

CBI/WCS Woodland Caribou Expert Workshop Summary

A workshop organized by the Canadian Boreal Initiative and Wildlife Conservation Society was held February 28 and March 1, 2006 at the University of Ottawa with habitat needs of woodland caribou as the central focus. The goal of the gathering was to explore how much consensus there is among caribou scientists about what is and what is not caribou habitat, and on parameters or thresholds for maintaining sufficient woodland caribou habitat in the face of large-scale anthropogenic disturbances. Presently, there is much focus on woodland caribou conservation through the twin vehicles of land use planning (occurring at various scales across the country) and species recovery planning. Therefore, it is an important time for scientists with caribou expertise to contribute to these important conservation decisions. Workshop participants considered how current knowledge might inform woodland caribou conservation and management processes. Limits in current knowledge were also identified and used to develop a future research agenda. Workshop participants (and affiliation) were: Stan Boutin (University of Alberta), Matt Carlson (Canadian Boreal Initiative), Stewart Elgie (University of Ottawa), Jean-Pierre Ouellet (Université du Québec à Rimouski), Katherine Parker (University of Northern British Columbia), Justina Ray (Wildlife Conservation Society Canada), Jim Schaefer (Trent University), Fiona Schmiegelow (University of Alberta), and John Weaver (Wildlife Conservation Society). A summary of workshop outcomes is provided below.

Important Aspects of Woodland Caribou Habitat

A major factor influencing the suitability of habitat for woodland caribou is predation risk, which caribou populations strive to minimize at the largest scales of habitat selection. Other factors such as food availability and snow conditions are also influential, but usually selected for at smaller scales. Predators of woodland caribou include species such as wolves, bears, coyotes, cougars, and sometimes wolverine. Although woodland caribou make up only a small component of the diet of any one of these species, even low levels of predation can threaten the viability of a woodland caribou population. Most predation occurs during the snow-free months; calf predation often occurs within 6 weeks of birth and predation of female woodland caribou is high just prior to calving. Various strategies are employed by woodland caribou to lower predation risk and enhance survival and reproduction:

1. Maintain low population density. Woodland caribou density is most of the time below 0.06 caribou per km². Herds of a sufficient size to maintain viability will therefore inhabit very large areas. The median area occupied by a herd is about 9,000 square kilometres¹, but larger areas are not uncommon.
2. Occupy areas where alternative prey (i.e. other ungulates such as moose and deer) density is insufficient to support predator populations. As a result, woodland caribou are generally found in regions with high proportions of habitat types such as old coniferous forest, peat or wetland complexes, and high-elevation areas. Such habitats typically are nutrient poor and do not provide sufficient vegetation biomass to support

¹ Schaefer, J. A., and S. P. Mahoney. 2003. Spatial and temporal scaling of population density and animal movement: a power law approach. *Ecoscience* 10: 496-501.

ungulates such as moose and deer. They are most influential not through direct effects such as provision of food or shelter to caribou, but rather through the proximate effect of maintaining low predator populations at the regional (i.e. herd) level. Therefore, habitats across the range of a woodland caribou herd must be incompatible with supporting high alternative ungulate populations in order to best maintain caribou population viability.

Relationship between Disturbance and Woodland Caribou Habitat

Most woodland caribou populations with ranges subjected to forest harvesting are in decline. The evidence suggests a critical threshold beyond which caribou-predator relationships become altered, with caribou recruitment and survival adversely impacted after that point. The principal driver of this appears to be habitat change brought about by disturbance. The relatively high reproductive potential of moose and deer allows them to take ready advantage of flushes of young vegetation that arise after forest disturbance, allowing predators to reach higher population densities than they might otherwise in regions where caribou occur. In multiple prey systems, therefore, caribou tend to be subjected to excessive predation, and populations usually decline.

Timber harvest is one of the principal drivers of human-caused large-scale disturbance in boreal forests. Fire is also an important disturbance agent in boreal forests. However, natural disturbances such as fire tend to be sufficiently isolated temporally and spatially that they do not support increased predator densities. In comparison, timber harvest is never isolated but rather is part of a regional development process that typically causes large-scale habitat change and increased predator densities. Habitat transformation caused by other land-use footprints such as well sites, pipelines, and seismic lines is also sufficient to cause caribou populations to decline through the same process. The role of roads is not straightforward, as roads and resource extraction occur in tandem. It appears, however, that initial drivers of shifts in numerical responses of alternate prey -- which, more than anything, will drive the predator response -- are stimulated by habitat change. Although roads may facilitate travel by wolves and other predators, the extent to which they provide access to human hunters also drives caribou population decline.

Management Implications

The above mentioned strategies used by woodland caribou to minimize predation risk have several important management implications.

1. **Woodland caribou management and conservation decisions should not occur at a smaller scale than that of a herd's range.** If habitat transformation in any part of a caribou herd's range is high enough to support higher alternate prey and predator densities, the herd will be at risk. This has implications for:
 - a. Designation of Critical Habitat under species recovery planning (see below).
 - b. Land use planning in regions occupied by woodland caribou. To conserve a caribou population, any land use planning process must consider, at minimum, the entire spatial extent of the herd range, which will be particularly challenging where delineations of herd ranges are unknown and where planning units are constrained by other factors.

2. **The entire woodland caribou range, across all herds, should be designated as critical habitat.** Caribou range in North America is delineated on the basis of herd ranges and, if range information is not available, general occupancy. Given the imperative of making management and conservation decisions at the range level, the designation of Critical Habitat should extend to the entire caribou range.
3. **Low levels of industrial development within a woodland caribou range may threaten the viability of the herd.** Research findings suggest that even low levels of industrial development are sufficient to threaten the viability of a woodland caribou herd, particularly within its summer range, due to the susceptibility of caribou to increased predation pressure as described previously.
4. **Large areas must be free from industrial activity to maintain woodland caribou herds.** Most threatened species have specific needs that can be protected through targeted management actions such as protection of habitat features that are relatively small in spatial extent. In comparison, woodland caribou conservation calls for protection of very large areas. Due to low population density, woodland caribou herds cover very large (thousands of square kilometers) areas. Population-level responses to perturbations are known to be driven by habitat changes within range and within certain distances (kilometers rather than meters) beyond the range margin. Because all evidence suggests this to occur at very low thresholds, options beyond absolute protection at large scales have not been successful.
5. **The effects of industrial development on woodland caribou are likely permanent.** There is no evidence of a woodland caribou herd successfully recolonizing an area after industrial activity has occurred. This is likely because industrial activity is almost never an isolated event. Rather, once industrial activity (e.g. a road or a cutblock) has occurred in a caribou range, more activity usually follows through time. This results in a permanent change to a region's habitats, which leads to increased predation pressure and, ultimately, caribou population decline. In comparison, woodland caribou do eventually recolonize burned areas because habitat disturbance caused by fire is sufficiently isolated (spatially and temporally) to not support increased predator populations.
6. **Extirpation of woodland caribou from disturbed regions will be delayed.** Industrial activity initiates processes that can take decades to cause caribou extirpation. Although caribou populations may persist in a developed area for some time following the disturbance, population parameters such as cow:calf ratios and adult survival rates (less than 80%) generally exhibit sustained declines prior to extirpation. Once initiated, however, caribou extirpation is probably not possible to reverse because of the sensitivity of caribou to predation risk and the long-term effect of industrial disturbance on predation pressure.
7. **Timing of human activity has little effect on woodland caribou populations.** Although most predation occurs during the snow-free months, human activity at

anytime during the year affects woodland caribou. This is because the primary effect of human activity is transformation of habitat such that higher predator populations are supported. The summer and winter ranges of most caribou herds are in close proximity, which means that disturbance to the summer or winter range at any time of year can cause increased predation pressure during the summer. A potential exception are herds that display spatially separated summer and winter ranges. Such herds may be capable of tolerating higher levels of disturbance in their winter range than their summer range.

8. **Commonality likely exists between herds across Canada regarding impacts.** While woodland caribou employ different strategies to maximize survival and reproduction, there are also probable consistencies in their response to habitat changes that primarily affect predation rates.
9. **Thresholds of disturbance are not fully known but appear to occur at the scale of kilometres or more.** Ample evidence indicates that there is a relationship between woodland caribou demography and range condition, such that habitat changes brought about by natural and human disturbances will result in impacts to parameters such as adult survival rate and recruitment. A growing number of studies demonstrates that detrimental effects on caribou behaviour and occupancy occur at the scale of 2-10 km from landscape disturbances. Therefore, identifying areas in which little or no human disturbance is allowed will be important to maintaining viable caribou populations. Existing evidence is likely adequate to allow for caribou habitat protection requirements to be identified, at least on an interim basis, following a precautionary approach. However, further analysis and research is needed to better understand thresholds in range condition that could be used to generate recommendations on minimum area of protection needs, or extent of allowable human footprint in any given area.

These management implications suggest that practices that minimize the footprint caused by industrial activity are unlikely to protect woodland caribou populations. While new approaches to minimizing disturbance might be less detrimental to caribou populations, long-term data will be required to determine their effectiveness. Based on current knowledge, it is likely necessary to protect entire herd ranges from industrial activity to sustain caribou populations. As such, woodland caribou present a unique challenge with respect to managing species at risk.

Research Needs and Next Steps

An important management question is what amount of disturbance to a woodland caribou range is sufficient to cause caribou population decline. Research suggests that even low levels of disturbance cause woodland caribou population declines and extirpation. To date, however, no analysis has attempted to synthesize the substantial data that exist across Canada to define the relationship between range condition and woodland caribou population change. Such an analysis is being undertaken over the next 6 months in a collaborative initiative involving caribou biologists from across the county. The analysis

will use existing data to estimate the relationship between range condition (e.g. natural and human disturbance, habitat amount and distribution) and woodland caribou population parameters such as female survival and recruitment. Results will be presented in a publicly available report that is anticipated to be completed by Fall 2006.