LICHEN ASSESSMENT

CHISANA CARIBOU RANGE

2011

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Key Findings

- We surveyed only a portion of the caribou range, focusing on areas known to be commonly used; only 1.2% of the surveyed area had observable lichen present.
- Within lichen patches, lichen species appeared sparse.
- *Stereocaulon* spp., a species not typically among the preferred caribou lichens, was predominant.
- Because of the observed low abundance and sparse distribution of lichen (particularly of preferred lichens) we cannot use a spectral mixture analysis to predict preferred lichen abundance and distribution in the Chisana caribou herd range.
- Future work could include a more comprehensive aerial survey or the collection of more ground samples to enhance our understanding of lichen abundance and composition.

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Introduction

The goal of this study was to visually assess the abundance and distribution of caribou forage lichen across the Yukon portion of the Chisana caribou herd (CHCH) range to:

- better characterize habitat quality and availability; and
- determine the feasibility of conducting a spectral mixture analysis using satellite imagery to estimate the distribution and abundance of preferred lichens (Theau et al. 2005).

An increased knowledge of lichens across the CHCH range will provide insight into limitations to the herd population and will help inform future range management decisions.

Background

The CHCH is a small herd of Northern Mountain caribou ranging across the Yukon-Alaska border (Figure 1). The herd is situated on the Klutlan Plateau within the St. Elias Mountain Range, near the headwaters of the White River. It ranges within the boundaries of Kluane Wildlife Sanctuary and Asi Keyi Natural Environment Park and falls within the traditional territory of both the White River and the Kluane First Nations. On the Alaska side of the border, the herd range falls within the Wrangell-St. Elias National Park and Preserve (Figure 1).

Population trends from the early 1990s through to 2003 indicate that the CHCH experienced a steady population decline, raising conservation concerns. In response, in 2009 a working group was established with the goal of developing a management plan for the herd (Chisana Caribou Herd Working Group, 2011). The observed population decline has been attributed to a number of factors including poor habitat quality.

Yukon caribou typically rely almost exclusively on a diet of specific lichen species including: *Cladina mitis, C. rangiferina, C. stellaris, Cetraria nivalis, C. cucullata, C. islandica*, and *Cladonia* spp. There is very little known about the abundance and distribution of these lichen species across the CHCH range, however, anecdotal evidence has suggested that they are present in very low quantities. Furthermore, fecal analysis has indicated a relative lack of this forage lichen in the winter diet of the CHCH (32%) compared to other Yukon herds (mean=75%) and rather, a higher abundance of moss (Farnell and Gardner 2002). There is a clear need to identify the abundance and distribution of preferred lichen forage species and characterize overall habitat quality and availability across the range.

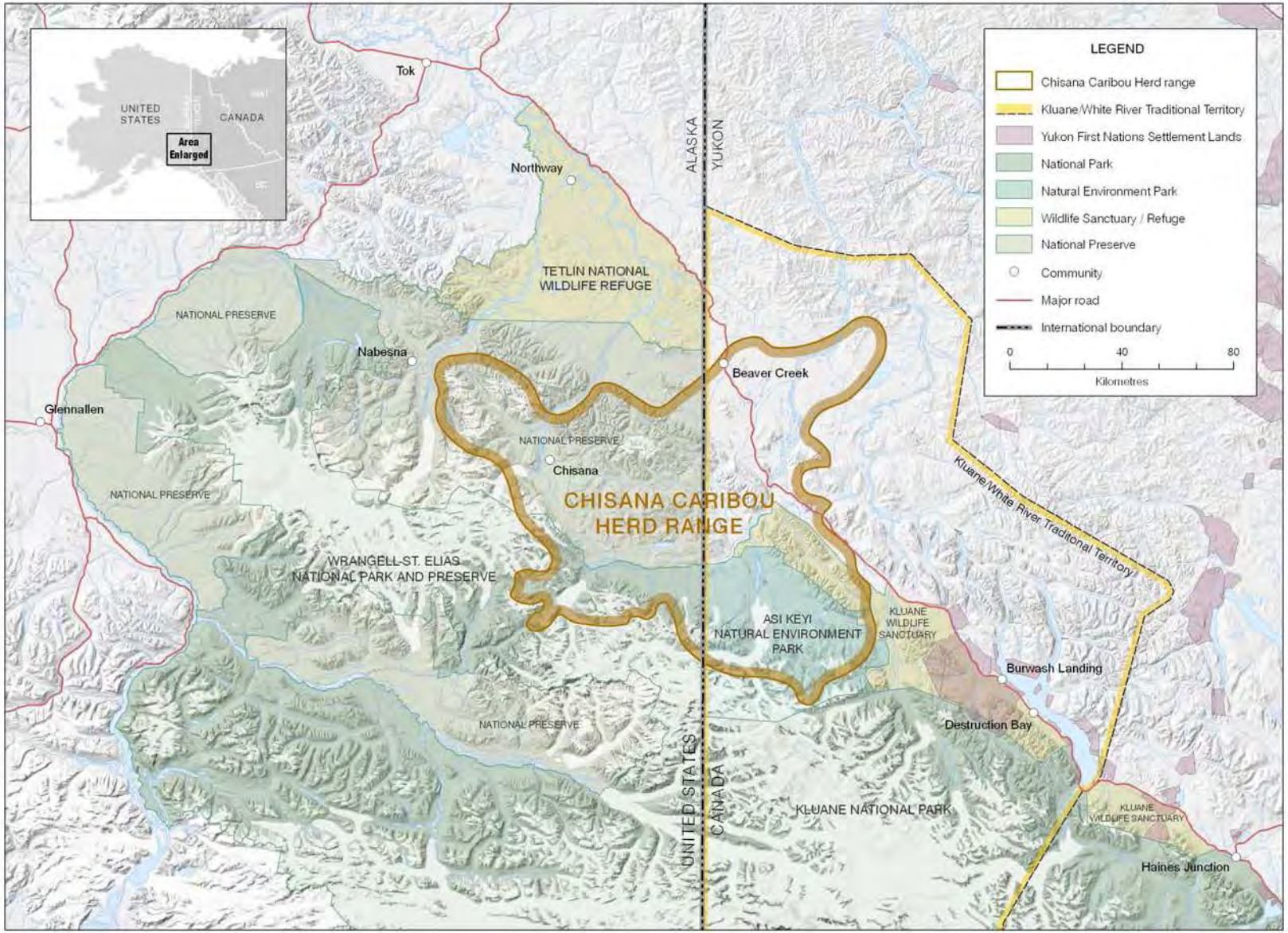

Figure 1. Annual range of the Chisana caribou herd and overlapping political boundaries in Alaska and Yukon. (From: Chisana Caribou Herd Working Group, 2011**).**

Methods

A reconnaissance flight was conducted on September 1, 2011 using a Bell 206B Jet Ranger. We flew a total of 7 hours and travelled 915 km across the range. Due to flight time constraints, areas within known caribou winter range (Wildlife Key Area Inventory 2009) and areas identified by a local expert with knowledge of lichen distribution in the area were the highest priority locations to visit. Wherever possible we avoided areas not expected to be characterized by lichen (e.g. rock faces, waterbodies). The flight path also excluded an area identified as a no-fly zone (due to concerns over sheep disturbance) by a local outfitter (Figure 2).

We considered areas visible along the flight path (i.e. approximately 200 m on either side of the aircraft) that we estimated to have greater than 10% lichen cover to be lichen patches. The location of lichen patches were recorded by taking geo-tagged photographs and linking them to a GPS-recorded flight path. To identify lichen species present, we collected representative lichen samples in 3 areas where lichen cover was greater than 50% for later identification in the lab by a vegetation expert.

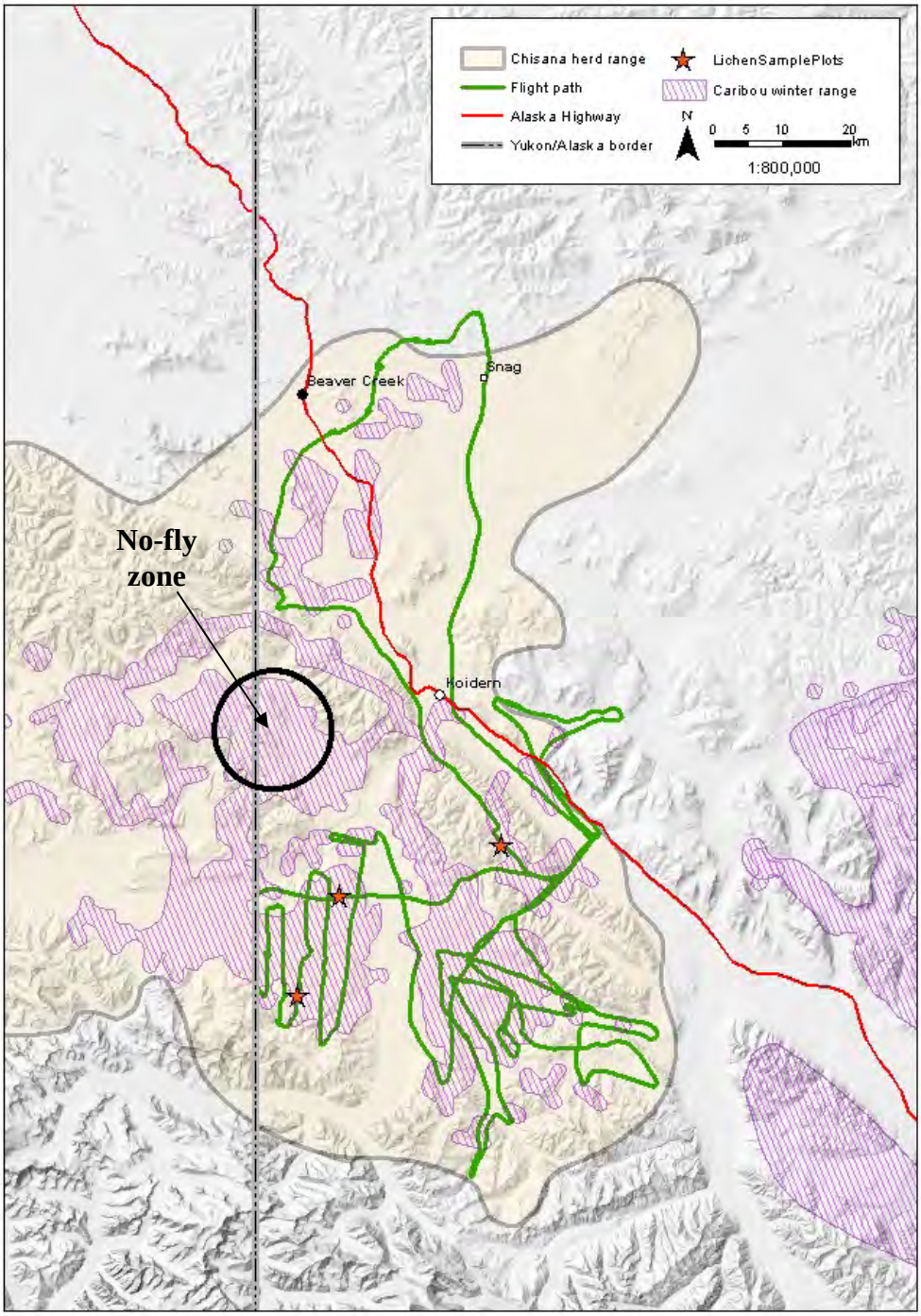

Figure 2. Caribou forage lichen reconnaissance flight path and ground sample locations, September 1, 2011. No-fly zone was identified prior to flying by a local outfitter.

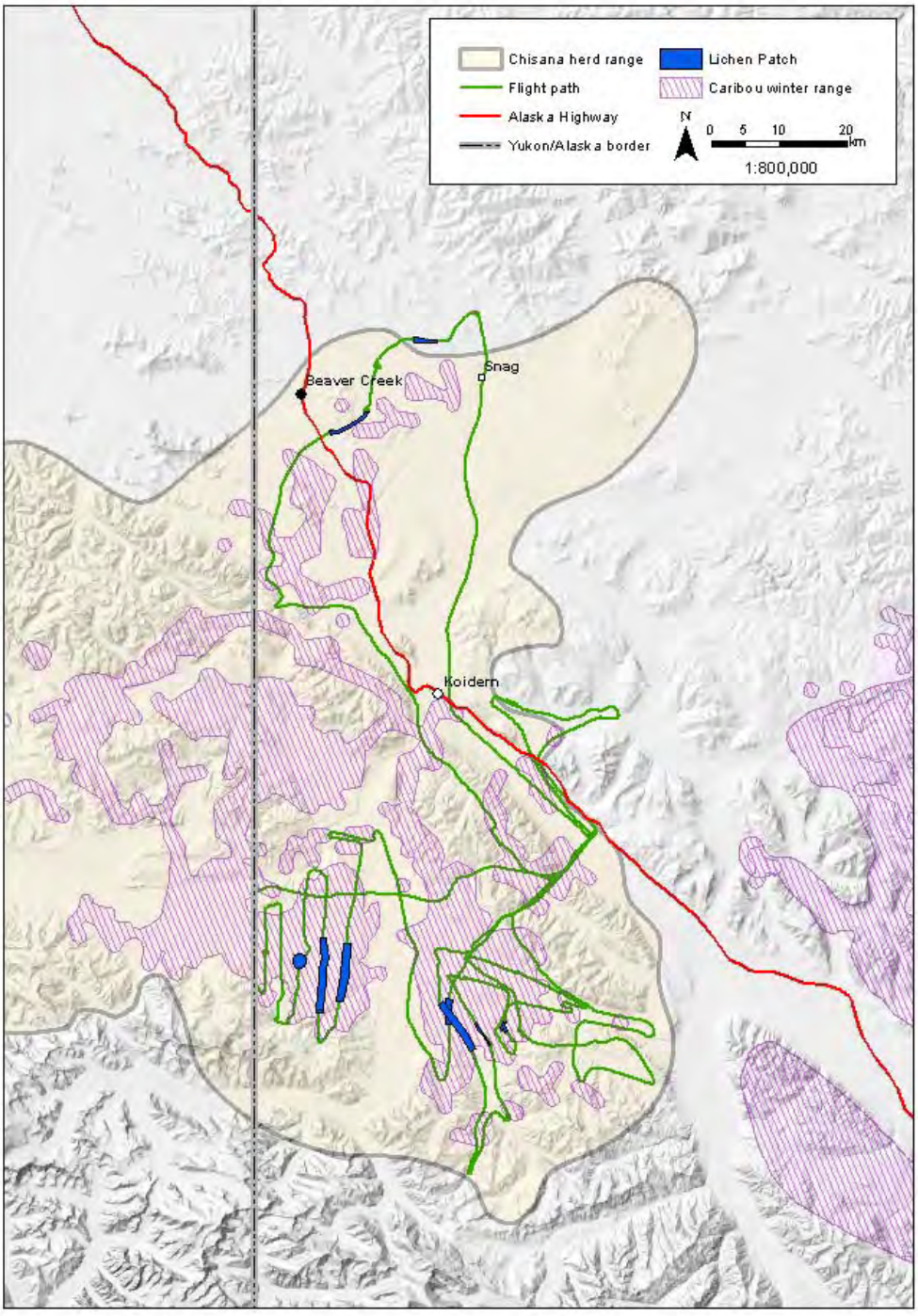

Figure 3. Lichen patches observed during the caribou forage lichen reconnaissance flight, September 1, 2011. Patches were at least 400 meters wide and 400 meters long and had ≥10% lichen cover.

Results

Lichen abundance & distribution

We characterized only a very small proportion of the survey area as having lichen patches (Figure 2). Patches observed during flight contained between 10 and 50% lichen and were typically between 2 and 10 km long. We did not determine actual patch widths; observations were made only along the flight path where we could see approximately 200 m on either side of the aircraft. Only 6% of the entire range was surveyed (366 km^2 or 915 km x 400m), and only 1.2% of this area was characterized as lichen patches. We consider this to be a very crude estimate due to the coarse nature of this survey. The lichen that we observed was primarily within known caribou winter range which suggests that caribou are foraging in areas where lichen does occur, however limited it may be (Figure 3). An exception was in the northern part of the study area where lichen patches were observed outside of the winter range boundaries.

Lichen composition

Within patches, lichen appeared sparse. Aerial views of lichen patches were characterized by multiple colors, consisting primarily of a greyish hue with a small amount of light green cover; this indicated the presence of a mixture of lichen species. Samples of representative lichen collected from the 3 ground plots indicated that *Stereocaulon* spp., a species not typically among the preferred lichens (Cichowski 2002), was predominant. Where present, *Stereocaulon* spp. was never found in large quantities with regards to biomass, was of a relatively shallow depth, and was often well-interspersed with moss and ground shrubs. Other lichens found in small quantities were *Cladina mitis, Cladina rangiferina, Flavocetraria cuculatta, Flavocetraria nivalis, Masonhalea richardsonii, Cladina uncialis, Peltigera* spp., and *Thamnolia subiformis*. Small amounts of *Cladonia* spp. were also found. It should be noted that *Racometrium* spp. was observed in high quantities in some areas. From a distance this moss may be confused with *Stereocaulon* spp. due to their similar greyish hue.

Conclusions

Overall, lichen did not appear to be abundant throughout the CHCH range. Where lichen was present, it was predominantly *Stereocaulon* spp., a lower quality species for caribou, and was intermixed with moss or other non-lichen species. In the CHCH range, *Stereocaulon* spp. replaced the more preferred lichens (e.g. *Cladina mitis, C. rangiferina,* and *Flavocetraria* spp.), typically abundant in other caribou herd ranges throughout Yukon.

For Chisana caribou, *Stereocaulon* spp. is presumably an important dietary component, even though it is generally not considered as palatable or digestible as the other common Reindeer lichens. Observed lichen patches were mostly within the known CHCH winter range. It is likely that caribou are foraging in relatively lichen-rich areas but as a result of the lichen species available, individual diet is of lower nutritional value. This suggestion is substantiated by results of a fecal analysis of the CHCH (Farnell and Gardner 2002) which indicated the winter diet of the CHCH is high in moss and low in lichen compared to other Yukon herds. Lower nutritional value of winter forage could be a contributing factor to the observed population declines of the CHCH as it can lead to lower calf birth weights, reduced development rates, and decreased survival (Espmark 1980, Adams et al. 1995).

Based on the low amount of lichen observed, particularly of preferred lichen species, a spectral mixture analysis through satellite remote sensing techniques would not likely be effective in quantifying overall lichen abundance and distribution across the CHCH range. Spectral mixture analysis requires the material of interest (i.e. preferred lichens) to have a significant influence on the spectral signature. The material of interest must therefore be present in sufficient quantity and clearly visible by satellite sensors. A spectral mixture analysis to predict preferred lichen abundance and distribution would likely be of low accuracy and misleading, given that very few sites in the CHCH range would meet the criteria. For this reason, we do not intend to pursue this method of lichen assessment.

Future research directions may include further visual surveys in areas of the CHCH range not visited in the current study and/or the collection of samples from more ground plots as the current study was limited in the number of samples taken. These initiatives will augment our understanding of lichen abundance across the entire CHCH range and will make the results of lichen patch composition from the current study more conclusive.

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