Remote Sensing of Snowscapes and Caribou (*Rangifer tarandus*) Movement in the Northwest Territories of Canada

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ABSTRACT

Caribou play a crucial role in nutrient cycling and turnover, and they are an essential herbivore and prey animal in northern ecosystems. This keystone species undergoes exceptionally large, annual synchronized migrations on the order of thousands of kilometers, triggered by shared environmental stimuli. Relationships between climate factors and caribou populations and their migration patterns remain ambiguous. Recent studies suggest that snow characteristics may be primary drivers of migration, largely due to caribou's high level of mobility and their dependence on landscape conditions for locomotion. We use three datasets to explore the spatial and temporal relationships between landscape-scale caribou movement and snowpack characteristics in the Northwest Territories, Canada, over two decades. We use GPS (Global Positioning System) tracking collar data of barren-ground caribou provided by the Government of the Northwest Territories Department of Environment and Natural Resources to identify individual animal location and migration patterns, with a focus on the Bathurst herd. We derive environmental factors from Calibrated, Enhanced-Resolution Brightness Temperatures (CETB) at 3.125 km resolution and Moderate Resolution Imaging Spectroradiometer (MODIS) data at 500-m resolution. The GPS collar data provides the location of >200 animals (1996-2017) at multiple pre-determined (but varied) time intervals daily. These datasets allow us to further understand whether and how snow characteristics such as melt/refreeze status and the presence of ice are related to caribou movement. Do migration patterns align with snowscape characteristics, possibly indicating a preference for conditions that increase mobility? Do changes in snow factors influence the timing or duration of their movement? A strong relationship between snow melt onset, refreeze cycles, or rain-on-snow events would suggest that expected changes in snowpack variability could lead to range shifts and changes in the overall timing, duration, and synchrony of movement.

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