NCASI Fact Sheet
FS-24-03
IMPACT. SCIENCE. SOLUTIONS.
MAY 2024

The Complex Effects of Climate Change on Woodland Caribou

Introduction

Climate change is a complex issue with far-reaching implications for ecosystems worldwide, particularly in higher latitudes. Woodland caribou (*Rangifer tarandus* caribou), a threatened sub-species closely linked to Canada's boreal forests, may face challenges from the interaction between climate shifts and ecological dynamics. This Fact Sheet explores the detailed effects of climate change on woodland caribou, covering habitat use and nutrition; physiological responses; insect, disease, and parasite dynamics; predator-prey relationships; and natural disturbances.

Habitat Use & Nutrition: Climate change is expected to alter where woodland caribou live, and whether habitats they forage in can meet nutritional requirements for survival and reproduction. However, it remains uncertain how changes in temperature and precipitation may impact the seasonal pattern of plant growth and the nutrient content of plant species that caribou eat. Early snow melt causing longer growing seasons on spring and summer ranges may allow forbs and shrubs selected by caribou during summer to green up earlier in the year, providing extra nutrients around the calving season (Denryter et al. 2017). However, earlier plant growth also results in an earlier decline in forb and shrub nutrients during late summer and early autumn, a period crucial for caribou to regain body fat stores needed for breeding and winter survival (Cook et al. 2021). The interplay of warmer winters and unpredictable precipitation events could disrupt caribou mobility and foraging, which, in turn, could influence body fat levels and resiliency to winter weather. If climate change reduces habitat quality and nutrition, not only could it negatively affect caribou reproduction and survival, but thinner caribou are more susceptible to threats like insects, parasites, disease, human disturbance, and predators.

A young caribou bull taking advantage of reduced insect harassment due to high winds to forage on willow in British Columbia. *Photo credit: Rachel Cook*

Physiological Responses: Woodland caribou's cold-adapted features provide limited relief against heat stress caused by even small temperature increases. Their physical characteristics (e.g., having few functional sweat glands, a thick insulating coat, and a furred muzzle) can lead to increased respiration and heart rates at temperatures as low as 12°C. In addition, many of the plants and lichens that caribou eat are defended with compounds that require complicated detoxification strategies by the animals. Studies have shown rising temperatures may compromise a caribou's ability to detoxify these plant defense compounds, which could reduce their energy and protein intake, leading to declines in reproduction and survival.

Insects, Parasites, and Diseases: Elevated temperatures are anticipated to increase insect harassment, especially from species such as horseflies, black flies, and deer flies. At the same time, shifting pathogen distributions due to climate change may make caribou more susceptible to disease and parasitic infections, affecting their overall health and resilience.

Predator-Prey Dynamics: Climate-induced shifts in habitat could increase the overlap between caribou and predators, heightening the risk of predation. The migration of other alternative prey species (e.g., white-tailed deer) northward may increase resource competition (i.e., food availability), habitat overlap, and wolf predation, which poses challenges to caribou survival and ecosystem stability.

Natural Disturbances: Climate-driven natural disturbances, including wildfires, insect outbreaks (affecting habitat and not the animal directly, e.g., mountain pine beetle), and drought events, are projected to become more frequent, prolonged, and severe. These disturbances may disrupt habitat, alter food availability and nutrient content, and increase predation risk for caribou, adding to the challenges in finding suitable habitat.

Conclusion

Woodland caribou populations in Canada are deeply connected to the intricate ecology of boreal forests, making them vulnerable to the varied impacts of climate change. Understanding the complex relationships between habitat changes, nutrition, physiological adaptations, ecological dependencies, and disturbance dynamics is crucial for developing effective conservation strategies to preserve caribou populations in a changing climate.

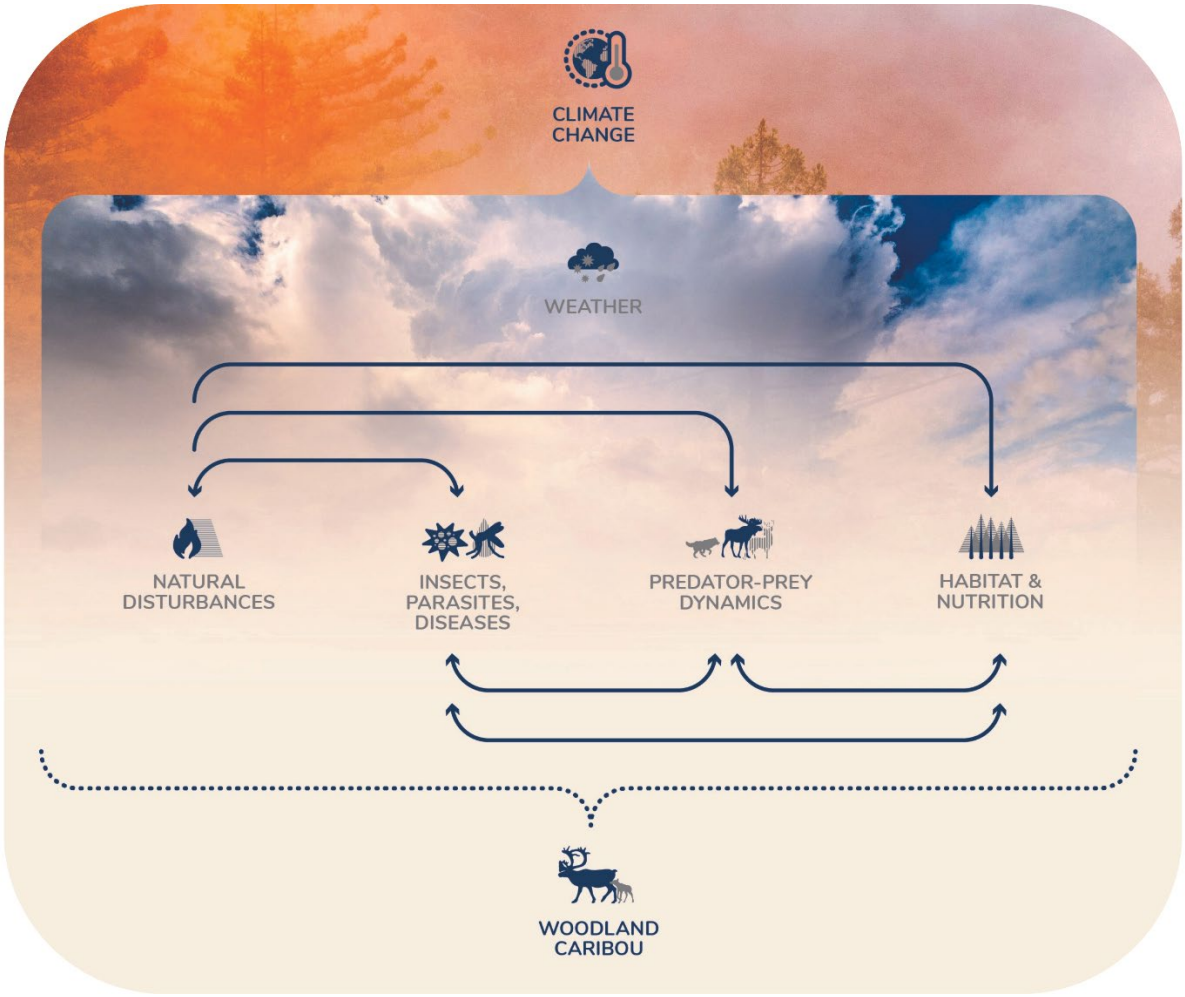

Illustration of the complex interplay and cascading consequences of climate change on the ecology of woodland caribou.

References

Cook, J. G., Kelly, A. P., Cook, R. C., Culling, B., Culling, D., McLaren, A., Larter, N.C., & Watters, M. (2021). Seasonal patterns in nutritional condition of caribou (Rangifer tarandus) in the southern Northwest Territories and northeastern British Columbia, Canada. Canadian Journal of Zoology, 99(10), 845-858.

Denryter, K.A., Cook, R.C., Cook, J.G., and Parker, K.L. 2017. Straight from the caribou's (Rangifer tarandus) mouth: detailed observations of tame caribou reveal new insights into summer–autumn diets. Canadian Journal of Zoology 95(2):81-94.

NCASI. 2020. Current state of knowledge and research on woodland caribou in Canada. Technical Bulletin No. 1066. Cary, NC: National Council for Air and Stream Improvement, Inc. https://www.ncasi.org/wp-content/uploads/2020/06/TB1066-Sept2020.pdf

For more information contact info@ncasi.org