Fine-Scale Avoidance of Cutblocks by Two GPS-Collared Caribou In the Redrock-Prairie Creek Area

by Christoph Rohner and Tara Szkorupa

Two GPS-collared caribou entered an area with a concentration of 3-28 yr old cutblocks on the Redrock-Prairie Creek winter range during winter 1998-99. This is a first sample of detailed data on caribou responses to human-caused landscape changes in our study area. Two main results emerged: (1) both caribou showed a significant fine-scale avoidance of cutblocks, (2) both caribou used forested areas right next to cutblocks and there was no broad or consistent edge effect. Research is needed to identify whether (a) most or only few caribou enter areas with cutblocks (potential coarse-scale avoidance), (b) habitat around cutblocks remains effective caribou habitat and does not attract predators because of high abundance of moose and deer feeding on fresh vegetation in re-growing forests.

We are looking back on a first winter of monitoring caribou movements with the help of GPS collars. The performance of the system has been encouraging, and first results are emerging.

All of the 5 GPS transmitted results that far exceeded the number of locations possible by aerial location of conventional VHF transmitters. From October 1998 to the beginning of May 1999, more than 1000 locations were obtained for 4 caribou (Table 1; one GPS collar only completed 36.2% of all attempts for locations successfully).

These 5 intensively monitored caribou used a large portion of the Redrock Creek range, but only entered the Prairie Creek portion in late winter. Details about the use of winter ranges and habitat associations will be reported later.

A first analysis focussed on the behaviour of 2 caribou that approached within 2.5 km of existing cutblocks on the Redrock winter range.

Female 309 arrived in the vicinity of cutblocks on 2 Nov 1998 and stayed nearby for most of November and December. This caribou spent most of January and February several kilome-

Table 1: *Number of GPS locations obtained by 5 GPS collars on caribou in the Redrock-Prairie Creek Herd during winter 1998-99.*

Down-load	Collar	Caribou	N loca-tions	% Suc-cess
6-May-99	4c	F301	1283	99.6%
6-May-99	52	F324	1002	93.3%
6-May-99	51	F306	466	36.2%
6-May-99	5b	F300	1208	93.9%
6-Mav-99	5a	F309	1247	96.8%

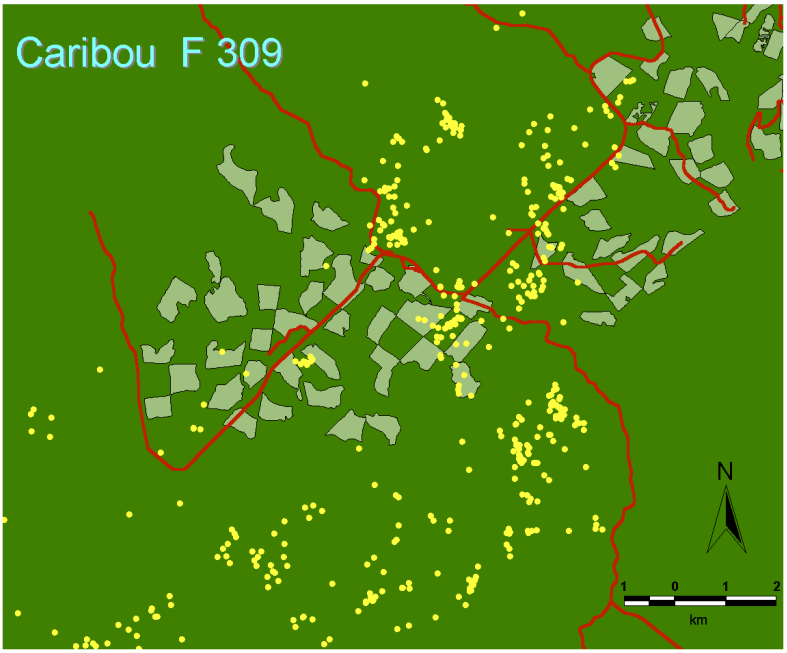

Figure 1: *Locations of caribou F309 in the vicinity of cutblocks on the Redrock winter range, Nov 1998 - Apr 1999 (roads indicated in red).*

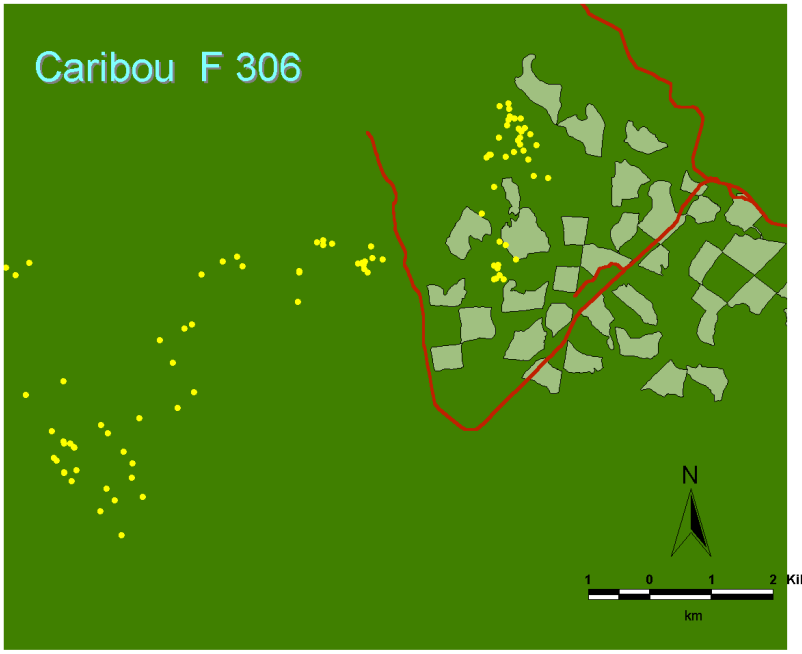

Figure 2: *Locations of caribou F306 in the vicinity of cutblocks on the Redrock winter range, Nov 1998 - Apr 1999 (roads indicated in red).*

ters west, but returned to the vicinity of cutblocks from 25 March to 7 April 1999 (**Figure 1**).

Caribou F306 came closer to the vicinity towards the end of winter, entered the area within of 2.5 km of cutblocks on 17 April 1999 and was still nearby at the time of last downloading of data on 6 May 1999 (**Figure 2**).

Avoidance Patterns

At first glance, Figures 1 & 2 show a broad scatter of caribou locations. The most obvious pattern is that both caribou did not stay far away from cutblocks, but maneuvred closely around them.

Only few points fall into cutblocks. Is this a result of avoidance, or was it just by chance that we don't have more caribou locations in cutblocks?

A systematic approach can be used to answer this question. It is best to first assume that all points are scattered randomly over the landscape.

If this was so, we would expect fewer points in clearcuts, simply because the total area of cutblocks is relatively small compared to the forested area in the vicinity.

Taking into account what habitat was *available*, and what habitat was actually *used* by caribou, we calculated an index of preference. This index reveals whether a specific habitat was used more frequently than expected from its availability (preferred) or was less used than expected from availability. We considered all

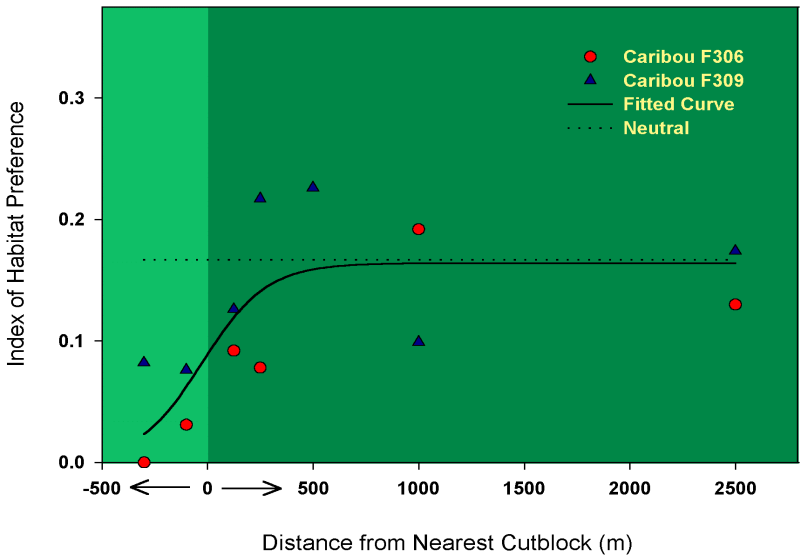

Figure 3: Preference of two female caribou for habitat types defined by the distance from the edge of cutblocks. Each data point is the result of comparing use versus availability on concentric circles (buffers) around cutblocks. A random distribution over the landscape would produce a neutral value of 0.14, higher values indicate preference and smaller values indicate avoidance. A sigmoid curve was fitted to the values (an outlier of 0.48 at 500 m for F306 was excluded).

habitat available that was within a 1 km radius of each caribou location. Calculations with differently-sized circles around each locations were all similar.

As habitat types we first identified cutblocks and surrounding forest. Think of a cutblock as a bull's eye, and now we look at the scatter of caribou locations over the target. As with a bull's eye, we can divide the landscape into concentric rings or segments, all with different values. These values are the results of calculating the preference index for each habitat or segment. **Figure 3** shows these values, from the centre of a cutblock towards the edge to the forest, and then away from a cutblock into unharvested forest.

There is a consistent pattern of both caribou avoiding cutblocks, although there is considerable variation as to be expected from a preliminary sample such as ours. This raises the question whether this observed pattern of avoidance could simply have occurred by chance, or in other words, whether the pattern is significantly different from random noise.

Statistical Tests

We used a standard procedure called 'Compositional Analysis' for statistical testing (see Appendix). As we do not have results of larger numbers of animals yet, we did not derive an overall significance but rather tested both caribou separately. For this purpose, we developed a randomization test (also called Monte-Carlo simulation or Bootstrapping, see Appendix).

Compositional analysis does not use a preference index but simply ranks habitats in the order of their use, and assigns a probability whether the difference in use between habitats would be expected by chance alone.

Below are the results of this analysis, somewhat simplified by only using 3 habitat types: cutblocks, forest edge within 250 m of cutblocks, and other forest up to 2.5 km from cutblocks.

The results show the same ranking for both caribou, and confirm a significant avoidance of cutblocks for both caribou. It is premature at this stage to conclude much on edge effects around cutblocks, but at least for the two monitored caribou in

Statistical Significance in Habitat Preferences

Caribou F 309:

Other > 250m >>> Cutblock

Caribou F 306:

Other >>> 250m >>> Cutblock

> not significant
>>> significant ($p<0.05$)

winter 1998-99, such potential edge effects were narrow and certainly did not exceed 200-300 m.

Fine-Scale Avoidance and Management

The pattern of fine-scale avoidance of cutblocks is encouraging as it supports the plans to provide effective caribou habitat around harvested areas. Our preliminary results demonstrate that at least some caribou are using forested habitat close to cutblocks.

At this stage, we know very little about behavioural responses of caribou to different types of industrial activity. We selected the two caribou because they travelled into an area with scattered cutblocks. It is possible that other caribou avoid these areas altogether (coarse-scale avoidance). Continuing research efforts are expected to answer this question, and will contribute to a better understanding of caribou responses to industrial development.

Habitat avoidance as a planning tool?

'If animals are attracted to a habitat type it must be good habitat, and if they avoid it then it must be bad.' Such rules of thumb are commonly applied to the management of wildlife species. But this rule does not always apply.

Sometimes, avoidance of disturbances can actually mean that the animals will be able to avoid negative effects from development simply by staying away from the danger. In the case of caribou on winter ranges, a lack of a strong avoidance of areas with clearcuts would not automatically mean that this habitat is automatically suitable for wintering.

Attractive habitats can become 'sink habitats', or in other words, habitats that will not support animal populations using them. An example are salt licks alongside Highway 40 - without precautions, there is an imminent danger that the attractive roadsides will cause traffic mortalities that cannot be sustained by even a very healthy caribou population.

A more subtle but very similar scenario may arise around harvested areas. As the regrowing forests provide ample fresh vegetation, moose and deer are attracted and wolves may concentrate some of their hunting effort in these areas - leading to a higher predation risk for caribou.

Outlook

Ongoing research will first establish any potential avoidance with a larger sample of caribou, taking a fine-scale and course-scale approach into account. Secondly, it is planned to investigate the costs and benefits that caribou experience in different habitat types, and how these are affected by different forms of industrial development. One source of information about predation risk near cutblocks will consist of an analysis of space use by GPS-collared wolves, another source of information on benefits in different habitats will result from work on foraging activity of monitored caribou.

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Appendix: Calculations

Index of Preference: Manly's α (e.g. Krebs, C.J. 1989. Ecological Methodology, Harper & Row, NY.)

Compositional Analysis: Aebischer, N.J., P.A. Robertson, and R.E. Kenward. 1993. Compositional analysis of habitat use from animal radio-tracking data. Ecology 74: 1313-25.

Randomization Tests: >800 permutations of original data across 3 habitat types; randomization separate for each individual; maximum of 4 loc/d; N locations F309 = 189 and F306 = 55. Bootstrapping according to Hall, P. and S.R. Wilson. 1991. Two guidelines for bootstrap hypothesis testing. Biometrics 47: 757-762.

'Research News' is intended to update members of the West-Central Alberta Caribou Standing Committee (WCACSC) about recent highlights of supported research, which are currently prepared for final products.
 -- *Subsequent issues are planned to address survival of monitored caribou in West-Central Alberta, caribou and mature forests, responses to roads, and use of winter ranges based on telemetry and snowtracking.*