Presentation of the Nunavik Tundra Project (ArcticNet/Ouranos)

Work team: Pascale Ropars, Nicolas Casajus and Dominique Berteaux

Although change is not new to Nunavik, the last few decades have been marked by rapid and significant transformations: the permafrost has deteriorated, average temperatures have risen, and weather conditions have become less and less predictable. The distribution and abundance of some species have also changed, in part due to milder temperatures. As climatic conditions are expected to continue improving in the coming decades, it is highly probable that the host of animal and plant species in Nunavik will continue to transform. The purpose of our project is to understand how these changes will affect the functioning of ecosystems and identify potential threats for communities in the region.

Given its expertise in High Arctic ecology, the Canada Research Chair in Northern Biodiversity at the Université du Québec à Rimouski (UQAR) decided to address concerns closer to home in Québec and direct its bioscience and climate change knowledge towards land protection management tools for Nunavik. Under the Plan Nord, the Québec government has set the ambitious goal of reserving 50% of its northern territory from industrial development. This exercise requires thorough knowledge of the territory and the potential future effects of climate change. Bolstered by our close working relations with the teams responsible for protected area planning in Nunavik (the Kativik Regional Government and the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (sustainable development, the environment and the fight against climate change)), we are producing ecosystem vulnerability maps that will contribute to decision-making regarding which territories to protect. Through this process, we have compiled a large quantity of data on the climate, biology and ecology of Nunavik, and would now like to share it with the region's residents.

<u>Climate: What should we expect in the coming decades?</u>

Based on the model of the last two decades, average temperatures are expected to continue increasing in Nunavik in the 21st century (Fig. 1). This increase will occur more quickly in the north than in the south due to a phenomenon known as "polar amplification". The northern tip of the Ungava Peninsula could therefore experience an increase in average annual temperatures of 4.7°C, i.e. temperatures currently recorded in the heart of Québec's boreal forest (Fig. 1).

In addition to increased temperatures, the precipitation regime is expected to change in the coming decades. While total annual precipitation should increase, the proportion of precipitation that falls as snow will decrease, as will the duration of snow cover. The frequency of mild spells and winter rain may also increase, making travel by ice even more difficult than it already is.

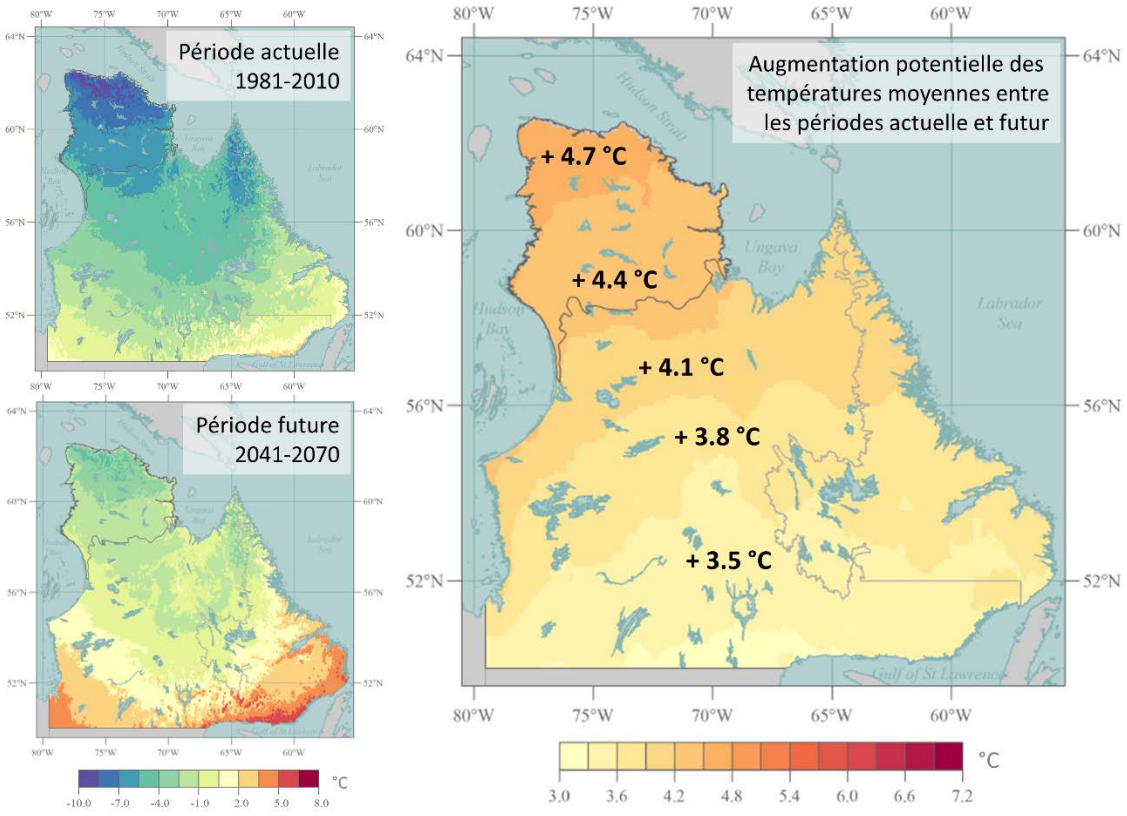

Figure 1 Spatial representation of average temperatures in northern Québec currently (1981–2010; top left) and as forecast for the period 2041–2070 (bottom left). The expected increase in average temperatures according to different climatic models from the current period (1981–2010) to the future period (2041–2070) are shown at right.

Landscape transformations

Several northern communities have reported changes in the abundance and height of shrubs (Fig. 2), in particular dwarf birch (*avaalaqiaq*; Fig. 3). In addition to altering the appearance of the landscape, this densification of shrubs affects the growth of berries (crowberries, blueberries, small cranberries) gathered by northern communities while providing an ideal habitat for certain animal species. The snowshoe hare, for example, requires shrub cover for food and protection against harsh winter conditions. The densification of shrub cover experienced in Nunavik over the past two decades has enabled this mammal to migrate deeper into the territory, along with its main predator: the Canadian lynx. More and more sightings of both these mammals are being recorded, especially in the region of Kuujjuaq.

Figure 2 Densification of shrub cover between 1988 and 2008 near the village of Kangiqsualujjuaq, Nunavik. All the ground covered by a mix of low vegetation (grasses and lichens) in 1988 in the foreground had been colonized by shrubs in 2008. Photo: Esther Lévesque.

Used as a source of fuel for camp fires and traditionally as material for mattresses, dwarf birch has taken full advantage of warmer summer temperatures to grow more quickly. Over the past two decades, an increase in the spread and height of dwarf birch has been observed in Nunavik, in particular in the forest tundra region.

Figure 3 Dwarf birch (*avaalaqiaq*) is the main shrub species involved in expanding vegetation cover in Nunavik.

Northward migration of mammals and birds

The number of species (i.e. biodiversity) present in Nunavik is relatively low compared with southern Québec. This difference can be explained, among other reasons, by the harshness of the climate which limits the northward distribution of a good many species. Based on the strong relationship between species distribution and climatic conditions, we developed a model to show potential future distribution of biodiversity across Nunavik during the period of 2041–2070 (Fig. 4). The forecast changes in the number and composition of species in the near future are significant and could have consequences on some culturally important species for Aboriginal communities, in particular migratory caribou.

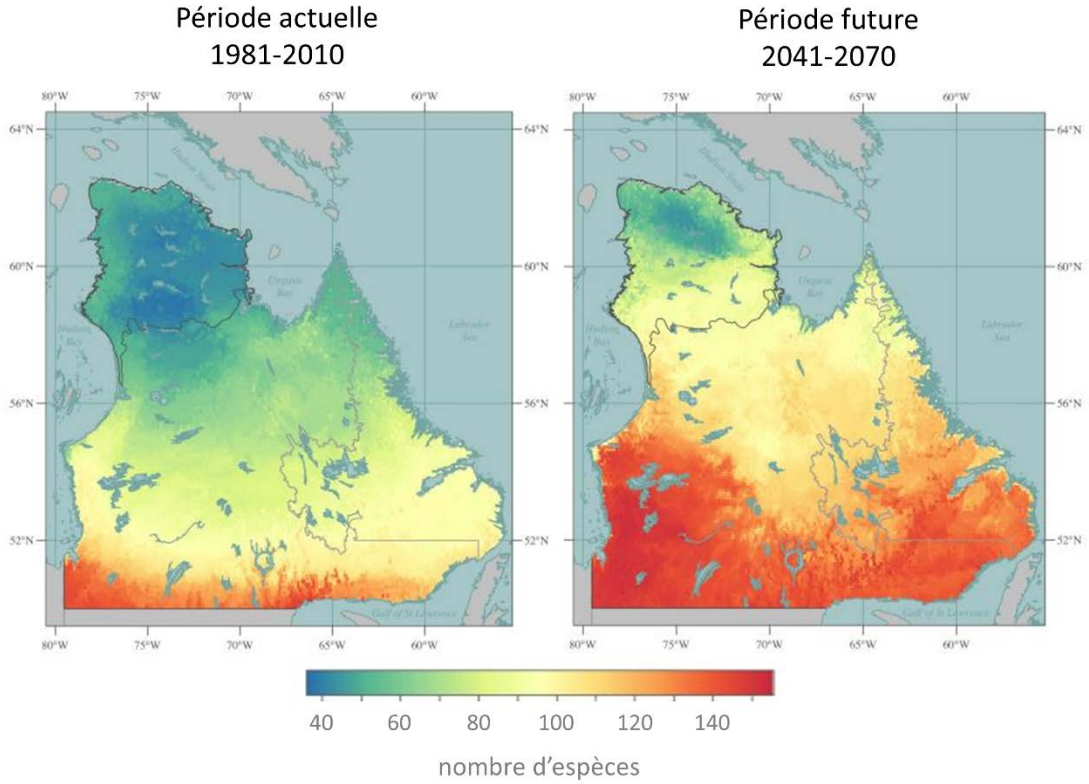

Figure 4 Number of mammal and bird species currently (1981–2010; left) and forecast (2041–2070; right). Due to expected milder temperatures in the coming decades, migration is likely to occur.

Species that could benefit from the forecast milder temperatures in Nunavik include the black bear, which is already showing signs of a northward migration (Fig. 5). Interviews conducted between 2007 and 2009 recorded black bear sightings as far north as Kangiqsujuaq; moreover, this species has been observed on a few occasions in the last five years around Salluit. Black bear dens inventoried on the Ungava Peninsula suggest that this species is now wintering in the region, changing its status from a simple summer visitor to a year-round resident.

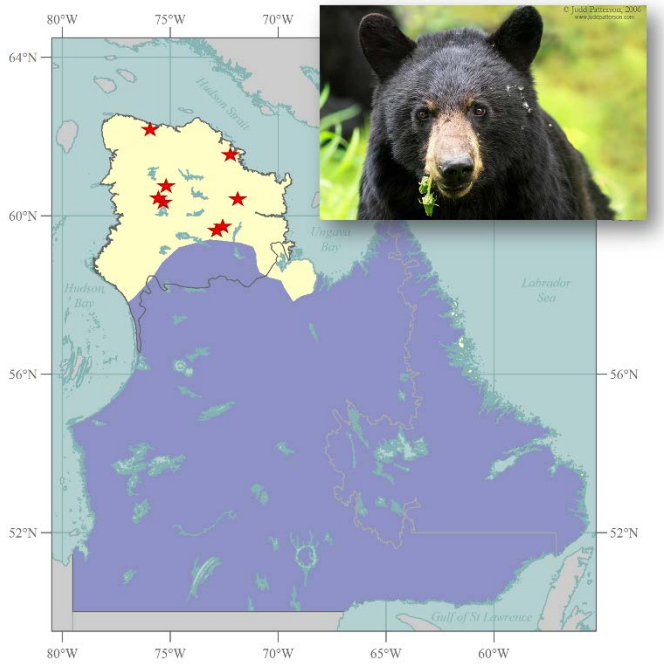

Figure 5 Black bear range (purple), as determined by the International Union for Conservation of Nature (IUCN). Red stars indicate the locations of recent sightings of this species outside of its known range (data provided by the Ministère des Forêts, de la Faune et des Parcs (forests, wildlife and parks) and by Steeve Côté, Université Laval).

Nunavik will face many significant changes in the 21st century. Not only might the number of species increase, but the links between these species (predator–prey) may also be altered, leading to an extensive restructuring of ecosystems. Not all species will benefit from the new climatic conditions at the same pace, which could produce mismatches between predators and prey. Through the next part of our project, we will attempt to translate these mismatches into an integrated index of ecosystem vulnerabilities that can be used for conservation management.