

NCASI Caribou Nutritional Research Program

NCASI's Caribou Nutritional Research is Unique because...

- It is the largest and most comprehensive caribou nutritional research program ever undertaken
- It includes the use of the only tame caribou research herd currently in the world
- It resulted in one of the most thorough summer and fall forage vegetation surveys (quantity and quality), as related to caribou, ever conducted in North America
- It incorporates the first re-measurement (repeated measures) evaluation of body condition ever undertaken with wild caribou in Canada to separate winter versus summer effects on condition
- It includes the largest cross-Canada sampling of body condition of wild caribou

NCASI's Caribou Research by the Numbers:

2009: *Start of NCASI's Caribou Nutrition Research Study*

+750: *The number of caribou sampled in the wild component of the research*

214: *The number of sites (enclosures) sampled with tame caribou*
(135 in Northeastern British Columbia (2013-2015), 79 in Northern Ontario (2017-2018))

1450: *Hours of Sampling Tame Caribou foraging*
(942 in Northeastern British Columbia, 508 in Northwestern Ontario)

233: *Number of Forage Species Identified*

1,626,648: *Observed Bites*
(1,193,461 in Northeastern British Columbia, 433,187 in Northwestern Ontario)

891: *Total field sampling sites (Vegetation only and with tame caribou)*
(314 in NE British Columbia, 105 in Northwest Territories, 344 in NW Ontario, and 128 in NE Ontario)

\$4,000,000: *Research funding invested to date*

2021: *Projected end date*

Where has NCASI's Caribou Nutritional Research been conducted?

- Dryden (Northwestern Ontario)
- Cochrane (Northeastern Ontario)
- Fort St. John-Fort Nelson (Northeastern British Columbia)
- Fort Simpson-Hay River (Northwest Territories)
- Fairbanks (Alaska)

Global Hypothesis:

Forest management, when judiciously applied in a manner that does not significantly alter predation dynamics, can improve habitat by increasing the abundance and frequency of high quality (energy/protein) forage for caribou in non-winter seasons, and that potential influences of forestry on nutritional resources varies by ecological context and forest successional status.

Project Purpose:

- (1) To document the extent across space and time of nutritional adequacy (or inadequacy) of caribou ranges in Canada based on sampling of wild caribou populations;
- (2) To identify attributes of habitats that mechanistically account for variation in caribou nutrition at fine scales (providing an explicit basis to understand how forest management affects the nutrition of caribou); and
- (3) To provide stringently-tested forest management and decision-support tools (models) that link specific habitat attributes to habitat selection, distribution, and population demographics of woodland caribou, to the extent possible.

Research Objective:

- To identify the extent to which landscape-level planning should account for nutritional needs of caribou in the summer, evaluate the role of forest management in caribou conservation efforts, and provide guidance via landscape models that account for nutritional needs of caribou in landscape planning.

Research Timeline:

2009-2012: NCASI's Research in Fairbanks, Alaska begins at the Robert G. White Large Animal Research Station. NCASI annual winter sampling of wild caribou herds begins (to present day).

April 2013: Tame caribou are transported from Alaska to Fort St. John, British Columbia

Summers of 2013-2016: British Columbia field trials are conducted for evaluating relationships between forage and other habitat characteristics on foraging efficiency and nutrition during summer and early autumn in the mountain and alpine regions of British Columbia

April 2017: Caribou are transported to Dryden, Ontario

Summers of 2017 and 2018: Ontario field trials conducted for determining the nutritional limitations within western Ontario (Dryden)

Summer of 2018: Eastern Ontario (Cochrane) vegetation sampling is conducted to assess a potential west-east gradient in forage quality and quantity

2019-2021: Development of caribou nutritional models to help facilitate landscape planning and enhance active forest management. NCASI annual winter sampling of wild caribou herds continues.

Novel Findings to Date...

- Caribou milk formula developed for use with raising neonate caribou in captivity
- Strong effects of nutrition on performance (calf growth, changes in body fat and body mass in adults) of lactating cows and their calves during summer demonstrated
- Caribou found to be highly-selective foragers (selecting only 28 of 233 available plant species in BC; similar findings are expected for Ontario)
- A number of forbs and deciduous shrubs found to be important dietary components in summer. These plants are important because they support markedly higher forage intake rates than ground and arboreal lichens and are a better source of protein. Thus, plant communities offering a diversity of palatable shrubs and forbs along with lichens seem to provide the best forage base for caribou in summer.
- Some caribou populations in Canada exist in nutritionally-limited environments
- Some vegetation community types often considered to be key caribou habitat found to provide inadequate to markedly-inadequate nutrition in summer for calf rearing and recovery of body reserves
- 50-90% of undergrowth found to be unsuitable caribou forage, depending on vegetation community type, due to low levels of energy and protein and/or high levels of toxic plant compounds
- Abundance of suitable forage found to frequently be higher in young seral stages after logging or burning, but this varies considerably depending on ecological site conditions

Further Projected Outcomes

- Using the datasets resulting from our field research, we will develop models to predict caribou nutrition as a function of vegetation characteristics, which will integrate the effects of forest management on those vegetation characteristics
- We will evaluate the ability of these models to predict broad-scale caribou population attributes (i.e., body condition, pregnancy rates)

Research Implications for Government Landscape-Level Planning and Industry

- Some woodland caribou populations, but not all, exist in areas with inadequate nutritional resources, irrespective of the presence (or not) of anthropogenic disturbance;
- Active forest management can contribute to creating and maintaining “preferred” caribou forage;
- A sensitive balance must be struck between managing for habitats with higher nutritional quality/quantity and the potential negative effects of logging; and

- The forest sector can contribute to caribou conservation through managing forests to improve nutritional conditions if habitat conditions resulting from logging do not appreciably increase predation risk. This can be optimized by having tools to properly assess and identify where high-quality habitat is located and what might be done to enhance it elsewhere, both of which will be derived from knowledge of what vegetation conditions are needed to meet requirements of individual caribou.

NCASI's Caribou Nutritional Research Publications to Date:

Parker, K.L. Barboza, P.S. (2013). Hand-rearing wild caribou calves for studies in nutritional ecology. *Zoo Biology*, 32: 163-171.

Thompson, D.H., Barboza, P.S. (2013). Nutritional implications of increased shrub cover for caribou (*Rangifer tarandus*) in the Arctic. *Canadian Journal of Zoology*, 92: 339-351.

Thompson, D.H., Barboza, P.S. (2013). Responses of caribou and reindeer (*Rangifer tarandus*) to acute food shortages in spring. *Canadian Journal of Zoology*, 91: 610-618.

Denryter, K. A., Cook, R.C., Cook, J.G., Parker, K.L. (2017). Straight from the caribou's mouth: detailed observations of tame caribou reveal new insights into summer-autumn diets. *Canadian Journal of Zoology*, 95: 81-94.

Cook, J.G., Kelly, A., Cook, R.C., et al. (In prep). Overwinter changes in nutritional condition of woodland caribou in southern Northwest Territories and northeastern British Columbia. Target journal: *Canadian Journal of Zoology*.

Cook, R.C., Crouse, J., Cook, J.G., Stephenson, T.R. In prep. Nutritional condition indices for caribou: evaluating accuracy, precision and sensitivity. Target Journal: *Canadian Journal of Zoology*.

Denryter, K.A., Cook, R.C., Cook, J.G., Parker, K.L., Gillingham, M.J. In review. Energy maximizing versus time minimizing among different nutritional classes of caribou. *Behavioral Ecology*