,750	4,000–8,000	Public	5	2	2–3 NGO, state, CBO	Listed	2	NO
	2005–2007	1,500	20,000–40,000	Public, private	8	1	2 NGO, state, CBO	Listed	2	VHF
	2007–2008	2,000	8,000–20,000	Public, private	1	1	NGO, state	Listed	1	VHF
	2010–2011	N/A	>40,000	Public, private	60	1	NGO, state	Listed	1	GPS
	2012–2013	300	<200	Public	1	2	NGO, state	Delisted	1	VHF
	2013–2014	380	<200	Public, private	1	2	NGO	Delisted	1	NO

[a] Nongovernmental Organization (NGO), Community Based Organization (CBO).
[b] VHF—very high frequency; GPS—global positioning satellite; GPS*—collar lost during RRP; GPS**—collar on wolf pack but not utilized by RRP; NO—no radiocollar.

METHODS

We compared RRPs and participant perceptions using information collected through semistructured interviews with program coordinators, ranchers involved with the programs, and range riders (Reed et al. 2009). A semistructured interview allows for new ideas to be brought up during the interview as a result of interviewee responses. The interviewer develops and uses a set of questions based on the topics that need to be covered during the conversation, usually in a particular order. The interviewer follows the guide, but is able to follow topical trajectories in the conversation that may stray from the guide when deemed appropriate. Semistructured interviews are useful for in-depth insights to stakeholder relationships (Reed et al. 2009).

Because only 17 cattle-based RRPs were in, or had operated in, the NRM, we included all identified programs in our study. This sampling method was warranted because the primary objective was to develop an understanding of breadth and depth of current (and historical) NRM RRPs (Reed et al. 2009, Singleton and Straits 2010).

We subsequently contacted all NRM RRP participants recommended by the program coordinators to solicit their participation for interviews. For the larger RRPs (>20 rancher participants), we concluded our interviews when the information obtained from our data reached saturation. In social research, saturation defines the point of redundancy at which no new information can be obtained from further data collection from other participants (Glaser and Strauss 1967, Reed et al. 2009). Accordingly, when RRP-participant interview responses became repetitive, interviewing for that specific program was terminated.

The combination of nonrandom and saturation sampling could produce a bias if the coordinators or ranchers initially interviewed recommended like-minded individuals for sampling. To mitigate this potential source of bias, we interviewed the key individuals in RRPs with >20 ranchers (Reed et al. 2009, Singleton and Straits 2010). Key individuals were defined as those persons who operated the larger cow–calf operations and herds that grazed larger pastures. Bradley and Pletscher (2005) identified larger cow–calf operations as those that encompassed larger pastures; these operations were at higher risk to wolf–livestock depredations (see Bradley and Pletscher 2005: table 1). Thus, the ranchers most likely affected by wolf presence and most likely engaged with the range riders on an individual basis were interviewed.

To develop the typology, we interviewed key personnel from agencies partnering in each RRP effort ($n = 20$) January 2014 through April 2014 using a semistructured phone interview to define program structure, operations, and duration (Reed et al. 2009). The interviews identified 1) the time span of the program; 2) whether the program has ended and, if so, for what reasons; 3) how information was communicated in the program; 4) how many range riders were employed; 5) rider duties, time periods that riders actively monitor cattle, area that riders monitor; 6) what type of transportation each rider uses (e.g., horse [*Equus ferus caballus*], four-wheeler, dirt-bike, truck); 7) information regarding risk-reduction actions; and 8) levels of wolf activity (i.e., no. and size of wolf packs covered by RRP area). Our interviews also identified any other nonlethal tools that were used in addition to the RRP (e.g., carcass removal programs, fladry) and trends in livestock losses to known predation prior to and following RRP implementation. We asked the coordinators to identify program's strengths, weakness, successes, and areas for improvement (Reed et al. 2009).

Through interviews with RRP coordinators, we identified participating ranchers. The coordinators initially contacted the participating ranchers to determine interest in participation and initiate interview scheduling. We conducted participating rancher interviews ($n = 25$) October 2014 through January 2015 using a semistructured face-to-face interview protocol (Reed et al. 2009). We asked respondents to describe their ranching operation and role on the ranch. We also asked them to identify rider duties and their expectations for an optimal range rider. Because interviews were semistructured, new information emerged. The structure of the interview process was flexible to accommodate this new information (Reed et al. 2009). We also asked the ranchers to identify program's strengths, weakness, successes, and areas for improvement.

Range riders employed by each program were also identified by respective RRP coordinators. The coordinators initially contacted the range riders to solicit their participation in the study. Range rider interviews ($n = 6$) were conducted October 2014 through January 2015 using a subset of questions from the coordinator interview guide. We asked questions designed to obtain information about rider background, their perception of rider duties and activities, levels of wolf activity (i.e., no. of wolves, frequency of encounters), communications, perceived effects (e.g., changes in wolf movements or behavior, reduction in livestock losses), and areas for program improvement.

It is also important to note that interview respondents in each group (i.e., coordinator, rancher, range rider) do not strictly fit a single category because the groups were not mutually exclusive. For example, a coordinator for one program could also be a rancher; a rancher could be the range rider; the coordinator could be a range rider; or they could all be one and the same person. Thus, more individuals in each group were contacted than the sample size suggests. For example, although 6 interviews were conducted with range riders, 3 additional range riders were previously interviewed as coordinators. Therefore, the overlapping roles of participants observed in several RRPs influenced the sample size and reduced the number of interviews conducted.

All survey instruments were pretested prior to implementation in the field (Reed et al. 2009). The survey instruments used were reviewed and approved by the Utah State University Institutional Review Board process (IRB Protocol no. 5491).

Data Analysis

Interviews were transcribed, printed, and initially read to gain an increased familiarity with interview responses (Reed et al. 2009). A second reading of transcripts enabled development of an outline of key points for each interview. Using these outlines, and a third review of the interviews, transcripts were hand-coded to identify common themes for each group (coordinators, ranchers, and range riders). We used these themes, along with data collected from responses to pertinent interview questions, to describe RRP structure and scopes and assess program benefits and challenges as perceived by the participants that may affect the sustainability of RRPs (Reed et al. 2009).

RESULTS

Program Overview—Status and Purpose

We conducted interviews with 51 participants in 17 RRPs in 3 states. Range Rider Programs were implemented in Montana, Oregon, and Washington, with the earliest program beginning in 2003 (Table 1). Seven of the efforts (41%) have ended (6 in MT and 1 in OR), while 10 of the RRPs (59%) were currently operating (4 in MT, 1 in OR, and 5 in WA).

Fifteen of the 17 programs (88%) were developed primarily as a nonlethal option for mitigating wolf–livestock conflict by increasing human presence in areas grazed by cattle that also encompassed wolf territories. Two RRPs (12%) were implemented primarily to enhance range health through intensive herding practices, but secondarily to reduce wolf–livestock conflicts. Every RRP engaged a person(s) to "ride-the-range" to provide a human presence. Based on the range of definitions and program descriptions obtained through the interview process, 3 main categories emerged. However, these categories were not mutually exclusive, but included 1) livestock monitoring, 2) wolf surveillance, and 3) livestock herding.

Livestock monitoring RRPs primarily engaged range riders to increase herd supervision for cattle. These riders also recorded herd behavior, detected herd health concerns, identified potential wolf depredation attractants in a grazing area (i.e., carrion and livestock carcasses), while creating a human presence around livestock. Rapid detection and reporting of potential problems enabled ranchers to efficiently address concerns and reduced risks to the herd.

Wolf-monitoring RRPs engaged riders to provide increased information on wolf location and activity, or in some cases, the lack of wolf activity in an area. Riders tracked and located wolves using a variety of methods including ground-tracking, howling surveys, trail cameras, and radiotelemetry with either global positioning satellite (GPS) transmitters or very high frequency (VHF) radiocollars. The riders used information obtained through radiotelemetry to detect areas of relatively great wolf use (such as rendezvous sites, commonly used travel routes, and areas with the greatest potential risk to livestock) to focus range riding efforts. Riders also actively hazed wolves in these locations (Fig. 2).

Figure 2. Radiocollared wolf in Montana.

Livestock-herding RRPs were livestock-centric and functioned to rekindle cattle's herding instinct to mirror the behavior of wild ungulates. Riders used low-stress livestock-handling techniques to keep cows and calves paired and herds grouped. One additional goal of intensive herding was to improve rangeland health through actively managing herd grazing distribution and intensity. Herding allowed riders to mitigate the potential for overgrazing, prevent overuse of riparian areas, and facilitated weed management.

We identified common RRP objectives despite logistical differences among programs. These included 1) establishment of a human presence to reduce the negative effects of wolves on livestock; 2) increased the level of information on wolves and livestock through increased human presence and monitoring; 3) increased communication of information to participants; 4) development of a collaborative framework for addressing wolf–livestock conflict that included agencies, ranchers, and conservation groups; 5) increased coexistence between people and wolves by helping maintain ranch sustainability; 6) reduced the number of conflicts that result in lethal wolf removal; and 7) improved range health.

Organizational Components of the RRP

The RRPs' organizational structure included a sponsoring organization(s), a funding mechanism, and some form of command-and-control that included a supervisor (i.e., a coordinator), the landowner(s) who utilized a RRP's service (i.e., ranchers), someone in the field who did the work (i.e., the range rider), and a mechanism that provided periodic feedback. Program sponsors included conservation groups, community-based organizations, and state agencies (Table 1).

For the purpose of our study, conservation groups were defined as NGOs that functioned to conserve natural resources and were based outside of the communities in which they coordinated RRPs. Community-based organizations were defined as local groups based in the community in which the RRP was implemented (i.e., watershed groups, ranching groups, county stock growers associations). State agencies were defined as state governmental fish and wildlife agencies that were responsible for recovering and managing wolf populations.

Each RRP was directed by an individual(s) who had the primary responsibility to coordinate the program. Coordination duties typically included designing and implementing the RRP; providing funding; training riders; providing rider support; and maintaining communication among partners, ranchers, and riders. In 12 of the 17 RRPs, one (or more) conservation group representatives were coordinators. In 6 of the efforts, a community-based organization representative was a coordinator, and in 12 of the efforts, a state agency representative (often a wolf biologist) served as the coordinator. Additionally, 5 coordinators had overlapping responsibilities by serving as both coordinators and ranchers that used the RRPs. Furthermore, 3 of these 5 coordinators were also the range riders.

Ranchers that participated in the Montana, Oregon, and Washington RRPs worked full-time on their livestock operations, whether as owners or managers. Three of 25 rancher participants managed a ranching operation for an absentee owner, but most described their ranches as family operations. All 25 ranches were identified as cow–calf operations, 2 of which included yearlings and 2 of which were secondary stock-cow operations.

Ranch characteristics that varied most were the number of head on each ranch, the ownership of land grazed by each ranch, and the area of land grazed by cattle on each ranch (Table 1). The number of livestock for each ranch ranged from 100 cow–calf pairs to 1,300 cow–calf pairs plus 150 stock calves. Ranchers described the type of land grazed by their ranch as one of many combinations of the following: private, deeded, leased, state, U.S. Forest Service, Bureau of Land Management administered lands, and tribal lands. Rancher interviews also identified the area grazed by each ranch (Table 1).

Range riders monitored wolves and livestock and in some cases, were responsible for herding cattle. Range rider duties varied based on program focus and targeted their efforts according to program "version" (i.e., livestock monitoring, wolf surveillance, livestock herding). Three of the 6 range riders interviewed had a background working with livestock. Two of these 3 worked on the ranch prior to official hiring and funding through the RRP. A fourth rider had a background in hunting and trapping, and a fifth rider had a background in working with grizzly bears (*Ursus arctos horribilis*). Five of the 6 range riders interviewed had lived or worked in the area they were hired and knew the ranchers prior to range riding. Four of the range riders were selected by ranchers, one rider was approached by a conservation group (though was hired to ride for the family ranch), and one was hired by a community-based organization.

Technical Components of the RRP

The basic tenet of all the RRPs was the provision of a human presence in areas inhabited by wolves. Human presence was defined as routine human activity on the landscape around livestock, which wolves would detect and avoid. Despite program reliance on this concept, coordinators, rancher, and rider responses suggested this term was loosely applied and was not well-understood in terms of optimal utilization. Human presence ranged from targeted and active presence to dispersed presence. The amount of effort a rider could put into one area was dependent on the size of the RRP area that needed monitoring, along with a variety of other factors (e.g., topography, no. of ranches to monitor, no. of livestock).

Range riders used a variety of transportation methods based on the area they needed to cover and objectives of their particular RRP effort. The most common were horses and all-terrain vehicles (ATVs) or motorcycles. Eight RRPs used only horses, 4 used only ATVs, and 5 used a combination of horses and ATVs.

In 11 RRPs, ranchers were involved in the range rider selection process; whereas in 3 efforts, program coordinators selected the individual. In another 3 efforts, a rancher was the range rider (and the rancher was also a coordinator). Regardless of who conducted the hiring, expectations for an optimal range rider were identified. Most coordinators agreed that ranchers preferred a known and trusted individual to conduct range riding, often represented by someone that had worked for them in the past, a family member, or a local individual from the community. Ranchers expected a strong work ethic, along with knowledge of the area, and knowledge of cattle, as one rancher suggested "older cowboys or ranchers—semiretired would be best" (Anonymous, personal communication). Ranchers also expected some level of wildlife knowledge or tracking skills, as well as horse skills, suggesting a rider should have the ability to track animals, handle a horse, and communicate with the livestock owner. The importance of good communication skills was also emphasized. Furthermore, many ranchers believed riders must be capable of working alone and safely in rugged, isolated areas that might be inhabited by grizzly bears.

In 10 RRPs, radiocollars were used to help target range rider efforts and increase rider efficiency (Table 1). The radiocollars provided wolf location information to determine locations with greatest risk for wolf–livestock conflict and aid riders in planning their day's work. Seven RRPs had no access to radiocollars, 5 programs used VHF collars, and 5 programs had GPS collars with VHF capabilities (Table 1). Two programs lost use of their GPS collars due to wolf mortality.

Program Costs

The cost of an RRP for one grazing season ranged from US $20,000 to $40,000. Funding for 9 programs came from non-NGOs and grants. Funding for 2 efforts came from state agencies and funding for 5 efforts from a combination of state and NGO funds.

In Montana, the Montana Livestock Loss Board provided one-time grants to several RRPs. In Oregon, funding initially came from the state Wolf Management Program, but during the course of the RRP the source changed. The new funds came from the Oregon Department of Agriculture, where money was funneled through the county to the RRP. Washington also had state money available to help fund their RRP. With funds provided by the state legislature, the state Department of Fish and Wildlife developed a 50:50

cost-share program to support range riders. The RRP cost-share approximated $10,000. To further assist with funding, a conservation group helped ranchers by providing matching funds.

Coordinator, rancher, and range rider responses facilitated identification of shared RRP benefits (Table 2). Because programs were context-specific and unique in many ways, these benefits may have been weighted differently for each effort. However, this list was still central to most RRPs and included depredation mitigation; technical benefits that included increased information about livestock and wolves, and rapid carcass identification; proactive nonlethal; and social benefits that included reduced stress, improved public perception, empowerment, and trust building (Table 2).

Overall, RRPs were uniquely adapted to their specific context. Though the RRPs shared similar goals, each RRP operation varied greatly, reflecting the location, time period and duration, federal status of wolves, level of wolf activity, number and type of coordinating groups, number of rancher participants, number of livestock, area and terrain, and availability of radiotelemetry technology. Although RRPs may have differed in longevity and operations, 4 common themes emerged during the interviews. The 4 themes included 1) sustaining a human presence as a depredation deterrent; 2) the use of radiocollars or GPS transmitters to monitor wolf packs; 3) trust, relationships, and politics; and 4) a stable funding source to ensure program continuity.

Depredation Deterrent

Although RRP participants concurred that the sole purpose of the range rider was to establish a human presence, the roles and responsibilities of the range rider differed according to the context of each individual RRP situation (e.g., level of wolf activity, area and terrain, no. of livestock, federal wolf status). The RRP participants also differed in their definitions of, and terminology used to describe, what constituted an RRP and a range rider. Their perceptions influenced daily RRP operation. These differences surfaced in the initial interviews with program coordinators. As interviews were completed with other RRP participants, the diversity in range rider definitions increased. The definition of a "range rider" varied not only among sponsors (i.e., conservation group, state agency, community organization), but within each of those groups as well.

Additional concerns were voiced by participants regarding the effectiveness of human presence in deterring wolves. Throughout the interview process, anecdotal stories surfaced that suggested range riders successfully prevented potential depredations by hazing wolves away from cattle. However, respondents also noted that despite frequent detection of wolf activity, actually seeing a wolf was rare and hazing opportunities were uncommon. Furthermore, a common response from coordinators and ranchers was that range riders did not reduce the likelihood of a wolf attacking livestock.

Participants often described wolves as intelligent animals that habituate to humans when no negative consequence is associated with the interaction. The coordinators' and ranchers' opinions about the effectiveness of the human presence in deterring wolf–livestock depredations were mixed, but all agreed that increased husbandry provided information through trusted reports and observations. They also agreed that riders were so widely dispersed that their limited presence in any one area was not sufficient to alter wolf movements. Thus, the riders could reduce livestock losses to predation, but felt they imparted little deterrence.

Radiotelemetry

Participant perceptions regarding radiotelemetry—either VHF or GPS—highlighted the multifaceted and complex nature of these technologies in relation to the legal status of wolves (Bradley et al. 2015). Proponents of radiocollars believed the technology helped range riders target their efforts on a large landscape. Aside from increase range rider efficiency, many participants felt ranchers appreciated the information about wolf locations that range riders provided through use of radiotelemetry.

However, when wolf radiocollars were available and utilized by range riders, additional concerns surfaced. The location data obtained from a radiomarked wolf may only represent one individual, and not the pack. Additionally both GPS and VHF collars were reported to have technical limitations that included inconsistent downloads from GPS collars and difficulties associated with rider access to GPS locations.

Ranchers agreed that use of radiocollars by riders could increase RRP efficiency, particularly in programs where riders were expected to find dispersed cattle on a large landscape. Ranchers also identified radiotelemetry as a source of conflict and distrust between government agencies and the ranching community when the wolf information obtained from agency use of radiotelemetry was not shared frequently or was otherwise withheld. For riders tracking wolves, they also described how quickly and how far wolves could travel, explaining the challenges of knowing where to focus efforts. In summary, program participants generally believed radiomarking of wolves, either with GPS or VHF technology, helped to mitigate some of the challenges faced by ranger riders on large landscapes by offering some guidance for where to begin the day.

Table 2. Perceived benefits and challenges of Range Rider Programs (RRPs) in Montana, Oregon, and Washington (USA) based on interviews of participants, conducted during 2014–2015.

Shared RRP benefits	Current and future challenges
Depredation mitigation	Riders spread thin
Herd information	Use of tools
Wolf information	Social challenges: varying levels of trust
Rapid carcass ID	Use of lethal control by riders
Proactive nonlethal	
Sleep at night factor	
Empowerment	
Building trust	
[a]Herding benefits	

[a] Herding benefits identified in 3 RRPs.

Policy, Trust, and Relationships

Program participants believed relationships among any combination of partnering agencies and organizations, ranchers, and range riders also could influence the outcome of a program, suggesting there was more to RRP effectiveness than simply reducing depredation events. Positive relationships among sponsors, ranchers, and riders were believed to build trust and increase collaboration.

Federal, state, and local policies also influenced trust levels. Coordinators that represented conservation organizations sought to improve coexistence with large carnivores and reduce the number of wolves killed. Although ranchers were open to trying nonlethal tools, several coordinators believed ranchers still wanted lethal wolf control to be an option if wolves began attacking livestock.

Several ranchers described how urban majorities influence wolf policy and affect ranchers. Ranchers felt ranching communities were in the minority, with the majority of their state population living in cities, where conservation groups are also frequently based. They perceived the urban majorities as pro-wolf and perceived that these majorities further complicated wolf management because they politically pressured the state wildlife agency to protect wolves. The federal status of wolves also affected the level of trust and collaboration among ranchers, government agencies, and conservation groups. Ranchers involved with RRPs where wolves were federally endangered shared a common skepticism and distrust for government agencies. Regardless of the intent of the RRP, distrust remained and the involvement of a conservation group or state agency was enough to limit rancher participation. Ultimately, disagreement among ranchers, conservation groups, and state agencies resulted in the loss of funding for 2 programs.

Lastly, the range riders themselves were often viewed as being critical in developing trust and fostering positive relationships. Wolf activity reports provided by range riders were highly valued by ranchers, so routine reporting of wolf observations or a lack of wolf activity help build the trust and the working relationships needed to mitigate wolf–livestock conflicts. In this regard, RRP coordinators stressed the importance of ranchers choosing their own rider in building trust instead of the coordinators selecting an outside individual.

Funding

Lack of a stable funding source plagued all of the RRPs we studied. Participants described funding as short-term and difficult to obtain from year to year. Because of funding concern, the respondents from all 3 groups questioned the long-term sustainability for the programs. Furthermore, many questioned who should pay for an RRP. Coordinators frequently explained their impression of rancher sentiments about funding: "From (one rancher's) perspective, they didn't choose to have the predators here, and so they shouldn't have to pay to reduce the conflict and it should be something that comes from the outside" (Anonymous, personal communication). Ranchers felt the pro-wolf conservation groups should use their funding to help people on the ground living with wolves. Thus, ranchers participating in RRPs sponsored by conservation organizations expressed more positive perceptions about these groups than ranchers in other areas where conservation organizations were not involved. Although most ranchers did not directly fund a range rider, they often provided in-kind support such as housing, ATVs, pasture for horses, investment in time, and more.

Because most coordinating agencies and organizations were limited in funding ability, several coordinators indicated they would like to see cost-shares established with ranchers. But cost-shares presented challenges of their own. One coordinator explained that though they developed a great cost-share, "you've got to sign a contract with the department, which is not a popular thing to do ... we're having a tough time getting people to sign up" (Anonymous, personal communication). Some ranchers decided not to pay for an RRP, but rather preferred to incorporate some aspect of the RRP into their operation, though it was not in a manner consistent with typical RRP operations. Ranchers agreed that the RRPs offered value and benefits; however, although they may have liked the social aspects of the programs, they were businessmen and perceived the costs to outweigh the benefits.

DISCUSSION

Messmer et al. (2001) described predator management as a pendulum, identifying dramatic shifts in predator policy between 2 extremes—overharvest to overprotection. Bruskotter (2013) elaborated on this concept, noting both social and political facets of wolf controversy. Although sociopolitical factors influence the contentious debate over wolves and wolf management and exacerbate social conflict surrounding this species, acknowledgement of the role these factors play can help shape solutions that slow the "predator pendulum" and find provide middle ground for optimal decision-making, development, and implementation of conflict mitigation techniques that provide benefits to multiple and diverse stakeholders. Although most of the Range Rider Program (RRP) participants we interviewed questioned the effectiveness of the programs in reducing wolf depredation on livestock, they placed value on the technical and social benefits of RRPs.

The primary technical benefits identified by participants were increased information acquisition and communication. Ranchers particularly appreciated information about wolf activity, assistance monitoring their herds, and any communication regarding potential concerns. Rapid detection of injured livestock was viewed as a benefit for a rancher's business in that it reduced the vulnerability of these individuals to wolves. Ranchers appreciated information about wolf activity, which enabled them to make informed decisions such as increasing monitoring efforts or moving livestock.

Range riders further provided a benefit to ranchers by simply being the only proactive nonlethal tool they could use on a vast landscape where cattle were widely dispersed. Bradley and Pletscher (2005) reported that cattle herds dispersed over larger pastures were more at risk of wolf

depredations. Having more riders on larger pastures was identified as a need by all interviewed RRP participants.

Rapid carcass identification was also identified by ranchers and coordinators as a highly beneficial function of range riders. Ranchers felt that the large allotments with varied terrain and tight drainages make finding a carcass nearly impossible. More range riders could also facilitate rapid identification of a carcass and protect the site for investigation, leaving more evidence for determining the cause of death.

Coordinators believed an increased awareness of livestock losses during the grazing season also could take blame off wolves if causes of death identified were not wolf-related. If enough of the carcass was left to provide evidence to confirm the event as a wolf depredation, the rancher could receive compensation for the animal. Additionally, confirmed depredation events were helpful in facilitating lethal removal of offending wolves, which could reduce future livestock losses associated with a chronic depredating pack. Finally, carcass identification played a critical role in carcass removal or, in remote locations, using fladry around the site so wolves did not become accustomed to eating livestock (Shivik 2004).

Though many nonlethal tools were believed to be useful in small pastures, ranchers felt range riders were the only nonlethal tool they could use on their larger, more rugged grazing allotments to monitor cattle. Therefore, RRPs gave ranchers a proactive option, where they would otherwise have none. This was of particular importance for ranchers in the states of Washington and Oregon. In both states, nonlethal strategies had to be in place prior to a depredation for lethal wolf control to be considered an option. In essence, range riding helped "check the box" so that lethal control was still available if wolf depredations of livestock occurred.

Participants readily acknowledged RRP social benefits. Increased information about livestock not only helped inform decision-making, but provided peace-of-mind for ranchers. Similarly, several ranchers noted that increased information about wolves also helped reduce their fear of the unknown. Ranchers identified yet another helpful social aspect of an RRP—the ability of the RRP to improve public perception of ranching. Some ranchers felt they were demonized by conservation groups and the public, so RRPs provided a way to positively affect public perceptions of ranching.

Another important set of social benefits of RRPs applied to the broader context of wolf–livestock conflict. Both coordinators and ranchers identified RRPs as a tool that helped remove the ranchers' feeling of powerlessness because ranchers could actively employ RRPs (Messmer et al. 2001). The RRPs also incorporated ranchers as active participants and, in many programs, involved them in decision-making because "the objectives are defined by the landowners involved" (Anonymous, personal communication). Thus, the program gave ranchers proactive control of the situation in a difficult business and politically sensitive situation. This sentiment was particularly prevalent in areas where wolves were listed for Endangered Species Act protection.

Because wolves were recently re-established and their actual effects on livestock were largely unknown, early RRPs implemented a trial-and-error approach to mitigate wolf–livestock conflicts. For the earlier programs, there was limited information about how to deploy a range rider. Although the common concept was "you've got to put somebody out there," specific ideas of rider duties varied from tracking and hazing wolves to accounting for all livestock and providing extra herd supervision. Early RRPs programs relied heavily on traditional and local ecological knowledge to develop their initial operating structures. As new information became available, many of the programs adapted. For example, several programs added more riders after an initial field season to better cover the RRP area. Other programs expanded efforts based on increased wolf activity and development of new wolf packs.

Several programs also utilized existing conservation partnerships to develop their effort. For example, one program in Montana had an established collaborative framework in place for addressing other natural resource issues. As wolves moved into their areas, the collaboration developed and implemented an RRP, building on the relationships that were already established. Through multiple field seasons, frequent communication, and participant feedback, program coordinators learned from personal experience how to adapt the effort to increase efficiency. Other programs, however, had to establish new relationships and build collaborations to address wolf–livestock conflicts.

The federal status of wolves in the areas where RRPs were implemented clearly influenced participants' perceptions about the role and importance of radiotelemetry. In areas where wolves were federally protected and relatively new to the area, coordinators and ranchers wanted better information about wolf numbers, locations, and activity. In these areas, state agencies responsible for wolf recovery were also tasked with monitoring wolf population growth. As such, state agencies placed increased importance on documenting numbers and locations of wolf packs, numbers of breeding pairs, etc., via radiotelemetry technology. This need for wolf information influenced RRP focus toward wolf surveillance.

In contrast, RRPs conducted in areas where wolves were delisted, landowners had lived alongside wolves for many years, and a wolf hunting and trapping season were in place tended to focus more on the livestock monitoring and less on monitoring wolves. This may be due to landowner perception—threat of livestock predation was not as severe as they initially perceived. These illustrations suggest the fear of the unknown associated with newly established wolf populations may influence RRP focus and rider duties (Messmer et al. 2001).

The scope of RRPs also varied relative to coordination. In several RRPs, one conservation group sponsored an effort on an individual ranch while partnering with the state agency for technical support. In other projects, conservation groups, community-based organizations, and the state agency collaborated to implement a community-wide program. Thus, the level of coordination efforts seemed related to the scale of the project, ranging from individual ranches to

watershed-level efforts. Prior to implementing new RRPs, program participants could benefit from early discussions about how to manage daily operations and mitigate the effects of complex situations. These discussions could include 1) sharing information with the media, 2) sharing sensitive location data, 3) changes in radiocollaring protocols, and 4) managing a depredation situation.

Shifting RRP focus away from a wolf surveillance approach to focusing on improved livestock management may be a more useful approach for future programs (Bradley and Pletscher 2005). Although participants believed wolf surveillance using radiotelemetry supported more targeted range rider efforts, it also was a source of conflict, particularly if sharing of location data was limited or questioned. Montana Fish, Wildlife, and Parks was investigating strategies to shift their wolf monitoring efforts away from reliance on radiocollars and toward a Patch Occupancy Model. This decision was based on robust wolf populations, limited resource availability, and the desire to manage wolves in ways more similar to other big game species (Bradley et al. 2015).

In areas where wolves were federally protected and populations were expanding, however, RRPs may still benefit from continued use of radiocollars. Wolves recolonizing new areas tend to have larger territories, so riders may have great difficulty identifying high-risk areas without wolf location data. Thus, riders in these states (particularly in programs that monitor multiple ranches with one rider) are spread thin and may need continued guidance to target their efforts with any efficiency.

In summary, the RRPs we studied shared attributes of a successful community-based conservation strategy (Berkes 2004). The RRPs were both adaptive and collaborative in the application of a nonlethal tool to mitigate wolf–livestock conflicts. The RRPs used participant feedback to make program improvements during each season (i.e., RRPs hired more riders, increased frequency of rider communication, altered areas of rider focus with new knowledge of wolf activity). Furthermore, RRPs incorporated multiple and diverse stakeholders in coordinating and decision-making roles, though some programs involved ranchers in this decision-making process more than others. As such, levels of trust were affected by relationships and levels of cooperation. Incentives, or program benefits, identified by respondents, varied based on stakeholder group association. Finally, traditional and ecological knowledge was used to develop the RRPs in each location and situation to address the specific context, needs, and challenges for individual program areas.

Overall, wolf–livestock conflicts remain a highly polarized topic that encompasses not only the technical aspects of wolf–livestock interactions, but also the social and political components associated with diverse opinions of wolves. To date, RRPs have not been scientifically analyzed to determine their effectiveness at mitigating wolf depredations. Although greatly desired, this type of quantitative evaluation will remain problematic because of the dynamic nature of wolf conservation. Future qualitative investigations, however, may provide further insights by quantifying and ranking perceived program benefits for participants via a more structured survey. This analysis would enable programs to better meet participant needs. The design of future surveys should, therefore, account for overlapping roles of participants (coordinator, rancher, rider) when determining sampling requirements for each respective group.

MANAGEMENT IMPLICATIONS

For current and future Range Rider Programs, wolf managers should help develop realistic expectations and work with rancher participants to develop a program that meets their needs, maintains transparent and frequent communication (particularly wolf-activity reports), and provides a forum for feedback. Programs will not be able to prevent all wolf–livestock conflicts, but should be established as an adaptive strategy that can change with shifts in wolf activity, loss (or gain) of radiocollars, occurrence of depredations, and even changes in federal wolf status. Should a confirmed livestock depredation occur, managers will benefit from a quick management response, both to reduce future risks to livestock and maintain trust and positive relationships with ranchers utilizing nonlethal risk reduction tools, such as Range Rider Programs.

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