Wolves —A Primer for Ranchers

J. Williams, D.E. Johnson, P.E. Clark, L.L. Larson, and T.J. Roland

Ranch management has become more complex since the U.S. Fish and Wildlife Service (USFWS) reintroduced wolves into Idaho and Wyoming in 1996. In areas where wolves have migrated, ranchers and government officials have verified increased death loss and injury of livestock (cattle, sheep, goats, horses, and llamas) and dogs. In addition to mortality of stock and companion animals, ranchers have reported losses caused indirectly by wolves, such as calves being trampled while the mother cow is fighting wolves, increased injury to livestock resulting in increased veterinary care and treatment costs, and increased stress on livestock and ranching families.

Ranchers also report increased livestock aggressiveness, especially toward working dogs, and other behavioral changes that make moving and handling livestock more difficult. Ranchers who have kept continuous records from the pre-wolf period report a loss of body condition in cattle and lower calving rates, which directly impact ranch income. Ranch managers also report increased time and expenses for range riding, checking on herds, extra meetings, additional travel, and other management-related activities pertaining to dealing with a protected predator.

Photo by Patrick E. Clark, USDA/ARS

Figure 1. A collar placed on a cow just after manufacturing.

A clear need emerged for research assessing the impacts of wolf presence on livestock on the range. The goal of the research is to provide a basis for development of viable mitigation strategies to reduce wolf depredation, management strategies, and regulatory policies that protect ranching enterprises while meeting national wildlife management objectives.

Project Description

Oregon State University (OSU), University of Idaho (UI), and the USDA Agricultural Research Service (ARS) initiated the Cattle-Wolf Interactions Research Project in 2008 to evaluate the effects of gray wolf presence on rangeland cattle production systems. The research was conducted in three study areas of high wolf presence in west-central Idaho and three study areas of low wolf presence in northeastern Oregon. Mature beef cows (*Bos taurus*) were tracked with custom-made GPS collars (Figures 1, 2, and 3) to record individual cow position at 5-minute intervals throughout the grazing season. A minimum of 10 cows on each of the 6 study areas carried GPS collars each year.

The study utilized an adaptive management process in which a committee of private and governmental stakeholders annually reviewed the interim findings from the project and then worked with the researchers and cooperating ranchers to refine existing research questions or pose new questions based on what they had learned.

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Research Project Study Areas

Research in Idaho was conducted at three study areas in Adams and Washington counties within or near the Payette National Forest. This region had established wolf populations and documented wolf depredation before the study began in 2008. The four study areas in Oregon (three in 2008) were located in Baker, Union, and Wallowa counties within or near the Wallowa Whitman National Forest. The fourth pair of sites was added in 2009 as more GPS collars were constructed and tested. Each Oregon study area was chosen to pair, ecologically and managerially, with a corresponding Idaho study area. The Oregon study areas, however, contained no known active wolf packs prior to and throughout the study, although occasional, undocumented wolf presence could have occurred. Each of the eight study areas was a combination of United States Forest Service (USFS) grazing allotments and private lands encompassing 25 square miles or more (Figure 4).

Wolf presence in the study areas was monitored during the grazing season using a number of complementary approaches including GPS and VHF radio-collared wolves, wolf scat sampling routes, trail cameras, direct observation, and depredation reports. Wolf presence levels were classified from low to high among and within grazing seasons using this information.

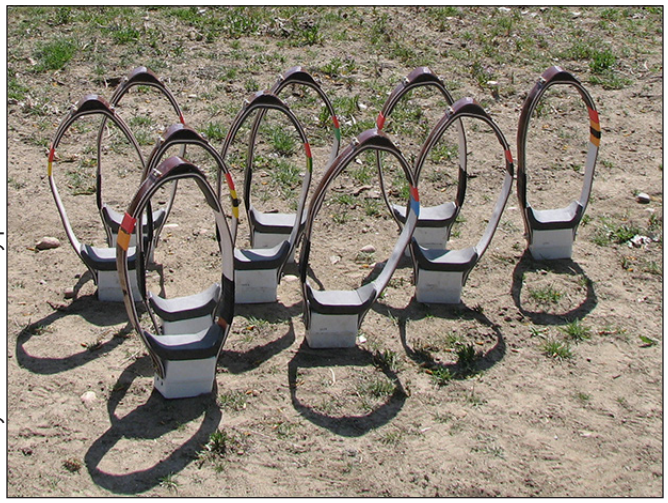

Photo by Pat Clark. Used by permission.

Figure 2. Collars being prepared to place on cattle at one of the research ranches. Animal tracking collars used in the project were developed over the last 10 years by Dr. Pat Clark and Dr. Douglas Johnson, along with cooperating engineers.

Photo by John Williams, © Oregon State University

Figure 3. A collared cow in a corral immediately following collar placement. The cow was hauled 50 miles north to spring pasture early the next day.

Data Collection Procedures

In early spring 2008, as part of the overall project, researchers placed 10 GPS collars on mature beef cows within a herd of 450 cow-calf pairs grazing one of the western Idaho study areas. This ranch is in the rugged area east of Hell's Canyon of the Snake River and south of the Seven Devils Mountains. Cow collars logged a position every 5 minutes through the grazing season.

Later that spring, the ranch experienced serious wolf depredation of heifers (uncollared) in the calving pasture near the ranch headquarters. Depredations continued, and in late summer 2009 most of the offending

Photo by Rod Childers. Used by permission.

Figure 4. Cattle grazing on research land in Oregon. This area is steep and not accessible by road. It is a very good spring range for cattle.

13-member wolf pack was lethally removed by APHIS Wildlife Services. (An example of a local wolf pack is shown in Figure 5.) A sub-dominant male wolf (B446) from that pack was captured by the U.S. Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) and collared with a GPS tracking collar on 22 May 2009. (An example of a collared wolf is shown in Figure 6.) Wolf B446 and a radio-collared female were subsequently spared for research purposes. Wolf B446 was tracked at 15-minute intervals for 192 days (~18,000 positions) as it ranged throughout the study area.

The activities of wolf B446 and his interactions with the GPS-collared mature cow herd and uncollared heifer herd led to a number of questions from stakeholders, particularly those from the ranching community. This publication is organized around key questions from ranchers, the research group, or the adaptive management committee. The GPS tracking data and other monitoring information that was collected allowed researchers to address some of these questions.

Answers to Stakeholder Questions

This long-term research project is composed of many individual studies. Some are ongoing. This report includes information from both the studies that have been completed and those that are still in process, as well as knowledge gained by the cooperators and researchers during the study.

How did wolf B446 use our mountainous landscape?

Immediately following capture and collaring, wolf B446 moved northward 2.2 miles and stayed in that locale for a day and a half. He then traveled 9 miles southwest to the pack's den site. By the third day, this wolf appeared to be moving as if unhampered by the capture and handling procedure or the weight and bulk of the GPS collar. During the 192-day tracking period, wolf B446 traveled an average distance of 11.4 miles per day (standard deviation = 4.75 miles per day). Actual travel distance was probably somewhat farther than this estimate, since straight lines were used to connect the 15-minute GPS points while the wolf most likely followed a curvilinear (circuitous or winding) route across the terrain and around landscape features.

Photo by John Williams, © Oregon State University

Figure 5. A wolf pack in the research area traveling in winter on a road.

Photo by Pat Matthews. Used by permission.

Figure 6. Collared wolf from the research area in Oregon.

The home range of wolf B446, calculated as the area completely enclosing all GPS positions, was nearly 211 square miles with a perimeter of over 55 miles. Daily travel distance by wolf B446 varied substantially: minimum distance was 2.2 miles per day and the maximum distance was 27.4 miles per day. This wolf traveled a maximum of 6.3 miles in 1 hour and 8.4 miles in 2 hours, a gauge of his sustained travel speed. The wolf was observed traveling ridgelines across the landscape and often used forest roads as travel routes. Favorite stopping locations were on outcroppings or benches with a good view of valleys and meadows below. At times the wolf was located near human activity. About 3.1 percent of GPS positions were located within 547 yards (500 meters) of an occupied house in the study area.

Wolf B446 did most of his traveling at night. This wolf typically began moving between 8:00 p.m. and 9:00 p.m. with maximum travel activity occurring near midnight (Figure 7). By 9:00 a.m., travel activity had clearly diminished.

What was the wolf movement in and around the heifer calving pasture?

The heifer calving pasture is located on private land within the general study area and encloses an open, grassy hillside with two creek drainages and a few scattered clumps of brush and trees. The pasture is visible,

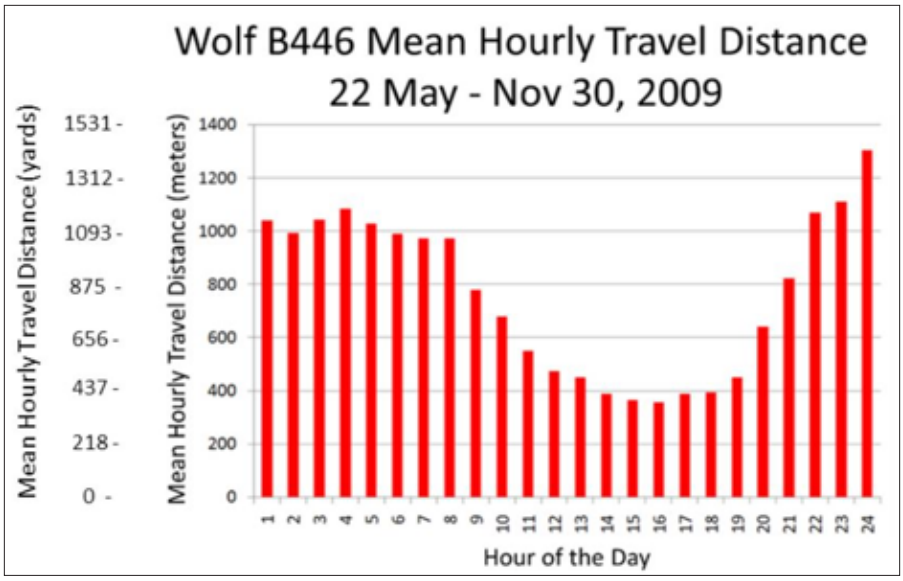

Figure 7. Hourly travel of wolf B446 averaged over the period between May 22, 2009 and November 30, 2009. Most of the travel occurred at night.

for the most part, from the nearby ranch buildings and houses. The pasture was, indeed, a focal point in wolf B446 movement patterns for nearly a month following his capture and release.

Between May 25, 2009 and June 24, 2009 (30 days from when data for this analysis began to be collected), wolf B446 visited this calving area 15 times. This wolf typically traveled the 6 miles from the den site to heifer pasture in 2 hours 30 minutes, usually arriving within 1 hour of midnight (11 times). It was not unusual for wolf B446 to remain in the immediate vicinity of the calving heifers for extended periods, even during periods when ranch personnel were documented as being nearby. Six of the 15 wolf visits to the pasture lasted longer than 22 hours, which means the wolf remained in the locale through most of the daylight hours of the following day. Six visits lasted for 4 to 6 nighttime hours, and two visits were less than 2 hours. This leads us to the proposition that once wolf B446 identified a prey source, he tended to stay with it.

What were the locations and extent of wolf depredation associated with the heifers?

There were 17 confirmed or probable wolf depredations on this ranch during 2009. Nine of these were discovered on the calving pasture between May 10, 2009 and June 15, 2009. Given the openness of this pasture and frequency of visits by ranch personnel, it is likely that all wolf depredations that occurred here were discovered. Depredations that occurred in the study area at large were much more difficult to identify and document.

Most other depredations discovered in the broader study area were located close to roads. Roads varied from paved/graveled main roads to more primitive on-farm and four-wheel drive roads, all of which were traveled regularly by ranch personnel (Figure 8). Some depredations occurred quite close to occupied houses which, in this area, were typically located along main roads. The ranch, which has maintained detailed records on the cattle herd for many years, reported death losses in 2009 that were well above normal (estimated at 2% or less). Most of the more than fifty head found dead or missing in the study area were recorded as suspected wolf depredation losses.

Undiscovered depredations likely occurred in the rougher, more remote portions of the study area. These were visited less often and observation was obstructed by terrain and vegetation, making detection of dead or dying livestock more difficult. Of the few beef carcasses actually found in these remote areas, most were found too late or were too thoroughly consumed or decomposed to allow precise determination of cause of death.

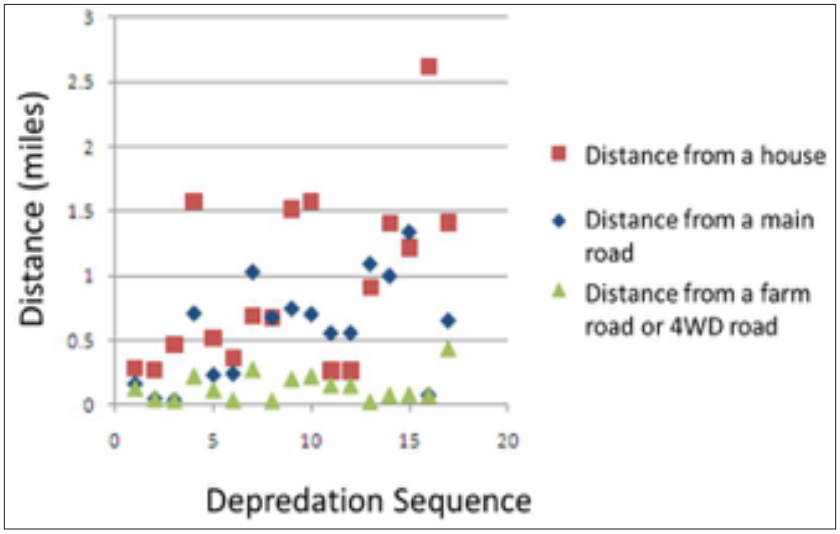

Figure 8. Distance of known cattle depredation sites during 2009 from occupied houses, main roads/highways, and farm or four-wheel drive roads.

It has been observed that cattle often stand and fight when in close proximity to wolves. Flight events sometimes do occur with cattle, and sometimes the whole herd will run away from encounter locations, but cows usually remain within the immediate vicinity of an encounter. Ranchers tell us that they find places where the vegetation was severely trampled and the ground chewed up by hooves. On our other research sites, ranchers reported that calves were sometimes trampled to death while the mother cow was trying to protect it. Ranchers and ranch employees also report that some calves appear to be "killed on the ground", even before they can get up. This may be related to the "freeze" response in young animals.

What interactions did wolf B446 have with GPS-collared mature cows with calves?

Ten mature cows out of a herd of 450 were GPS-collared on this ranch. The herd began the grazing season in April just above the Snake River at 1,500 feet elevation. As spring and summer progressed, the herd moved to higher and higher elevations, ending the summer in montane forests at nearly 6,000 feet. As these animals moved higher, they entered the area where wolf B446 and his associated pack was most active.

In late June, wolf B446 shifted focus from the pasture containing calving heifers (uncollared) to the mature cow herd that was grazing a mosaic of forest and meadow patches to the west of the ranch headquarters. From the first encounter between the wolf and a collared cow to the last encounter (November 3, 2009) was a period of 137 days. A documented encounter, interaction, or episode was defined as a pair of concurrent cow and wolf GPS positions within 547 yards (500 meters) or less from each other. All ten collared cows encountered B446 during this 137-day period (Table 1).

A total of 783 wolf-cattle encounters were recorded in 2009 (Table 1). Of this total, 244 encounters involved wolf and cow being within 273 yards (250 meters) or less of each other and 53 encounters included wolf-cow proximity of less than 109 yards (100 meters). Sometimes more than one collared cow encountered wolf B446 simultaneously; on one occasion, six cows were involved. A total of 448 separate events involving one or more collared cows that were within 547 yards (500 meters) of this wolf were recorded during the 2009 grazing season. Wolf-cow encounters of less than 109 yards (100 meters) were represented in 21 separate events with the longest event lasting just over 3 hours. Most of these wolf-cow encounters at very close proximity occurred between the hours of 10:00 p.m. and 4:00 a.m., when the wolf was most active and cattle were probably bedded (Figure 9). It was also a period of the day when managers and range riders would not normally be present on the landscape.

It should be noted, given the relative temporal coarseness of the GPS tracking data (5-minute intervals for cattle and 15-minute intervals for the wolf), that actual wolf-cow separation distances could have been much less than reported here. Some depredation may have occurred during these encounters, since two of the ten collared cows came home at the end of the grazing season without their calves (Table 1).

Where did wolf-mature cow interactions occur?

Most of the wolf B446-mature cow interactions occurred in a shallow arc about 7.5 miles (12 km) long and 1.5 miles (2.4 km) wide extending along the productive stream-fed bottomlands occupied by ranch facilities, hay fields, and open pastures. This riverine lower valley also has a village, scattered farmsteads, houses, and the only paved highway in the local area (Figure 11, page 7). Other encounters occurred in the higher mountains about 3.5 miles east-northeast of ranch headquarters that cattle grazed during late

Table 1. The number of encounters between wolf B446 and the 10 collared mature cows during a 137-day period from June 23, 2009 to November 3, 2009.

Animal	547 yd (500 m)	273 yd (250 m)	109 yd (100 m)
Cow collar 03	73	24	3
Cow collar 05	121	43	5
Cow collar 08*	41	14	3
Cow collar 18	61	10	0
Cow collar 19	99	36	7
Cow collar 20	140	37	12
Cow collar 21	93	20	5
Cow collar 22*	23	4	1
Cow collar 23	52	15	2
Cow collar 24	80	41	15
Total	783	244	53

*Cows carrying collars 08 and 22 came home at the end of the grazing season without calves.

summer and fall. Most close-range encounters (less than 109 yards or 100 meters) tended to occur in vegetation mosaics, composed of small patches of conifer forest and dry meadows located on the lower slopes of hills or in valley lowlands. In contrast to the depredations associated with the heifers, wolf encounters with the mature cow herd took place predominantly in rougher and less traveled areas of the landscape where cattle could not be easily or frequently observed by ranch personnel.

Does the presence of a dwelling reduce wolf activity?

The GPS tracking data indicate that wolf B446 approached within 547 yards (500 meters) of houses during 158 separate events between May 23, 2009 and November 30, 2009. These events account for about 4.6 percent of all wolf positions acquired during this period (Figure 10). If combined, the areas within 547 yards of occupied houses would represent about 3.1% of the total home range (211 square miles) used by this wolf. Thus, he occupied the 547 yard (500-meter) dwelling buffers at a slightly greater frequency than all the rest of his range (those areas not within 500 meters of a dwelling). He was located within 273 yards (250 meters) of a house 119 times and within 109 yards (100 meters) 27 times. The closest approach to a summer-occupied house was 50 feet (15 meters) and to a house occupied year-round 220 feet (67 meters). On one occasion (6/17/2009), the pack that B446 was a part of (7 individuals at that time) stayed on a hill overlooking a ranch within 547 yards of the ranch house from 4:34 a.m. to the following day at 4:09 a.m. Most of the close wolf-house proximate positions occurred during the nighttime hours. The presence of an occupied house, therefore, did not seem to deter wolf B446 from utilizing the local area.

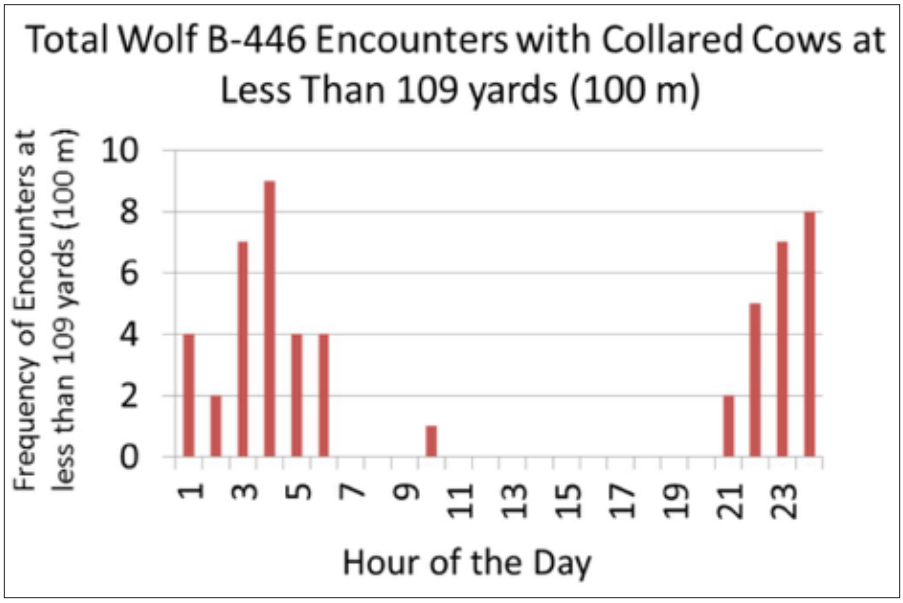

Figure 9. Timing of cow-wolf encounters at less than 109 yards (100 meters). There were 53 encounters at this distance or less during the period from June 23, 2009 to November 3, 2009 (137 days).

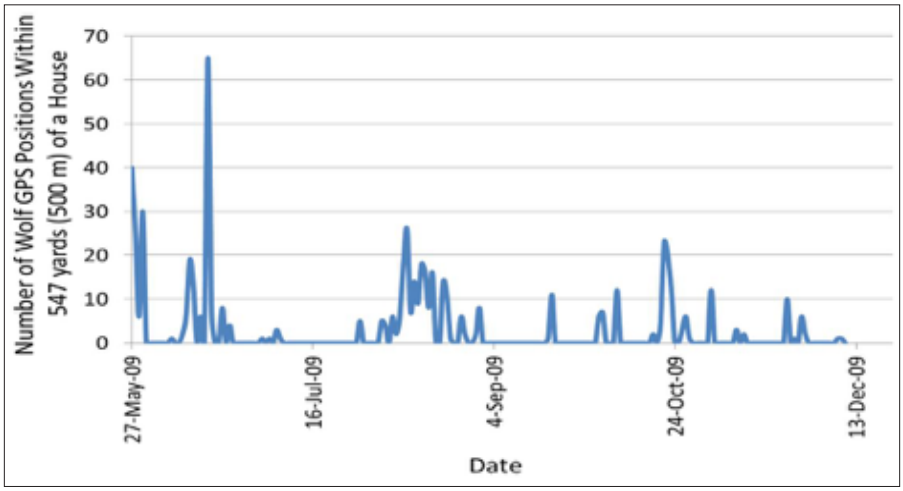

Figure 10. Timing and frequency of Wolf B446's proximity (<547 yards) to houses. Throughout the period that this wolf was collared, he frequently was near houses, often for extended periods.

Local residents reported that they often found wolf scat and tracks near dwellings, and wolf transit routes were identified crossing the highway and main valley within several hundred yards of farmsteads. This data from B446 implies that the presence of a dwelling alone will not necessarily prevent wolves from using an area.

Were close cow-wolf interactions (less than 109 yards or 100 meters) principally in riparian zones?

It has been suggested that increased wolf presence may create a "landscape of fear" inducing elk and other ungulate prey to decrease their use of riparian zones in favor of open upland habitats because approaching wolves are more easily detected. Theoretically, riparian

zones near streams could be risky habitats for wild and domestic ungulates alike because these habitats typically contain tall shrubs that reduce visibility and offer ambush cover for predators. Furthermore, wolves with young often use grassy riparian meadows as rendezvous sites, thus concentrating wolf presence in this habitat type during summer months when cattle are commonly grazing there (see Chigbrow, 2016).

Streams on this landscape are typically small (less than 5 ft. [1.5 m]) across, and similarly, riparian buffers on these streams are limited to less than 100 ft. (30 m) on either side of the stream.

We found that 2 of 53 (3.8%) close-range wolf-cow encounters (less than 109 yards separation) occurred within 100 ft. (30 m) of perennial or intermittent streams (Table 2). These near-stream areas represented about 7.6% of the total home range area used by wolf B446 (Table 3). Thus, the frequency of encounters was lower than the percentage of this land class and does not indicate a preferred area of activity. Conversely, 66% of close-range encounters occurred in areas greater than 330 ft. (100 m) from streams, which represented about 75% of the wolf's home range and a greater activity preference. In this wolf's data set, there was no trend of increased wolf-cow encounters near streams, and it is interesting to note that this young-adult male wolf was neutral/negative in preference for near-stream habitats (Table 3 and Figure 11). The wolf did spend time traveling along ridgelines, often stopping on higher terrain with good viewsheds. Female wolves, especially those with pups, could behave differently on landscapes and have different spatiotemporal preferences as they search for prey. We look forward to more high frequency GPS data on wolves of both sexes and of varying age to further define this research question.

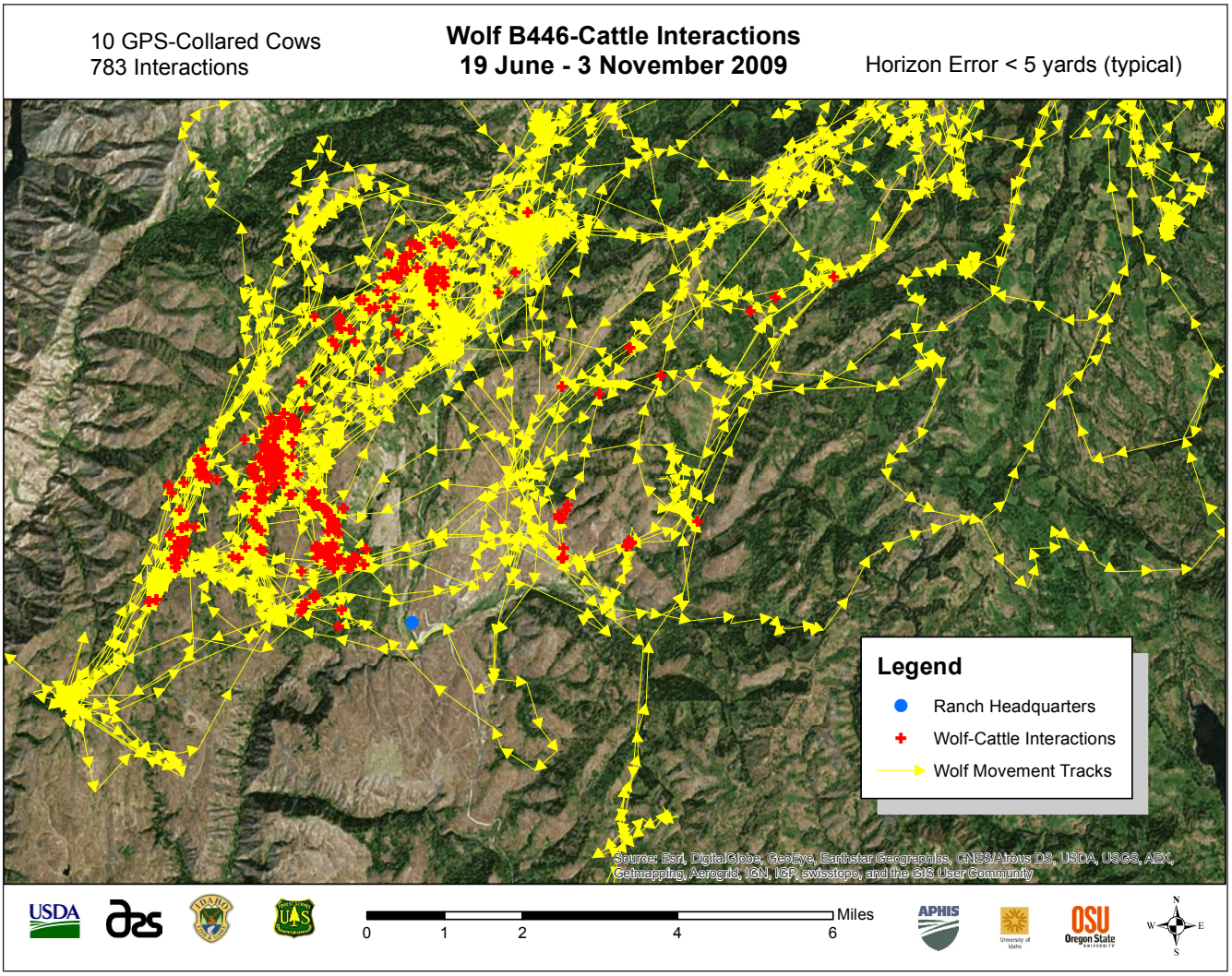

Figure 11. Distribution map of wolf B447 movement.

Table 2. The number and relative percentage of close-range encounters; less than 109 yards of separation (100 m) between a collared cow and wolf B446, partitioned by buffer distance from a perennial or intermittent stream (as defined and mapped by USGS).

Stream buffer distance (both sides of stream)	Number of wolf-cow encounters	Percentage of total wolf-cow encounters	Cumulative % of wolf-cow encounters
----feet----	----#----	----%----	----%----
0–33 (10 m)	2	3.8	3.8
33–66 (20 m)	0	0	3.8
66–98 (30 m)	0	0	3.8
98–131 (40 m)	1	1.9	5.7
131–164 (50 m)	0	0	5.7
164–328 (60 m)	15	28.3	34.0
>328 (>100 m)	35	66.0	NA
Total	53	100	NA

Table 3. Relative riparian usage and preference ratio values for wolf B446 during May 23 to December 1, 2009, partitioned by buffer distance (in feet) from a perennial or intermittent stream (as defined and mapped by USGS).

Stream buffer distance (both sides of stream)	Number of wolf GPS positions	Percentage of total wolf GPS positions	Areal percentage of wolf home range	Preference ratio
----feet----	*----#----*	*----%----*	*----%----*	
0–33 (0-10)	238	1.3	2.6	0.52
0–66 (0-20)	500	2.8	5.1	0.55
0–98 (0-30)	753	4.2	7.6	0.55
0–131 (0-40	993	5.5	10.2	0.54
0–164 (0-50)	1,235	6.9	12.7	0.54
0–328 (0-60)	2,680	14.9	25.3	0.59
>328 (>100 m)	15,314	85.1	74.7	1.14
Total	17,994	NA	NA	NA

Table 4. Comparison of riparian buffer use by collared cattle on both permanent and intermittent streams between 2008 (high wolf presence) and 2009 (extremely high wolf presence)

Stream buffer distance (on both sides of stream)	2008 high wolf: % of total GPS in buffer	2009 extreme wolf: % of total GPS in buffer	Difference %
33 ft. (10 m)	1.05	1.68	+ 0.64
66 ft. (20 m)	2.13	3.34	+ 1.21
98 ft. (30 m)	3.25	4.98	+ 1.73
131 ft. (40 m)	4.36	6.45	+ 2.10
164 ft. (50 m)	5.49	7.87	+ 2.38
328 ft. (100 m)	10.86	14.60	+ 3.74

If cattle avoid riparian areas as wolf pressure increases, we should have observed movement of collared cattle away from riparian areas in years with higher wolf depredation (Table 4). This was not seen when 2008 collared-cow data (high wolf presence) was compared to 2009 data (extremely high wolf presence). When one considers that most of the wolf-cattle close encounters occurred between 9:00 p.m. and 6 a.m., it seems more likely that areas where cattle bed are at higher risk for depredation. In general, bedding areas will reflect shared characteristics of good visibility, dry surface conditions, and deeper (rock-free bed area) soil. These attributes provide comfort, protection against insects, security (related to predation from bears, lions, and wolves), and favorable bedding.

For a full account of study results documented from this research effort, refer to the reference section of this document.

Related Research Studies

Does the presence of wolves impact the temperament and physiological responses of beef cattle?

The principal hypothesis tested in this study was that the presence of wolves near cattle affects temperament and stimulates physiological stress responses known to impair cattle productivity and welfare, particularly in cattle belonging to herds previously subjected to wolf predation. To address this hypothesis, mature beef cows were subjected to an experimental model designed to simulate a wolf encounter, including wolf scent, pre-recorded wolf howls, and three canines physically similar to wolves.

In this study, 50 cows were randomly selected from the same ranch in Idaho previously described (see "Research Project Study Areas," page 2). These cows were part of a herd which had experienced multiple confirmed wolf predation episodes from 2008 to 2012. None of these cows, however, had suffered any confirmed direct physical injury from wolves. For the purposes of this study, they were considered to be familiar with wolf presence and had likely observed at least one pursuit or predation event. These cows were taken to the OSU Eastern Oregon Agricultural Research Center (EOARC) in Burns, where they were mixed with 50 cows randomly selected from the EOARC beef herd. The EOARC herd had never been exposed to wolves or wolf activity. Both groups of cows were pregnant, non-lactating, crossbred beef cows and came from herds where domestic herding dogs were occasionally used to move cattle.

It is important to note that these cows originated from different herds and were reared using different management schemes and in different environments. Therefore, the impact of previous wolf exposure on the temperament and stress-related parameters evaluated herein cannot be completely distinguished from cow source. To address this, cows were commingled and, for 50 days, received the same management and were acclimated to the personnel and handling facilities. More importantly, parameters evaluated were not directly compared between the herds; instead, they were evaluated within each cow based on the changes between pre- and post-exposure values.

After the commingling and acclimation period, researchers conducted pre-exposure baseline assessments that included an evaluation of temperament (chute score, exit velocity, and temperament score), collection of blood samples to determine cortisol or stress hormone levels, and body temperature (intravaginal) monitoring at 30-second intervals.

Simulated wolf encounter

Immediately after the pre-exposure assessments, cows were subjected to a simulated wolf encounter for 20 minutes. Wolf urine was applied to 12 cotton plugs that were attached to the drylot fence line every 35 feet (6 plugs per pen) before experimental procedures began. Pre-recorded wolf howls from wolf packs residing in Wallowa County, Oregon were played continuously from a stereo system located 30 feet from the drylot pens. Three trained dogs were conducted on leash by two trained technicians outside the drylot perimeter fence. Two adult German Shepherd females represented adult wolves, and one adult Border Collie × Alaskan Malamute female represented a young wolf. The maximum and minimum separation distances allowed between dogs and cows were 80 and 15 feet, respectively.

Almost immediately after the simulated wolf encounter started, all cattle that had previous experience with wolves bunched up in the farthest corner of the pen and stayed there during the entire 20-minute simulation. Conversely, cows that had no experience with wolves remained dispersed throughout the drylot pen. This behavioral difference suggests that cattle previously predated by wolves immediately adopt a fear-related protective behavior after perceiving signs of

wolf presence, whereas the same outcome may not be observed in cattle unfamiliar with wolves. Supporting our hypothesis, cows that had experience with wolves became more excitable and had an increase in plasma cortisol and body temperature following the simulated wolf encounter. Internal body temperature and plasma cortisol concentrations in cows that had no exposure to wolves were unchanged by the simulated wolf encounter.

Post-exposure assessments

After 20 minutes of simulated wolf encounter, cows were again evaluated for temperament and blood cortisol level, and body temperature monitoring instrumentation was removed for downloading and data analysis. The wolf simulation continued during the post-exposure assessment by leaving the wolf howls running and the dogs in the close vicinity of the cows.

All three parameters (body temperature, temperament measurements, and plasma cortisol concentrations) showed statistically valid differences between the pre-exposure and post-exposure assessments. The results in the paper state: "Results from this experiment indicate that the simulated wolf encounter increased excitability and fear-related physiological stress responses in cows previously exposed to wolves, but not in cows unfamiliar with this predator. Therefore, the presence of wolf packs near cattle herds may negatively impact beef production systems via predatory activities and subsequent death and injury of animals, as well as by inducing stress responses known to impair cattle productivity and welfare when packs are in close proximity to previously predated herds."

For a full account of this specific research study, please see the special report by Cooke et al. (2013).

Can we predict where cattle-wolf encounters will likely occur within large grazing areas?

Goal and objectives

This study, developed and implemented as part of the overall Cattle-Wolf Interactions research project, evaluated the efficacy of wolf rendezvous-site mapping for predicting the spatiotemporal risk of cattle-wolf encounters (Chigbrow, 2016). Cattle GPS-tracking data and wolf rendezvous-site habitat classifications were used to develop predictive maps of cattle-wolf encounter risk within four U.S. Forest Service (USFS) cattle grazing allotments in western Idaho. The accuracy of these encounter-risk maps was then validated under a case study using spatiotemporal data from documented cattle-wolf encounters that occurred within one of these study areas.

Specific objectives of this project included:

1. Predict the habitat-selection patterns of cattle within these four study areas over three grazing seasons (2009, 2010, and 2011).
2. Evaluate the performance of an existing model for classifying the quality and suitability of habitats for use by wolves as rendezvous sites.
3. Identify areas of spatiotemporal overlap between predicted patterns in habitat selection by cattle and patterns in classified habitat suitability for wolf rendezvous sites, and thus map out where cattle-wolf encounters might be likely to occur during the rendezvous period.
4. Evaluate the efficacy of these cattle-wolf encounter risk maps by applying a case study at one of the study areas where actual cattle-wolf encounters were documented using concurrent GPS tracking data from both species.

Synopsis of results

Generally, areas classified as very high cattle-wolf encounter risk occurred on flatter, smoother slopes within concave terrain such as stream terrace meadows and, at higher elevations, small headwater basins containing springs or seeps where forage productivity would tend to be high. Not all of these very high-risk areas were located near surface water. Some very high risk areas were also associated with gently-sloping forest openings rather than in broad meadows. In contrast, areas classified as very low encounter risk were generally steep slopes.

Most areas in the high- and very high-risk classes were located in stream terrace meadows, which are important to cattle producers because these areas can provide considerable amounts of palatable, high-quality cattle forage. The importance of meadows increases as the summer grazing season progresses and upland forages begin to dry and lose quality. As demonstrated by the case study, cattle grazing in these predicted high- and very high-risk areas are indeed much more likely to have encounters with wolves than cattle in areas of lower risk, assuming wolves are present in the general area.

Management implications

By knowing where possible interactions among cattle and wolves may occur, ranchers can more effectively invest resources and intensify husbandry practices to discourage wolf activity in specific areas. Well-targeted use of range riding, guard dogs, scare devices, fladry, or biofences can discourage wolf activity in some isolated instances. These mitigation techniques, however, cannot be used effectively to protect the whole of an extensive grazing allotment from wolf depredation. These techniques can be effective if specific high-risk areas can be identified, and the mitigation effort is then concentrated in these specific areas. By identifying areas of high cattle-wolf encounter risk, producers and natural resource managers can work to adjust cattle distribution and pasture rotation schedules to avoid placing cattle where they may come in conflict with wolves during the June–August rendezvous period.

In cases where cattle are missing and wolf depredation is suspected, ranchers can use cattle-wolf encounter risk maps of their grazing areas to better determine where depredations may have occurred. By applying this technology, initial searches for missing cattle can be more effectively focused on higher-risk areas before expanding the search to less likely areas. Moreover, the cost/benefits of grazing cattle in certain areas can be effectively evaluated, and decision makers can respond dynamically as wolf presence levels in the grazing area vary over time.

Simply put, knowledge of spatiotemporal cattle-wolf encounter risks across extensive, rugged, and remote landscapes can help ensure that cattle producers and natural resource managers take proper steps to reduce actual cattle-wolf encounters, minimize any harmful interactions, and optimize cattle distribution across the rangeland to the benefit of both cattle production and sustainable wolf management. Reducing cattle-wolf encounters is beneficial to both the ranching communities and wildlife conservationists.

Future Work

This study was designed to characterize the relationship between wolves and cows occupying the same landscapes. Our observations led to several interesting questions which, unfortunately, were beyond the scope of the current research project:

1. At what level did the presence of wolves stress calving heifers?
2. Did the stress persist throughout the day?
3. Could the increased stress lead to increased incidence of dystocia (calving difficulty), calf rejection, impaired cow/calf pairing, or diminished mothering activity?
4. Does this interaction result in long-term productivity issues?

As one might expect, collaring cattle is relatively easy, while collaring wolves is more challenging for a variety of reasons. Much remains to be learned about how wolves interact with cattle, and we will have ample opportunity to observe these encounters in the future. We expect that a more complete picture will emerge as wildlife agencies collect more GPS data with shorter recording intervals. We encourage these agencies to make their data available to the broader scientific community so that experts in various disciplines can gain insight into wolf predation on both wild and domestic species.

We suggest that a more thorough examination of the effects of wolf predation on cattle biology, physiology, and behavior will help define the magnitude of this new stressor on animal health and performance. This information would generate practical management strategies to mitigate impacts. Veterinarians and other animal health care providers will be key players, and we suggest that information be shared between individuals.

Economic and labor ramifications of wolf presence on ranching enterprises need more work because management strategies on every ranch is to some extent unique to that ranch. We have observed that some individual herds tend to receive most of the depredation in an area, so the impact is concentrated instead of spread evenly across the ranching community. This can lead to specific ranches and ranch families shouldering heavy economic burdens that others do not face.

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