



## CANADIAN FOREST SERVICE

# Science HIGHLIGHTS

### DROUGHT AND FOREST DIEBACK

## How is drought affecting Canada's forests in a changing climate?

**A climate moisture index is helping researchers assess the impact of droughts and providing the foundation for web-based, timely mapping of changes in drought severity in Canada's forests**

Forests on the northern edge of the Prairies and across northern Ontario are afflicted by varying degrees of drought, which makes them directly susceptible to dieback and indirectly susceptible to threats like fire and insects. Climate change could compound these threats.

"Under a changing climate, drought poses a risk to the sustainability of Canada's forests, especially in regions such as the Prairie provinces where trees are already stressed by lack of moisture," says Ted Hogg, a researcher with the Canadian Forest Service–Natural Resources Canada at the Northern Forestry Centre in Edmonton.

Hogg has developed a climate moisture index to track moisture and temperature in forests to predict how well those forests will grow.

Moisture and temperature are key to Hogg's work. Looking at either one in isolation doesn't provide enough information to forecast how well a forest will grow. Consider the fact that annual precipitation in Lethbridge, in southern Alberta, is about 40 percent—or 120 millimetres—higher than in Whitehorse, Yukon, but Whitehorse has far more trees. The difference says Hogg is in the "rate of evaporation"—and why Whitehorse has a higher climate moisture index.

### Climate moisture index maps year-to-year changes

The index is calculated from weather data, including the input of moisture from rain and snow, and the losses of moisture from evaporation and transpiration—water vapour released from the leaves of trees and other vegetation. Using computer programs, researchers are able to take weather station records and make maps of the year-to-year changes in the index across an entire region.

"It allows us to do statistical analysis on how past droughts and changes in moisture conditions have affected the growth, health and mortality of aspen forests in different areas across the region," Hogg says. Aspen was focused on because it's the most common broad-leaved tree in the Canadian boreal forest and in the forest along the northern edge of the Prairies, called the parkland zone. Dieback and mortality of aspen forests is a major concern in the Prairie Provinces and more recently, across northern Ontario and the western United States.

### Overview

A climate moisture index tracks moisture and temperature in forests to predict how well forests will grow.

Droughts will continue to pose a threat to the forests of the future—a lot can be gained from developing new and innovative ways to help trees grow in drought-sensitive regions.

Hogg is building a more sophisticated index called the soil moisture index, which will enable researchers to break down drought impacts into smaller periods of time.



Aspen dieback in Prince Albert National Park, August 2007

Dieback is a condition in trees where a high proportion of the branches have been killed, either by pests or by extreme weather such as drought.

Currently, the index is being used in a project led by Hogg that is providing knowledge on how drought and insects affect the aspen forests of western and central Canada. The project includes monitoring of 180 rectangular plots, each with about 30 aspen trees, in the parkland zone and the boreal forest.

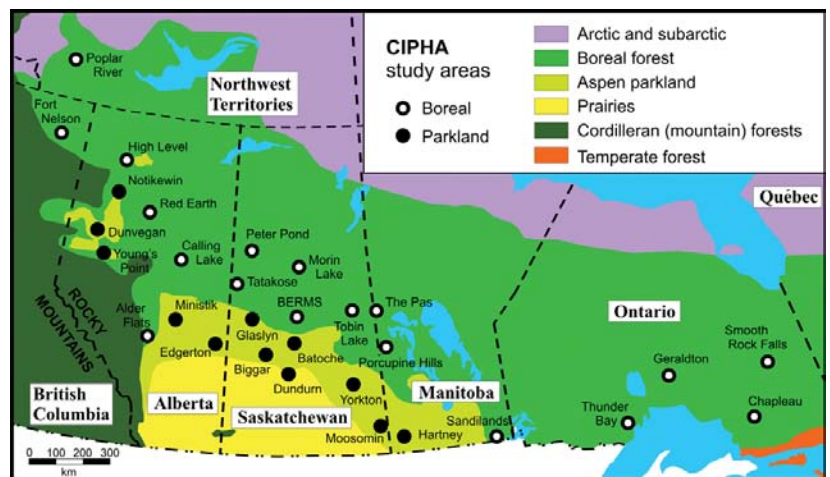
Every year, researchers visit the plots and record tree mortality, dieback, defoliation and presence of insects and diseases. They sample tree rings, which show how fast a tree grows. Wider rings indicate good growth. Distinctively white-coloured rings show that the tree was severely defoliated, which separates the effect of insects from climate.

### Soil moisture index set to produce nearly real-time data

Today, Hogg is building a more sophisticated index called the soil moisture index. This index will enable researchers to break down drought impacts into smaller periods of time. "We're trying to look at something that would provide near real-time reporting of drought conditions. The public could access this through a web-based mapping application," Hogg says.

Having a more timely way to assess the threat of drought could help inform policies designed to mitigate the effects of drought in a changing climate. For example, instead of only replanting with local seeds after harvesting, using seeds from drier climates could make sense.

"We can be certain that droughts will continue to pose a threat to the forests of the future. So a lot can be gained from developing new and innovative ways to help trees grow in drought-sensitive regions," Hogg says.



Climate change impacts on the productivity and health of aspen (CIPHA) study areas

