

Past and future landcover change in the Torngat Mountains of Nunatsiavut and Nunavik, Canada

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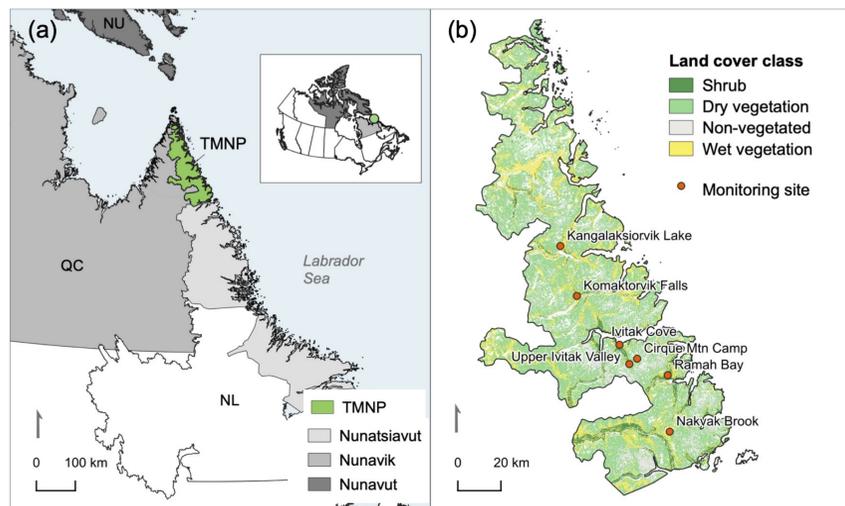
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Project Overview



- The Torngat Mountains of Nunatsiavut and Nunavik (northern Labrador and Québec) have recently undergone significant greening due to increasing shrub cover and abundance.
- Shrubification has coincided with warming temperatures and a decline in herbivore pressure by the Torngat Mountain and George River caribou herds.
- Landcover change can have large impacts on habitat conditions for culturally significant plants (e.g., berries) and wildlife (e.g., caribou and ptarmigan), and is implicated in many biogeophysical feedbacks.

In this study, we investigate **where and to what degree landcover types have shifted in the Torngat Mountains in the recent past and identify 'hot spot' areas likely to undergo shrubification in the future.**

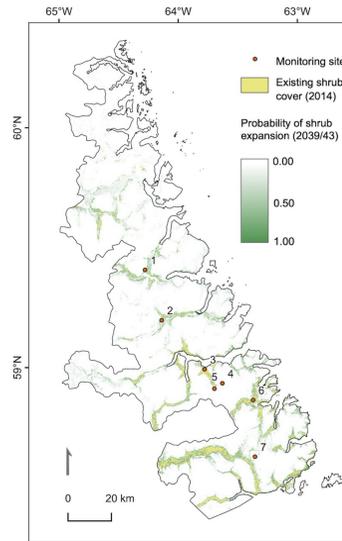
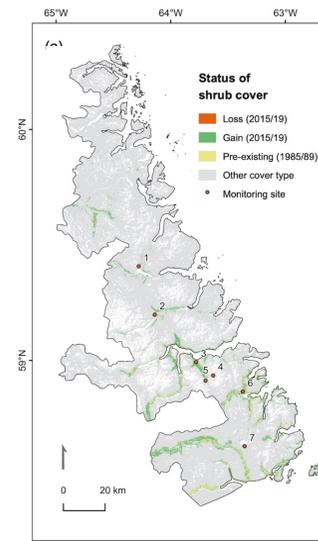
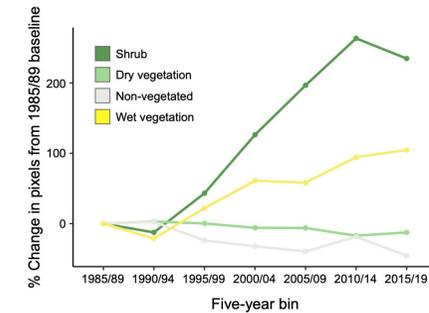


The study region, Torngat Mountains National Park (TMNP), shown in (a), covers an area of 9700 km². A land cover map developed by Ponomarenko and Quirouette (2014) was reclassified into four major land cover classes depicting land cover in ca. 2014, shown in (b). There are currently seven temperature monitoring sites in the park, indicated by red dots.

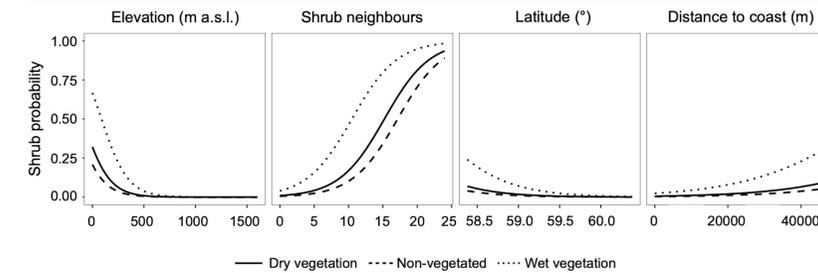
Ponomarenko, S.; Quirouette, J. SPOTS-Based Terrestrial Ecotype Map for Torngat Mountains National Park, 2014.

Results Summary

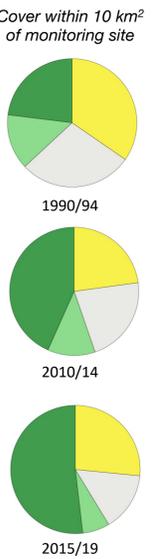
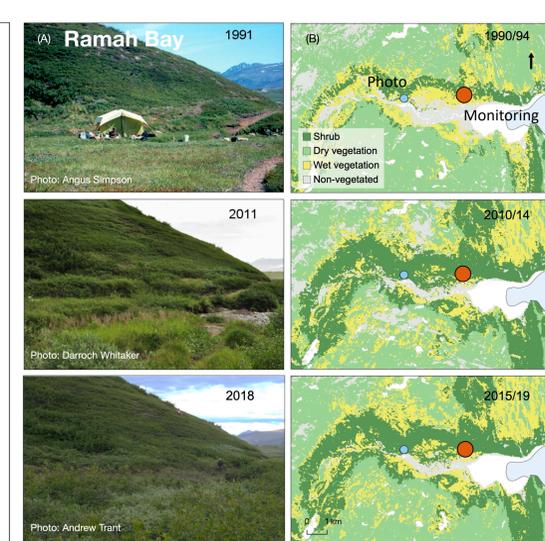
1. A significant increase in shrub (+235%) and wet vegetation (+109%) cover occurred from 1985/89 to 2015/19.



Pixels that transitioned to being shrub dominant in 2015/19 frequently originated from the 'wet vegetation' class, indicating that wet areas have experienced more shrub expansion than dry or non-vegetated areas.



2. The probability of shrub expansion from 1985/89 to 2015/19 was greatest in wet, low elevation areas in the south of the park. 'Shrub neighbours' surrounding a pixel also raised the probability of it transitioning to the shrub class.



3. The maps shown above display a widespread expansion of shrubs in valley bottoms in the south of TMNP from 1985/89 to 2015/19 (left) and the predicted probabilities of future shrub expansion in the park (right). A further ca. 50% increase in shrub cover is expected by 2039/43.

4. Rapid shrub expansion is evident through repeat photographs at Ramah Bay (above left) and through local land cover evaluation maps developed in this research (above right).

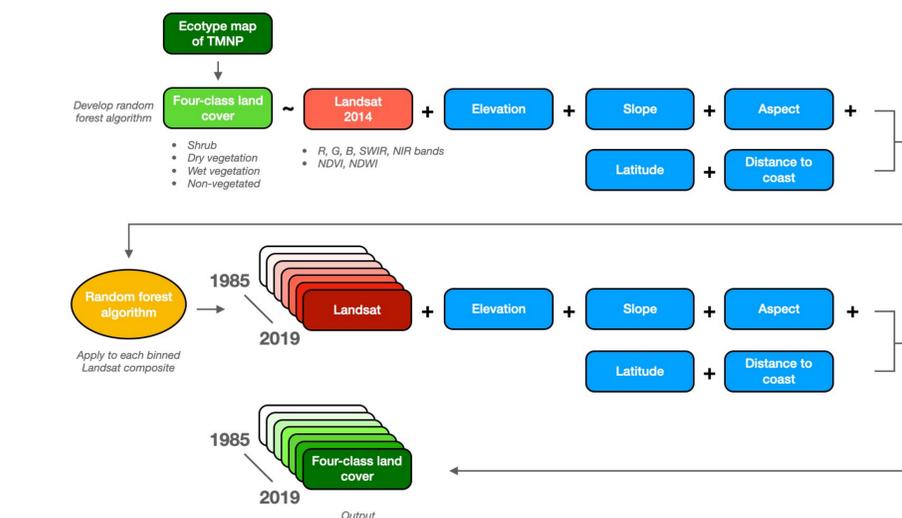
Highlights

- Significant shrub expansion has occurred over the past three decades and is expected to continue; shrub expansion will be spatially variable and will impact habitat for caribou and other species.
- In addition to informing habitat management for Torngat Mountains caribou, information from this study could guide the implementation of long-term vegetation monitoring program in the park.
- The approach used here has the potential to be used to reconstruct and predict landcover change in other areas of Canada's north where accurate land cover data are available.

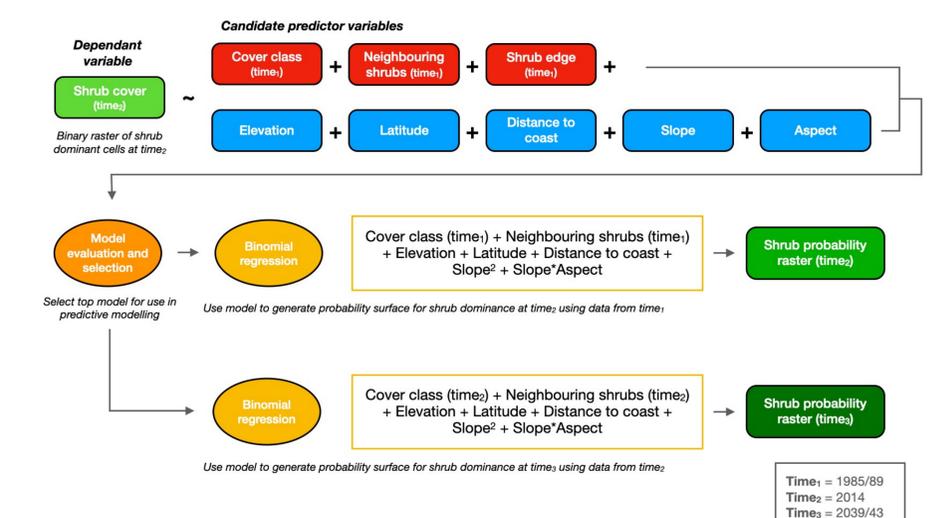
Research Approach

We developed a two-phase geostatistical modelling approach to (1) reconstruct landcover change from 1985 to 2019 across the 9700 km² area of Torngat Mountains National Park and (2) to develop a predictive model to infer where shrub expansion will occur in the future (by 2039-2043).

1. In phase (1), past changes (1985 to 2019) in vegetation cover were modelled using a random forest classification algorithm that combined an ecotype map with Landsat imagery and topographic rasters (30m resolution) of TMNP.



2. In phase (2), the probabilities of pixels transitioning to shrub dominant by 2039-2043 were modelled using binomial regression and the information generated in phase (1).



Time₁ = 1985/89
 Time₂ = 2014
 Time₃ = 2039/43