Wolf Cattle Interaction Study, 2012 Oregon Beef Council Short Report
Williams, J., D. Johnson, L. Larson, P. Clark. N. Rimbey, S. Hamilton

Introduction

The reintroduction of wolves into Central Idaho and the Yellowstone National Park, and their subsequent dispersal throughout the northern Rocky Mountains, has led to increased livestock depredation and conflict with livestock producers. Stock growers report both direct losses as injured or killed cattle, sheep, horses, and dogs, as well as calf wt loss and indirect livestock losses from increased stress resulting in lower conception rates, higher incidence of respiratory and other diseases, lower body condition scores, and changes in temperament resulting in more difficult handling. Producers also report herd management costs have increased with the presence of wolves because ranch personnel need to check on animals more frequently, spend more time doctoring injured stock, and expend additional effort searching for animals scattered during predation events so they can be removed to safe locations. Removal of cattle generally results in disruption of annual grazing plans and higher forage costs. Research that examines wolf impacts on domestic livestock resource selection, behavior and ranch-level economics are rare. Our study was designed to document the effect of wolf predation threat on cattle behavior, landscape use patterns, and resource selection by comparing areas with high wolf densities against those with low wolf densities. This study was also designed to generate baseline information on cattle spatial behavior before wolves become common on landscapes where they currently are rare. For a complete discussion of the study go to:
http://extension.oregonstate.edu/wallowa/sites/default/files/2012_october_22_oregon_beef_council_report_final_d.pdf

Study Sites

The study areas used consist of 6 sites total where 3 sites occur in Idaho, on the Payette National Forest (PNF) lands, in Adams and Washington counties, a region that has established wolf populations as well as, documented wolf depredation occurring before the study began in 2008. These Idaho sites were paired with 3 sites in Baker, Union, and Wallowa counties, Oregon on the Wallowa Whitman National Forest (WWNF) where wolves were absent or at very low presence levels in 2008. Site pairs had similar topography, vegetation composition, wild ungulate prey bases, and livestock management strategies. Oregon sites cover 108,655 acres while the Idaho sites cover approximately 134,395acres. Idaho sites are at the same latitude as Oregon sites. These six grazing allotments vary in elevation from 1680 ft. to 8,200 ft. and are characterized by rugged mountains and uplands that are deeply dissected by canyons.

Experimental & Sampling Design

This research is being conducted under a Before-After/Control-Impact paired (BACIP) experimental design. In this case, the experimental treatment or Impact is the change in wolf presence on Oregon study areas from a long-term, very low level to a sustained higher level. The Before period of the BACIP design is the period before the Oregon study areas acquire a substantial and sustained wolf presence while the After period is the period after that transition point when both the Idaho and Oregon study areas have substantial and sustained wolf presence.

The Clark Animal Tracking System collars, that offer long deployment lives (e.g., up to 1 year) at intensive sampling rates (e.g., collection of GPS positions at 5-minute intervals), are being used. Each spring between 2008 and 2011, 10 mature cows were randomly selected from cattle experienced with the landscape on each ranch. Herd size varies somewhat from site to site but the

Speed of collared cattle was also recorded by the GPS receivers. We used the pattern of velocity measurements to indicate animal activity (Figure 1). Cow velocities rarely rise above 6.2 miles/hr. under normal grazing conditions. Grazing periods are represented by a string of speeds above the detection threshold, resting periods by strings of values below the detection limit of the instrument. Direction travel to or from water or herded movement between pastures is represented by normal walking speeds between 2 and 4 mph.

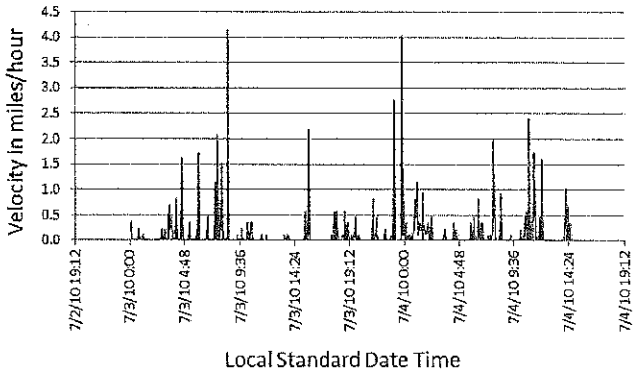

Figure 1. Typical velocity diagram of a GPS-collared cow. Actual cow velocities rarely rise above 6.2 miles/hr. under normal grazing conditions.

Travel Distance

GPS collar data have two issues when used to estimate travel distance. First, animals typically do not move in straight lines but weave across the landscape between food patches or along least-effort pathways between grazing areas, thus connecting GPS positions acquired at 5-minute intervals underestimates actual distance traveled. Second, cattle typically rest for 12 to 14 hours a day and GPS positions collected when an animal is stationary contain location errors which suggest the animal is moving when it actually is not. It is still possible, however, to gain insight into the travel distances of cattle with the raw (uncorrected) data sets. Daily travel distances of collared cows varied by study site, season and study year. As an example, in 2010, Cow 33 traveled an average of 7.37 miles/day compared to 4.99 miles/day for Cow 17. Maximum and minimum daily travel distance was 17.62 mi. and 2.39 mi. for Cow 33, while Cow 17 had 12.89 mi. and 1.97mi for these parameters.

Low travel distances during the early spring could be caused by abundant forage and animals grazing steep hillsides. Cows grazing hillsides typically move across the slope on terraces that have a relatively low gradient, because the steepness of the terrain restricts movement up and down the slope. On more level ground travel is easier and animals move farther. We have not examined travel distance relative to wolf presence levels or other potentially important variables (e.g., surface roughness, vegetation or landscape cover class, weather, etc.).

Cattle Preference for Landscape Features *(complete information on percent use and availability can be found in the complete report; see introduction for website)*

Distribution of cattle was not uniform. Oregon Site 1 is mountainous terrain with V-shaped valley form. The predominant stream types (Rosgen A and B) are steeper gradients, limited sinuosity and narrow floodplain width. Livestock spent 33% of their time on preferred slopes of 0-12% ($p<0.01$) and an additional 56% of their time on slopes 12-36% using those slopes. Livestock did not show a preference toward aspect or landscape cover classes. They spent 90% of their time in conifer forest type which dominates the allotment.

Time spent within a defined distance of a perennial watercourse was evaluated; percentage of time within each category was found, as well as cumulative occupancy within the defined distances. A buffer zone out to 10m (32.8ft) was established on either side of the map line feature representing streams. This area is considered as the potential interface area between cattle and aquatic habitats as defined by Ballard (1999). Beyond this area five other buffer zone classifications were established on both sides of the stream of 10-20m (65.8ft), 20-30m (98.4ft), 30-40m (131.2ft), 40-50m (164ft) and 50-60m (196.8ft). Although riparian zones are not explicitly defined the distance values do give an indication of time spent within the immediate area of the perennial water courses that are found within the respective study areas.

Zones closest to the water were not occupied more than zones further from the water source (Table 1). In site 1 this is likely attributable to the V-shaped valleys with "A" channels that predominate the area and limit the development of riparian meadow vegetation. In area 3, the elevation gradient of the landscape places the cattle in steep canyons containing perennial streams early in the grazing period. As cattle moved upwards, following snow melt, these same canyons limit their return to the streams for the remainder of the grazing period.

Cattle occupying site 2 are on a landscape where riparian areas occur on more moderate slopes. This allows the formation of broader geomorphic surfaces that support riparian vegetation. In this study area, cattle favored the zones out to 30m (98.4ft) with the greatest preference occurring equally within the 0-10m (32.8ft) and the 10-20m (65.6ft) classifications. Although preference of the zone 0-10m (aquatic habitat) is variable between study sites it should be noted that occupation of this zone was always less than 1 percent. This observation supports those reported by Ballard (1999) where intensive visual observations indicated a similar percentage of use. On a per-day-average basis, collared cows on site 1 spent 2.43 minutes per day in this zone with site 3 cows being similar at 2.58 minute per day. At site 2, which had more developed riparian areas, cows spent 11.78 minutes per day in the 0-10m zone. Cumulative stream-buffer-zone occupancy was similar between site 1 and site 3 with just over 1% occupancy for all areas between 0 m and 60 m of streams (Table 1). Site 2 was again different in this analysis as occupancy began in the 0-10 and 10-20m zone with a higher numeric values than the other two sites and reached nearly 4% cumulative occupancy out to the 50-60 m zone.

Table 1. Occupancy of buffer zones along streams for the 3 Oregon study areas.

Stream Area Occupancy	Percent Occupied in Buffer Zone			Cumulative Percent to Stream		
	OR Site 1 (08/09)	OR Site 2 (08/09)	OR Site 3 (09)	OR Site 1 (08/09)	OR Site 2 (08/09)	OR Site 3 (09)
Buffer Zones	%	%	%	%	%	%
0 to 10 m	0.18	**0.86**[1]	0.19	0.18	0.86	0.19
10 to 20 m	0.20	**0.88**	0.20	0.39	1.74	0.39
20 to 30 m	0.21	0.68	0.21	0.59	2.43	0.60
30 to 40 m	0.18	0.53	0.19	0.78	2.96	0.79
40 to 50 m	0.17	0.43	0.19	0.95	3.39	0.98
50 to 60 m	0.17	0.34	0.19	1.11	**3.73**	1.17
Probability	NS	<0.05	NS	NS	<0.05	NS

[1] Bold numbers within % occupied column indicate significant difference.

Bold numbers in cumulative column indicate significant total occupancy compared to buffer zone area.

Duration of Cattle Occupancy

On both Idaho and Oregon sites, 70-80% of the 2.47 acre (1 ha) gridded locations within allotments and private land inclusions received 12 or fewer cow positions throughout the grazing season. Twelve cow GPS positions translates to slightly longer than one hour of occupancy (66

include slopes up to 24%. Cattle occupied steeper landscapes up to 35% in proportion to their area. The consistency of slope use across allotments testifies to the influence of this factor on cattle distribution.

Analysis of the riparian buffer zones around perennial streams in Oregon (2008 & 2009) determined that in site 1 and 3, where streams are topographically confined and express minimal (area) riparian wetland development; cattle did not have a preference for any of the distance categories established. In site 2, where streams were less confined and the area of flood plain/wetland development was greater, cattle exhibited preference toward areas within the first 99 ft (30 m) from a perennial stream. However, regardless of these differences cattle did not use areas around perennial water more than upland areas. Cattle occupied areas beyond 197 ft (60 m) of the stream 96 to almost 99 percent of the time.

We are in the process of evaluating the degree of cattle dispersal during periods of known wolf presence. We were able to determine areas on the landscape where collared cattle were infrequent (on average 75% of the surface area studied was occupied by a collared cow for less than 1 hour), as well as where animals spent more time (foci). When collared cattle graze the same areas in different years some foci are the same but change is common. Foci typically are not on live streams.

Daily travel distance of collared cattle differs between animals and, at least on some sites, changes with season, years, and the topography being grazed. We have concern about accumulation of GPS errors when the receiver is not moving. We believe that closer examination of temporal velocity charts and the patterns they contain should allow us to not only get better estimates of actual travel distance, but also more accurately predict grazing vs. resting activities.

Although we only have analyzed data from 1 GPS-collared wolf (a total of 3 wolves have been collared but only 1 collar retrieved to date). This wolf (B446) had a sizable range and traveled impressive distances. Most of his travel occurred at night as did most of the interactions he had with collared cattle. Close encounters between B446 and collared cattle were frequent and the rancher reported cattle changed their behavior after wolves moved into the area by being more difficult to herd and handle and acting aggressively toward dogs. Wolf B446 was commonly within 547 yd. (500 m) of occupied houses (588 times or 3.1% of all wolf positions logged) during the 198 days he was tracked. Many confirmed depredations on this site were also close to houses, which implies that proximity to human habitation does not automatically confer protection from wolves. Wolf B446's daily travel distances varied substantially from day to day yet showed no seasonal trend between 24 May and 15 December 2009. This wolf, like cattle, had foci on the landscape that he frequented. The den site, rendezvous site, heifer calving pastures, and several locations in the northern portion of his range were identified as foci.

Cattle response to wolves may be apparent in velocity charts as rapid velocities during and immediately after the encounter. However, considerable variation exists with some cow's velocities remaining similar before and after encounters. In spite of this disparity, we believe that there is a potential for monitoring cow velocity with electronic accelerometers that could then signal the herdsman that a problem exists.

Cattle resource selection patterns are still being formally analyzed but on the site where collared wolf B446 was tracked, we have observed that cattle moved towards the fence lines adjacent to the private ranch lands and buildings. Whether this is a pattern that results from cognitive volition on the part of the herd to move toward safety or is simple non-directed flight, we don't know. We do not see broad scale change in the types of land being occupied by cattle, perhaps because they are not free to move out of the area. We continue to monitor both cattle and wolf spatial behavior and as more information is gathered, the picture should become clearer.

seemed to be focused on two locations during this period, the den site and the calving pasture. We should note that calving pastures are close to ranch dwellings which allow for frequent checks by the rancher during calving season.

Because Idaho Site 3 had a collared wolf, it was possible to examine wolf GPS track logs relative to known cattle depredation locations. In some depredation events, Wolf B446 showed a circular track with a radius of several hundred yards around or near the depredation site and in others a simple linear track across the depredation site. In several cases, confirmed depredations occurred at locations where B446 was not present which indicates that other pack members were involved. When confirmed and probable depredation events and wolf GPS locations are plotted, at least a partial picture of wolf activity begins to emerge. It has been suggested that human presence and activity is a deterrent to wolves. In this case, we found that confirmed depredation sites were often near dwellings and roadways. Depredations near centers of human activity are more likely to be detected and confirmed than those in rugged, remote areas of the study sites. Consequently, we cannot speculate whether more predations occur in remote areas than in human-frequented areas. Data for B446 does, however, suggest human presence was not a serious deterrent affecting his movement patterns.

Wolf/Cattle Interactions

Collared cattle on Idaho Site 3 first encountered the Wolf B446 at a threshold distance of less than 547 yards (500 m) on 19 June 2009. This herd of 450 cow-calf pairs contained 10 collared cows. Collared cows periodically encountered the wolf until 3 November 2009 when cattle were removed from the range. We should remember that the collared wolf was part of a larger pack of as many as 12 other individuals and these other wolves may have also encountered these cattle prior to these dates or at closer distances than B446. Also, since both B446 (15-minute intervals) and the collared cows (5-minute intervals) were tracked at a fairly coarse sampling interval, actual encounters could have occurred at much closer distances than those documented by GPS data.

Two of these 10 collared cows had lost their calves by the end of the grazing season. Both these calves were unaccounted for, never found, and were listed as missing. We were surprised by the frequency of interactions between collared cattle and this wolf. Sometimes more than one GPS-collared cow was encountered simultaneously. The maximum number of simultaneous encounters was 6 cows which could indicate a bunching by threatened animals. When broken out as separate events, there were 448 of the 783 total encounters at <500m that were independent (i.e., involved 1 collared cow only).

Most of the close encounters, i.e., at less than 109 yd. (100 m), occurred at night with all but 1 of the 53 encounters occurring between 8:00 pm and 7:00 am. The timing of nighttime encounters at < 100m was bimodal with 24 occurring between 10:00 pm and 1:00 am and 24 between 2:00 am and 6:00 am with peaks near 11:30 pm and 3:30 am.

Table 2. The number of times each of the collared cows on Idaho Site 3 encountered Wolf B446 during the 2009 grazing season. The period between first and last encounter was 137 days.

Cow/Wolf B446 Interactions (Count)	Animal (Cow Collar #)										
	003	005	008*	018	019	020	021	022*	023	024	Total
547 yd. (500 m)	73	121	41	61	99	140	93	23	52	80	783
273 yd. (250 m)	24	43	14	10	36	37	20	4	15	41	244
109 yd. (100 m)	3	5	3	0	7	12	5	1	2	15	53

*Animals marked with a star lost calves during the summer grazing season.