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Branching Out
from the Canadian Forest Service - Laurentian Forestry Centre

Forest Fires and Climate Change: Looking at the Past to Predict the Future

Fires have always played a major role in shaping the boreal forest, and fire activity has increased to significant levels during certain periods. Patterns of fire activity in the past can shed light on the present and provide insights for predicting the future.

Photo: S. Chalifour (SOPFEU)

Fire and the boreal forest: natural allies

Fires play a significant role in terrestrial ecosystem functioning and biodiversity conservation. Fire is an important process which influences the global carbon cycle and atmospheric chemistry. The boreal forest landscape, with its mosaic of different forest types, is the result of varied fire regimes, and many boreal forest tree species are adapted to recurrent fires.

Fire activity responds more rapidly to changes in meteorological and climatic conditions than vegetation does. A change in fire activity can induce changes in boreal forest landscapes that exceed the expected effects of climate change on the growth, reproduction and migration of forest tree species.

Photo: S. Gauthier (CFS)

Humans and fire

In spite of increased efforts to suppress fires, there has been a steady increase in the area burned in different regions of the world in recent decades. For example, in the mid-1980s, fire activity increased in the western United States, northwestern Canada, and northeastern Quebec. Anthropogenic climate change, caused by increased concentrations of greenhouse gases in the atmosphere, has contributed to this trend.

Photo: Y. Boulanger (CFS)

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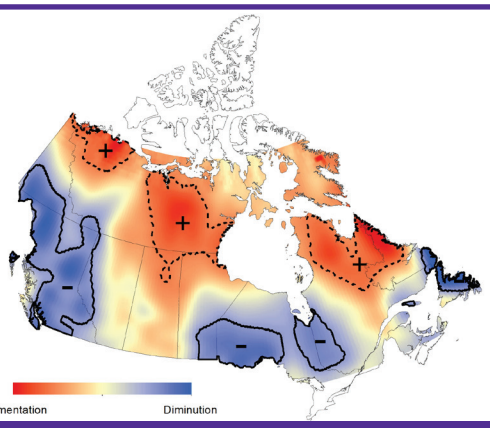
Changing patterns of fire risk

The risk of large forest fires is changing but this phenomenon is not uniform across regions around the globe.



Change in the risk of forest fires observed between 1901 and 2002 modelled using the Drought Code. This analysis only considers climate variables and does not include other factors such as human fire management and ignitions, vegetation changes, etc. Figure: D. Gervais (CFS)

Whereas the fire risk has increased significantly in the Canadian taiga over the past 100 years or so, it has declined in the area south of Hudson Bay, in western Canada, and in Newfoundland and Labrador. These regions were considered to be at high risk in the early 20th century, with one extreme event every five years; however, the risk is now considered low to moderate, with one extreme event every seven years. In the forests of central Canada and in those north of the Great Lakes, the risk of large fires has gone from an extreme level of more than one year in five to one in fourteen years. The declining fire risk trend in the southern part of the boreal forest is supported by many other data showing a decrease in the frequency of extreme drought years over the past 150 years, and by forest inventory data showing an increase in the average age of unmanaged forests.

Delving into the past

An international team composed of six researchers from the Centre européen de recherche et d'enseignement des géosciences de l'environnement (CNRS, Université Paul Cézanne, Collège de France), the Canadian Forest Service, the Centre de bioarchéologie et d'écologie (CNRS, Université Montpellier 2, École Pratique des Hautes Études de Paris) and the Université du Québec en Abitibi-Témiscamingue has reconstructed the past and present fire activity of the spruce-moss forest region of eastern Canada by analyzing charcoal from lacustrine deposits. The findings show that this boreal forest type experienced long periods of intense fire activity in recent millennia, reaching a maximum level 6,000 to 2,000 years ago.

Fire-climate relationship: a historical perspective

Research into the relationship between fires and climate and the evolution of this relationship over time shows that climate has a significant impact on fire activity in the boreal forest. Climate change over the last two millennia—characterized by a decrease in solar radiation, cooler temperatures, and an increase in precipitation—has contributed to a decrease in the frequency of large fires in the forests of northeastern North America. Information derived from analyses of past magnitudes has been combined with simulations from climate models in order to predict future fire activity based on different greenhouse gas emission scenarios. It appears that future conditions may resemble the conditions prevailing 6,000 to 2,000 years ago, which could lead to a significant increase in fire activity compared with the recent past.

These studies help increase our understanding of the natural forest dynamics of the boreal forest region. Forest stakeholders will be able to use this information in ecosystem management planning.

Useful links

Proceedings of the symposium entitled "Les feux de forêt : science et défis d'aménagement" (in French only):
http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/32298.pdf

Wildland fires:
http://cfs.nrcan.gc.ca/pages/153

For more information, please contact:
Martin Girardin
Natural Resources Canada
Canadian Forest Service
Laurentian Forestry Centre
1055 du P.E.P.S., P.O. Box 10380, Stn. Sainte-Foy
Quebec City, Quebec G1V 4C7
Phone: 418 648-5826
Fax: 418 648-5849
E-mail: martin.girardin@nrcan.gc.ca
Website: cfs.nrcan.gc.ca

Partenariat innovation forêt
FPInnovations
Canada