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Wolves: A Primer for Ranchers

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ABSTRACT: Ranch management has become more complex since wolves were reintroduced into Idaho and Wyoming in 1996. In wolf areas, livestock have experienced increased death loss and greater stress. Increased livestock aggressiveness has been observed, especially toward working dogs, making handling livestock more difficult. Additionally ranchers have reported a loss of body condition, lower conception rates, increased time and expense for management. Our study was designed to investigate the effect of wolf presence on cattle behavior, landscape use patterns, and resource selection by comparing high wolf density areas against low wolf density areas. This study also generated baseline information on cattle spatial behavior before wolves were on the landscape. A Before-After/Control-Impact Paired (BACIP) experimental design was used. Control study areas in Idaho (3) have high wolf presence while Impact study areas in Oregon (3) started with no wolf presence, and are shifting to elevated wolf presence. Paired Idaho and Oregon areas have similar topography, vegetation composition, wild ungulate prey bases, and livestock management. Cows are tracked at 5-minute intervals using GPS collars (10 per area) throughout the grazing season. Wolf presence is monitored by GPS, trail cameras, and scat surveys. Ten GPS-collared cattle in an Idaho study area encountered a GPS-collared wolf 783 times at less than 500 meters during 137 days in the 2009 grazing season. At 100 meters there were 53 encounters; 52 at night. Tests of naïve and experienced cattle exposed to a simulated wolf encounter found increased excitability and fear-related physiological stress responses in cows previously exposed to wolves. This was shown through increased cortisol levels, body temperature, and temperament scores. Cattle presence near occupied houses doesn't offer protection from wolves. Data shows wolves within 500m of occupied houses 588 times during 198 days of tracking. Many confirmed depredations on this site were also close to houses.

KEY WORDS: *Canis lupus*, cattle depredations, GPS collars, wolf-cattle encounters, wolf, wolf impacts, wolf presence, wolf costs

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INTRODUCTION

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.

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.

METHODS

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 (Figure 1) 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.

Study Area

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.

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.

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 Hells Canyon of the Snake River and south of the Seven Devils Mountains. Cow collars logged a position every five 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 13-member wolf pack was lethally removed by APHIS Wildlife Services. 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 May 22, 2009. 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 paper 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.

Figure 1. A collar placed on a cow just after manufacturing. Photo by Patrick E. Clark, USDA/ARS.

RESULTS

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 nine 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.

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 one hour and 8.4 miles in two 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. 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 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. 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.

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 ft elevation. As spring and summer progressed, the herd moved to higher elevations, ending the summer in montane forests at nearly 6,000 ft. 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.

A total of 783 wolf-cattle encounters were recorded in 2009. 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 am when the wolf was most active and cattle were probably bedded. 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

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.

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. Other encounters occurred in the higher mountains about 3.5 miles east-northeast of ranch headquarters that cattle grazed during late 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. 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.

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 farm-steads. 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 (< 109 yards or 100 m) 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 (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 two 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. These near-stream areas represented about 7.6% of the total home range area used by wolf B446. 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. 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.

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. 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.

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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