Statistical Downscaling of Temperature and Precipitation for Climate Change Impact Assessment of Rare Plants on the Limestone Barrens of Northwestern Newfoundland

by
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A thesis in partial fulfillment of the requirements for the degree of
Bachelor of Science, Joint Honours (Geography and Earth Science)

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September 2005

St. John's Newfoundland and Labrador

Abstract

This study examines the potential effects of future climate change on rare plant species that live on the limestone barrens of northwestern Newfoundland. Statistical downscaling techniques are applied to future climate scenarios from large-scale general circulation models (GCMs) to generate predictions of local climate change for the limestone barrens. The study examined two sites at either end of the limestone barrens - Daniel's Harbour and St. Anthony; output from two GCMs - CGCM1 and HadCM3; and involved three climatic variables that were considered relevant to rare plant conservation studies - maximum air temperature (Tmax), minimum air temperature (Tmin), and Precipitation (Precip).

Results of the downscaling exercise suggest that there will be an overall increase in mean annual air temperature (MAT) of approximately 4°C by the 2080s across the limestone barrens. Warming will be greater by ~1°C in summer and autumn, with only moderate change during the winter and spring. Minimum air temperature is expected to increase at a greater rate at the southern limits of the limestone barrens, which may result in a northward shift of their southern range boundary. Precipitation is more difficult to downscale than temperature, and results vary markedly according to the GCM used. CGCM1 predicts a consistent increase in mean annual precipitation (MAP) of 30-50% over the next century, while HadCM3 predicts a decrease in MAP of 10% at both sites over the next century. Both models predict that summer and autumn will have between 20 and 200mm greater precipitation than winter and spring. Average annual growing degree days will increase by 500 to 700 by the 2080s. GDD is consistently higher at Daniel's Harbour than at St. Anthony. Last day for snow on the ground is expected to be earlier under future climate scenarios, possibly between 2 weeks and 1 month earlier, due to changes in temperature and precipitation.