Session six

Habitat

The Eight North American Caribou Workshop,
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Brief communication

Habitat selection and use by muskoxen and reindeer in western Alaska: a preliminary report

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Due to their specific physiological and morphological adaptations to survival in the arctic, muskoxen and reindeer/caribou have evolved different foraging strategies and habitat preferences which are believed to keep competition at a low level (Klein, 1986; Schaefer *et al.,* 1996). On the Seward Peninsula in western Alaska, open herding of reindeer has provided cash income and a food supply for native people since their introduction in the late 1800s. Following introduction of muskoxen in 1971 and 1980, some reindeer herders have developed concerns about possible competition for forage with reindeer or antagonistic behavioral interactions between muskoxen and reindeer that might displace reindeer from feeding sites.

This study addresses those concerns with the following objectives: 1) to characterize muskox and reindeer habitat at different scales of selection (range, feeding sites, feeding craters, diet), to identify overlap and factors driving forage selection at each level for each species, and to understand implications for possible competition between the two species, and 2) to assess behavioral interactions between muskoxen and reindeer.

The study area encompasses the reindeer range of herder Herbie Karmun on the northwestern Seward Peninsula, between Kugruk River in the east, the mouth of Goodhope River in the westand Imuruk Lake to the south. Approximately 2500 reindeer and 150-200 muskoxen occupy the range year round. Feeding sites of both species were sampled and marked in March and April of 1996 (n=15 for muskoxen; 14 for reindeer) and 1997 (n=14 for muskoxen, 12 for reindeer). On a 30X30 m sample grid 10 random spots which characterize feeding sites, and 10 randomly chosen craters were sampled for snow depth and integrated snow hardness using a Rammsonde penetrometer (Skogland, 1978). The amount of above-snow vegetation (graminoids, shrubs or hummock) was recorded at each sample point. A composite fecal sample from 10 pellet groups was collected at feeding sites (n=16 for muskoxen in 1996, 15 for muskoxen in 1997, 13 for reindeer in 1996 and 13 for reindeer in 1997). Sites were relocated in summer when the vegetation cover was assessed using a 16-point sample frame. Since the exact availability of habitat during late winter is not known for either species, range was defined as the area within a radius of one mile surrounding feeding sites, a margin wide enough to generally include neighboring feeding sites. Within this area, control plots (n=10 for muskoxen in 1996, 10 for muskoxen in 1997, five for reindeer in 1996 and eight for reindeer in 1997) were sampled in the manner described above.

Data from both years were combined for the analysis. Snow data were analyzed separately by year. Fecal samples were analyzed by microhistological analysis. In order to assess their relative importance for the selection at each level, all variables were analyzed together by stepwise logistic regression. Multivariate analysis of variance (MANOVA) was used to detect differences based on species (muskoxen *vs.* reindeer) and use (used *vs.* available) at the diet, crater and feeding site levels, where the respective next highest level provided data for availability. Analysis is still in progress and all results are preliminary. While muskoxen fed almost exclu-

sively on exposed upland habitats dominated by lichen/*Dryas*/communities, reindeer used a wider variety of habitats, feeding also on tussock and tussock/ shrub tundra along slopes and in valleys. Decreasing snow depth appears to be the most important indicator for the selection of feeding sites and craters for both species. Snow hardness is also selected against by both species, but more clearly so at the crater level than at the feeding site level. For muskoxen, the amount of above-snow graminoids was also a strong indicator of crater selection. Vegetation cover of range plots does not differ greatly for muskoxen and reindeer. Muskox feeding sites have a higher occurrence of lichens and a lower occurrence of sedges and standing dead than reindeer feeding sites, while at the crater level the trend is reversed, with muskox craters higher in sedges and standing dead and reindeer craters higher in lichen. Reindeer diets were dominated by lichens (53.0±1.8%) while muskox diets were dominated by sedges, lichens and moss (26.9±1.8%; 23.0± 1.4%; 19.9±1.9%), respectively.

These values reflect diet composition after adjusting for differential digestibilities of forage classes (Boertje, 1981). While both species select for lichens and against sedges and standing dead at the feeding site level, differences in selection become more evident at lower levels of selection and reach their clearest separation at the diet level, with reindeer selecting strongly for lichens and muskoxen for sedges and to a lesser degree for mosses and lichens. Shrubs and willows are selected against by both species at all levels. Few direct behavioral interactions between muskoxen and reindeer were observed. Though muskoxen were occasionally frightened by reindeer running frantically from insect harassment, all other encounters were of a benign nature, with neither species appearing to be disturbed by the presence of the other. Complete analysis of the data will help to further quantify the degree of resource use overlap between muskoxen and reindeer at different levels of selection and its implications for competition.

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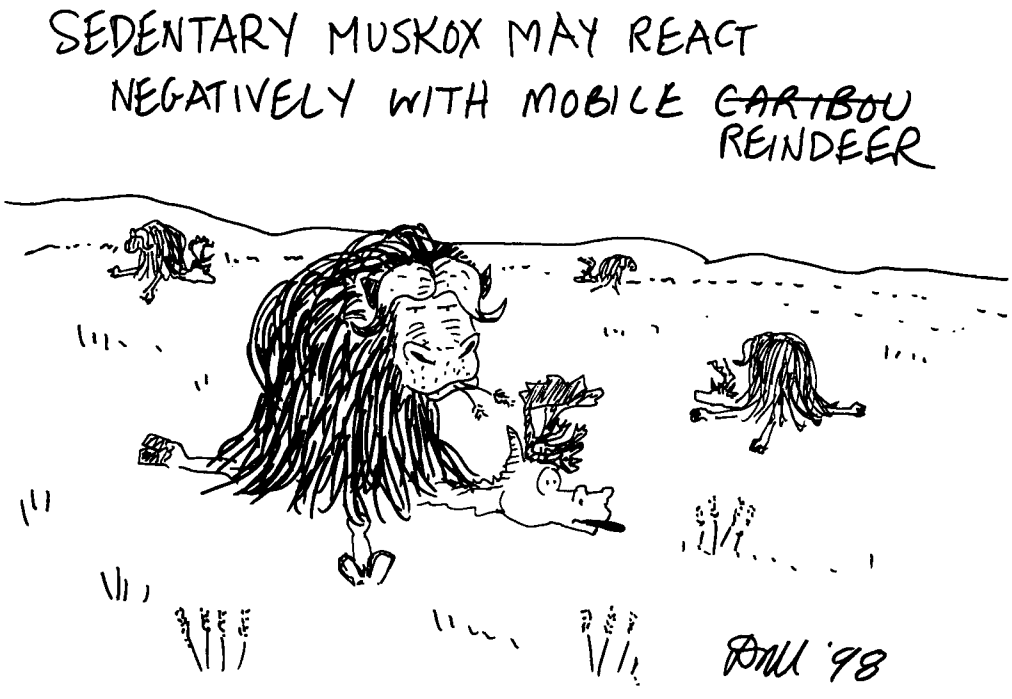

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Brief communication

Landscape-level considerations in the management of forest-dwelling woodland caribou (*Rangifer tarandus caribou*) in northwestern Ontario

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Abstract: Forest-dwelling woodland caribou (*Rangifer tarandus caribou*) are distributed widely across northwestern Ontario, although their range has receded significantly during the 19th and 20th centuries. Despite this continuous range occupancy, there is a clear mosaic of high value habitats used by caribou, separated by lower-use habitats. Radio-collaring data illustrate the large scale at which woodland caribou use the range (i.e. 100's to 1000's of sq. km/year). This mosaic of habitat use is a reflection of habitat conditions and landscape patterns created by wildfire within the boreal forest. As forest management and other human development extend further into woodland caribou range, the continued presence of caribou in the boreal forest will be dependent upon the continuation of forest landscape patterns similar to those which occurred with wildfire. "Mosaics" of scheduled harvest and deferred tracts intended to emulate natural fire patterns are in place for all Forest Management Units within caribou range.

Key words: forest management, landscape pattern, habitat management, caribou conservation.

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Introduction

Woodland caribou range has receded northward during the last century and a half, and this range recession appears to be relatively permanent. Management efforts are underway in northwestern Ontario to ensure no further range recession, and to maintain caribou use of currently occupied range. Management activities are being directed at the landscape level, because that is the scale at which woodland caribou in northwestern Ontario appear to be using their habitat.

The plotting of recent (1990s) observations of woodland caribou occurrence, without consideration of the degree of use, by 100 km² U.T.M. cells indicates that caribou occurrence is almost continuous within their range. The exceptions relate to isolated populations that still exist on some islands and mainland portions of eastern Lake Superior.

Natural Disturbance Patterns

Caribou in northwestern Ontario occur within the boreal forest. This area has historically been subjected to a number of natural disturbances such as wildfire, blowdown, and insect infestations. These areas vary in size from very small to very large (i.e. 1000's of km²). However, the dominant landscape pattern is most often determined by the large wildfires that periodically occur within the boreal forest. While woodland caribou typically frequent mature forests and habitually use traditional habitats, they have also had to deal with major, abrupt changes in forest structure, composition and function periodically caused by these large wildfires.

The broad scale at which caribou use the landscape, including their movements between seasonal habitats and their occupation of large areas even within one season, have allowed caribou to adapt to

the changing habitat conditions caused by these periodic wildfires, and to find new areas with both suitable habitat conditions and low predator densities.

Caribou Habitat Utilization

Despite their broad occupation of the landscape, areas of significant woodland caribou habitat can be delineated. Field staff were able to identify significant areas of winter habitat, calving habitat, and summer habitat, as well as basic movement patterns, based upon known information on:

- areas where caribou are more abundant during that season, and/or
- areas where caribou would predictably be present during that season.

This information was obtained from winter aerial surveys, summer surveys of lakes and islands, incidental reports from the public, and data from an ARGOS radio-collaring study. Major wintering areas were primarily areas of mature, sparsely stocked coniferous forest. Summer and calving habitats were focused on either shoreline/island habitat, or peatland areas with upland islands within them.

This significant caribou habitat is dispersed discontinuously across the forested landscape of northwestern Ontario, often separated by many km from other similarly classified habitat. This information supports the concept of range occupancy at the landscape level, while emphasizing that some areas are of greater value and use than others at any particular time.

Caribou Collaring Study

A number of woodland caribou across northwestern Ontario have been equipped with ARGOS satellite radio-collars as part of a co-operative research project with Laurentian University, in order to obtain information on caribou habitat use that would be of value to forest management planning. Twenty-one collars have been placed on a number of differenr caribou (more than 21, as collars have been refurbished and replaced on new animals periodically). Data from this small set of animals over a two year period portrays the broad landscape utilization pattern of caribou - information from these animals alone covers much of the area of continuous caribou distribution near the southern range boundary.

Information from two specific collared animals (#24135, #1616) further portrays the broad scale of habitat use by individual animals. Caribou 24135 spent considerable time within Wabakimi Provincial Park, a 892 000 ha park based in part on caribou habitat values, but also spent a considerable portion of its life cycle outside of this park. Movements of this caribou spanned a distance of over 90 km. Caribou 1616 similarly moved within an area approximately 80 km in diameter, and spent time both in Woodland Caribou Park (a park of 450 000 ha) and in the adjacent managed forest. These observations support the concept that caribou habitat cannot be managed solely within parks and protected areas, no matter how large, but must also considerable appropriate management of the adjacent landbase.

Caribou Habitat Management - The "Mosaic" Approach

The southern range of woodland caribou in northwestern Ontario occupies both provincial parks and forest management units. These forest management units are licensed for timber harvesting, and the expectation is that the entire unit will be harvested over a rotation period. A regional approach has been taken to caribou habitat management, so that caribou habitat requirements are considered during the development of forest management plans both within each management unit, as well as being coordinated across adjacent management units. Caribou habitat "mosaics" were developed to ensure long-range habitat supply in units scheduled for timber harvesting. These mosaics disperse timber harvesting across the landscape in a pattern somewhat similar to that created by wildfire, maintaining large tracts (100 km^2+) of mature conifer-dominated habitat and similarly allowing timber harvest in large tracts of timber to provide for the provision of future habitat.

The development and implementation of these caribou habitat mosaics requires both a landscape perspective (i.e. across several management units), as well as long-term planning (i.e. over the rotation age of the forest - usually 100 years). Mosaic development includes consideration of current habitat use, habitat capability and suitability, operational harvesting concerns, forest age, composition and structure, and the existing degree of forest disturbance on the landscape.

Challenges

There are several major challenges associated with the implementation of the regional habitat management and conservation strategy for forest-dwelling woodland caribou.

While this approach emulates natural distur-

bance patterns more closely than traditional timber harvesting approaches, it is still only an initial approximation of natural disturbance patterns, and does not by itself address associated natural processes. Considerations such as forest succession and future forest condition must also be addressed during the development of operational forest prescriptions.

i) The potential for a change in forest composition to a higher hardwood component at the landscape-level is of significant concern from a caribou habitat perspective.
ii) The creation of major forest access road networks has no natural parallel, and these roads have indirect effects such as increased and permanent edge, enhanced predator access, continued human presence, etc. To optimize the probability for continued caribou range occupancy, access must be carefully planned and managed.
iii) There are operational limitations to the forest industry's ability to make the transition to a more dispersed harvesting pattern, and there are also implications to the available wood supply that lead to lower harvest levels. Any approach that attempts to manage on an ecosystem-based approach by spatially directing timber harvest will have similar effects.
iv) The caribou habitat mosaic requires long-term planning of forest harvest and renewal, but at the same time it must be subject to periodic review during each planning cycle (five years). Changes in forest disturbance, caribou information and new science will all be considered during the periodic review and refinement of these habitat mosaics.
v) Taking a landscape approach to caribou management is controversial, particularly when it means the creation of large disturbance patches as well as the deferral of large, mature tracts from harvesting. However, if logging is to occur within caribou range within the boreal forest of northwestern Ontario, it appears important that the logging disturbance patterns approximate as closely as possible those created by natural conditions.

Conclusions

The continued presence of woodland caribou within the managed forest is clearly a conservation biology issue, and requires significant adjustments to forest management practices. Given that woodland caribou use the forest at a landscape level, management practices must also be addressed at this level, as well as at the more site-specific level (e.g. protection of individual calving sites). The emulation of natural wildfire patterns appears to hold the best promise for maintaining current caribou range, while recognizing that local considerations, ecological processes and related impacts such as the predator-prey balance must also be addressed.

Continued monitoring of caribou habitat use and range occupancy will be necessary to determine the long-term success of this strategy.

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HUMANS ARE CHANGING RAPIDLY!
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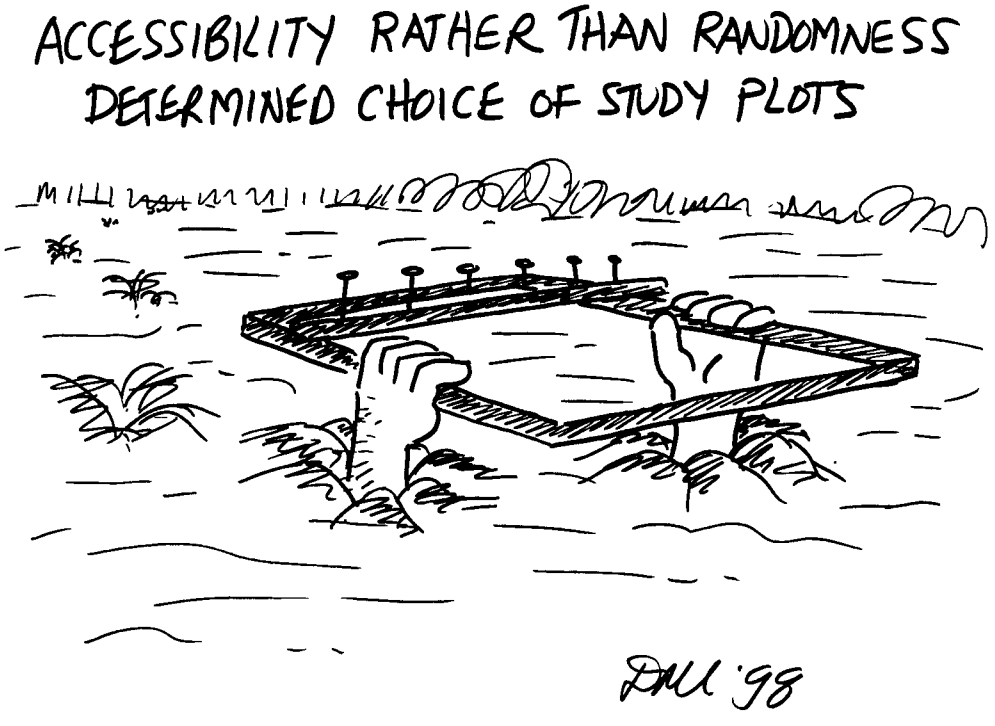
DM '98


ACCESSIBILITY RATHER THAN RANDOMNESS
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The ebb and flow of caribou in the high Arctic

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Abstract: Caribou (and reindeer), *Rangifer tarandus,* show a broad range of adaptability to varying habitats throughout the distribution of the species, from the southern limits of the boreal and taiga forests and intermountain regions of North America and Eurasia to the northernmost lands in the Arctic. The caribou and reindeer and the muskox, *Ovibos moschatus* are the only two ungulate species adapted to life in the high Arctic. In the high Arctic however, caribou and reindeer live close to the limits of their adaptabilty to the extreme conditions present there and their populations are chatacterized by wide fluctuations, often culminating in local extirpation. Although the muskox may be somewhat better equipped to survive the climatic and associated vegetational extremes of the high Arctic, the extremely efficient locomotive ability of caribou has enabled them to become established, during at least some portions of the Holocene, on virtually all of the high arctic islands, as well as the insular-like ice free portions of all of Greenland. Their often transitory presence in these extreme habitats appears tied to past periods of climatic change as well as short term climatic extremes. However, the arrival and successful establishment of caribou on the extremely remote arctic islands of Svalbard and Franz Josef Land 5000 and 4000 years ago respectively, required favorable climatic conditions for establishment and growth of forage plants, a population source from which they derived, and conditions permitting their long distance travel across the pack ice. The presence and dynamics of caribou on the Severnaya Semlya and New Siberian archipelagos have been the product of seeding by the large migratory herds on the adjacent mainland, favorable ice conditions in the straits separating them from the mainland, suitable climatic conditions on the islands, and the frequency of disruptions in their freedom to return to the mainland. Of critical importance to the establishment and persistence of populations of caribou in these marginal habitats at such high latitudes has been the absence or low density of predators, including humans, and freedom from the physiological stresses of insect parasitism and harassment common at lower latitudes. If the current patterns of global climate change continue, with greatest changes occurring in the Arctic, caribou in the high Arctic can be expected to respond through major distributional and population changes in relation to the regional variations that characterize atctic climate.

Permafrost, lichen, and woodland caribou: late-winter habitat use in relation to forage availability

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Abstract: Factors such as forage abundance and predation risk may influence an animal's habitat use patterns at a number of different scales. On a large scale, woodland caribou (*Rangifer tarandus caribou*) in north-eastern Alberta have been shown to restrict their movements to within large peatland complexes during winter. It has been suggested that avoidance of upland habitats may be influenced by predation risk. No study has been done on finer scale habitat use within these peatland complexes. The purpose of this study was to determine if late-winter habitat use within the peatland complex is related to the abundance of *Cladina* lichen. It was hypothesised that peatland classes containing permafrost would have the greatest *Cladina* abundance and, thetefore, be selected by caribou for feeding. We also predicted that telemetry locations would be closer to high forage areas than is expected by chance. Average *Cladina* ground cover was quantified for ten wetland types during the summer of 1997. Feeding sites were located by backtracking during the late-winter period from mid-January to the end of March, 1997. The wetland class for each feeding site location was derived from a digital wetland inventory using a GIS (Geographic Information System). The telemetry data analysed in this study was collected during late-winter in 1995, 1996, and 1997. A corresponding set of random points was genetated for each year. The distance to the closest habitat polygon with high forage abundance was calculated for telemetry and random points using a GIS. Vegetation analysis produced two habitat categories: 1) 'high' *Cladina* treed peatlands; and 2) 'low' *Cladina* open peatlands and non-peat wetlands. Contrary to our hypothesis, peatland classes containing permafrost did not have significantly higher *Cladina* abundance than other treed peatlands. Feeding site analysis did, however, show almost exclusive use of high *Cladina* habitats for feeding. In all years, telemetry locations were closer to high *Cladina* habitats than were random points. The distribution of high forage habitat within the peatland complex appears to be related to the pattern of habitat use. Future habitat use analysis will include a number of factors such as tree cover, habitat patch size, and stand age.

Crater site selection by woodland caribou of the Southern Lakes herd, Yukon: differential effects of congeneric lichen species

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Abstract: Caribou foraging during winter on snow-buried terrestrial lichens must locate resources by scent and access them by digging craters. Previous research found that caribou select crater sites where the relative abundance of certain lichen genera is greater, and avoid cratering at sites where these genera are scarcer or absent. I expanded on previous research by proposing that congeneric lichens species have differential effects on crater site selection, and tested my hypothesis with data collected by snow-tracking woodland caribou in the Southern Lakes Region, Yukon. Results supported my hypothesis. Cratering probability increased as the petcent cover of *Cladina mitis* became greater, but the percent cover of its close relative *Cladina rangiferina* had no effect. Similarly, cratering probability increased as the percent covers of *Cetraria islandica* and *Ce. cuculata* became grearer, but was unaffected by the percent cover of their close relative *Ce. nivalis*. The effects of *Ce. islandica* and *Ce. cuculata* are noteworthy because these species were as scarce as any taxa that did not affect crater site selection (their maximum % covers were, respectively, 5% and 22%, and their 75% quartile % cover was 0). In addition to testing my hypothesis, I found that cratering probability increased as the percent cover of *Cladonia* sp. became greater, but was unaffected by the percent covers of *Peltigera* sp. and *Stereocaulon* sp. (field personnel could not identify these genera to species). Crater site selection was unaffected by variability in snow depth or penetration, which was not surprising given the shallow snowpack of the study area (mean and standard deviation snow depth=31.5 (5.8) cm). I found almost no correlations among the percent covers of each lichen taxa, suggesting that the number of craters a caribou must dig, and thus the area it needs to search, will increase with the number of lichen species it is searching for. My results suggest that management decisions based on the distribution of lichen genera, rather than species, could underestimate the amount of land that should be protected to ensure the long-term persistence of a caribou population. Also, protecting areas where *Ce. islandica, Ce. cuculata, Cladina mitis* and *Cladonia* sp. are abundant likely will contribute towards conserving the Southern Lakes herd, which is endangered partly because of habitat loss. Research needed to refine conservation recommendations includes comparative nutritional analysis of lichen species, addressing the effects of species of *Cladonia* on cratering probability, and landscape-level analysis of foraging decisions and of lichen distributions.

Development and application of animal borne global positioning system (GPS) technology on woodland caribou

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Abstract: In 1996, a cooperative research and development project was initiated by Manitoba Hydro in cooperation with the Manitoba Model Forest (MBMF), Manitoba Natural Resources (MNR), the University of Manitoba Natural Resources Institute (MNRI), and TAEM Consultants. The research involves the testing of Global Positioning System (GPS) collars and mapping systems which have the potential to significantly enhance the efficiency of environmental and resource planning and mitigation. To date, over 8000 woodland caribou relocations have been logged and mapped into a Geographic Informarion System, and plotted on habitat maps of various scale and precision. Preliminary observations include; the identification of travel corridors between summer and winter range, habitat selection during various seasons, movement in relation to human disturbance, access and hydro lines. Ongoing testing of the system components is currently underway with future analysis being planned.

Seasonal range use and demography of the South Nahanni woodland caribou herd, southern Mackenzie Mountains, NWT and Yukon

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Abstract: Investigations of woodland caribou (*Rangifer tarandus caribou*) were conducted from March 1995-March 1998 to provide information on seasonal range use and demography of the South Nahanni herd (SNH) located in the southern Mackenzie Mountains of the Northwest Territories and Yukon. Parks Canada developed and sponsored the three-year baseline study to address the concerns of local First Nations, encourage collaboration with Territorial wildlife agencies and acquire an enhanced understanding of the little known SNH. The Yukon Department of Renewable Resources provided technical support from rhe outset and in 1996/97 contributed funds for fall composition surveys.

To define seasonal herd range and movements, twenty-five adult female caribou were radio-collared on late winter range in March 1995 and relocated five rimes annually. These locations showed that the SNH inhabits a traditional winter range of approximately 4000 km-sq within and adjacent to Nahanni National Park Reserve. The herd is more dispersed in other seasons and its overall range covers approximately 16 000 km-sq located principally within the upper South Nahanni Watershed of the Selwyn/Logan/Mackenzie Mountains. The majority of the SNH was found to migrate off winter range to calving, post calving, and fall rut areas northwest of the Ragged Range between the South Nahanni River and the NWT/Yukon Territorial Border.

A population census has yet to be conducted but is estimated to number 2000-3000 caribou (R. Farnell, Yukon Renewable Resources, pers. comm.). Annual survival of radio-collared adulr females averaged 0.81 during 1996 and 1997. The sex and age composition of the SNH was estimated from aerial surveys in October, 1995-1997. The adult sex ratio of adult males to females at that time averaged 39:100 (range 32.0-47.0) and the calf cow ratio averaged 21:100 (range 17.1-25.6). The calf:cow ratios over the three-year srudy period point to low recruitment and possibly an unstable or declining population. Both resident and guided non-resident hunters harvest the SNH but the extent of this harvest is not well known. Analyses of diet from fecal samples and snow depth/density results from late winter crater surveys indicate that winter forage is not a limiting factor for the SNH.

Data collected thus far provides insighr inro the herd's identity, seasonal range use and demographic trend but requires additional study for effective and informed management. The GNWT Department of Resources, Wildlife and Economic Development has committed to take a lead role in the further study and management of the SNH. Proposed study efforts include a detailed harvest analysis and stratified population census on late winter range in 1999.

Status and conservation of forest-dwelling caribou in Canada

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Abstract: The World Wildlife Fund Canada believes that the conservation of foresr-dwelling woodland caribou in Canada may be promoted by the production of a national map showing their range occupancy and status across the country. The 'draft' map presented is a compilation of data collected for each provincial jurisdiction from available sources. This 'best-estimate' representation highlights significant gaps. The mapping project undertaken by Northwestern Ontario is referenced as a case study of an excellent mapping strategy. Could this be the basis for a consistent approach to mapping the entire Canadian range of forest-dwelling caribou? The role of caribou as an indicator of boreal ecosystem health is raised. The importance of protected areas is visited along with the need for connecting corridors between protected areas and careful habitat management of the intervening landscape. Finally, the need for a national strategy of conservation is proposed and discussion regarding the formulation of this strategy is promoted. In this regard consideration is given to the best way of achieving consistency of approach while leaving latitude for adaptations to meet ecological variations.

Postglacial caribou remains preserved in snow patch in southern Yukon

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Abstract: In September, 1997 the first author noted a large concentration of caribou (*Rangifer* sp.) fecal pellets and a caribou antler on a permanent snow patch in the Kusawa Lake area of southwest Yukon. There is little recorded local or traditional knowledge of caribou occurring in the area in the last 100 years (O'Donaghue, 1996). The snow patch is at 1830 m above sea level in a north facing alpine basin. It is estimated to be about 750 m long and 300 m wide and 3-10 m thick. The site provided the opportunity to investigate long term ecological changes that affect caribou distribution in southwest Yukon. Fecal pellet samples were collected from 18 surface sites around the snow patch. Several faunal samples, including a jawbone, long bone and small clump of hair were also recovered. An ice coring auger was used to obtain buried fecal material, to determine the age of the accumulation. Also tecovered at the site on the edge of the ice patch was the shaft of prehistoric wooden dart. Fecal, bone and hair samples were sent for DNA fingerprinting to the University of Alberta to confirm the samples to species. Fecal samples were sent to the Washington State University for analysis of plant fragments. Fecal caribou material recovered from approximately 1.6 m below the surface and a small portion of the wooden dart were sent to Isotrace Laboratories at the University of Toronto for AMS radiocarbon dating. An age of 2450 BP ± 50 years was obtained for the fecal material and the dart was dated at 4360 BP ± 50 years. These dates indicate that the formation of this alpine ice patch may coincide with a mid-Holocene cooling trend and that aboriginal Yukon hunters have been harvesting animals, presumably caribou, at this location for at least 4000 years. The dart fragment appears to represent one of the few organic examples of atlatl technology (short spear propelled by a throwing board) ever found in Canada. These results indicate that the site offers a rare opportunity to explore a number of questions regarding implications of climate change on caribou populations, prehistoric ecology of large caribou populations and high elevation archaeological sites. The site will be further investigated over the next couple of years after an interdisciplinary study design is developed.

Seasonal distribution and important habitats of Beverly and Qamanirjuaq caribou

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Abstract: The Beverly and Qamanirjuaq Caribou Management Board initiated a project in 1996 to identify areas of important habitat for the Beverly and Qamanirjuaq caribou herds, and to produce documents and maps which will help the Board and others assess the potential effects of proposed land use activities on these caribou and their habitat. This work is being conducted with the support of Wildlife Habitat Canada and the Northwest Territories Department of Resources, Wildlife, and Economic Development. The first tasks undertaken by the author were: to compile available scientific information on the distribution and movements of the Beverly and Qamanirjuaq caribou herds; to enter these data into a geographic informarion system (GIS); and to produce maps of seasonal caribou ranges. Approximately 400 data layers have been incorporated into the GIS to date, including information from government surveys conducted between 1957 and 1994, locations of satellite-collared caribou from 1993 to 1997 (n=1793), and sites used by Beverly and Qamanirjuaq caribou to cross water bodies (n=120). Further information from surveys conducted before 1966 will be added to the current database, and traditional knowledge on caribou distribution and movements will be mapped when it becomes available. The Board is also preparing guidelines for assessing potential impacts of land use activities that could negatively affect Beverly and Qamanirjuaq caribou and their habitat. The reference materials produced by this project (e.g., reports, maps, CD-ROM) will make a large amount of previously inaccessible information available to a wide audience, including the Board, government agencies, Aboriginal resource management boards, land use planning boards, industry, and the public. This information will assist efforts to ensure that adequate consideration is given to requirements for caribou conservarion across the range of Beverly and Qamanirjuaq caribou during land use planning, protected areas planning, and appraisal of the potential environmental impacts of land use activities.