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Northern Notes
Canadian Forest Service • Northern Forestry Centre

Fire in the Watershed

The Greater Victoria Water Supply Area provides water to more than 350 000 people living in the Capital Regional District (CRD), the region that encompasses the city of Victoria, B.C., and its surrounding municipalities. The CRD is supporting a project in which specialized techniques are being used to describe the climate, vegetation, and fire-related changes over several thousand of years, capturing a range of climates. In the first phase of the project, Canadian Forest Service (CFS) researcher Kendrick Brown examined the long-term relations among climate, vegetation, and fire.

This analysis showed that during a past warm period, the forests around the watershed were more open than in the present day, and species well adapted to fire were more abundant. Analyses of ancient charcoal deposits suggested that both surface and crown fires prevailed in the past. CRD managers can take these and other observations into account as they develop the watershed's climate adaptation strategy.

In the second phase of the project, PhD student Nicholas Hebda is examining selected past fire events in detail. The aim is to better understand the short-term effects of fire within the watershed, both on the land and in the water, as well as recovery of the area after a fire occurs. For example, magnetic peaks observed in sediment samples correspond closely to peaks in the amount of charcoal, which reflect the occurrence of fires.

These results provide insights into the timing of fires, fire severity, the effects of fire on erosion, and recovery of the ecosystem after a fire. Measuring the size of sediment grains has also revealed that sediment deposited in the watershed also change after a fire, generally becoming finer (smaller and less coarse). Pollen analyses have shown a variety of vegetation responses, including increases in fire-adapted *Pteridium* and *Pseudotsuga menziesii* and corresponding decreases in fire-sensitive *Tsuga heterophylla.* Total carbon and nitrogen declined with each fire event, which may reflect increased delivery of inorganic sediments to the basin after fires, followed by gradual recovery to prefire levels.

Analyses of algae currently in progress are expected to provide additional information about the effects of fire on the aquatic environment, including changes in phosphorous inputs, productivity, and turbidity (cloudiness due to suspended materials).

Figure 1: Acquiring a Kayak sediment core from the Sooke Lake Reservoir. Pictured are CFS researchers Tony Trofymow and Kendrick Brown.

These analyses are revealing that although the fires had effects both on land and in the water, the watershed eventually recovers from the disturbances. During future fire events in the Greater Victoria Water Supply Area, managers will need to monitor various consequences to ensure they do not adversely affect water quality beyond established standards for human consumption.

Researchers:

Kendrick Brown kendrick.brown@canada.ca
Nicholas Hebda nhebda@alumni.ubc.ca

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Multi-Sensor Remote Sensing for Large-Area Forest Inventory

To monitor the productivity and health of forests, managers need information about their structure, condition, and extent. This information has traditionally been gathered in the form of a forest inventory, which is based on aerial photographs combined with field and aerial surveys. However, such methods are impractical for vast, inaccessible forested areas such as those of the Northwest Territories (NWT). Therefore, Canadian Forest Service (CFS) researchers at the Northern Forestry Centre (NoFC) in Edmonton, Alberta, have partnered with the Department of Environment and Natural Resources of the Government of NWT (GNWT), the CFS Laurentian Forestry Centre (Québec, Quebec), the Canadian Space Agency, and the University of Lethbridge (Lethbridge, Alberta) to create a satellite-based, large-area forest inventory.

This inventory, referred to as the Multi-source Vegetation Inventory (MVI), provides estimates of stand height, crown closure, stand and total volume, aboveground biomass, and stand age in 30 × 30 metre pixels across 44 Mha of the Taiga Plains ecozone. To derive these estimates, CFS researchers and their partners gathered and combined data from field inventory plots, airborne and satellite LiDAR (Light Detection and Ranging) samples, and optical and radar satellite images, as well as other topographic and climatic information. "First, we identified the type of land cover for each pixel, and then estimated stand attributes for each forest pixel based on the most similar pixels for which we had forest inventory data," says Guillermo Castilla, a remote sensing research scientist at the NoFC.

"To circumvent the scarcity of forest inventory plots in the NWT, we created a large number of surrogate plots where forest attributes were estimated using space-borne LiDAR data based on a chain of models calibrated with actual field data. Thanks to this approach, we were able to derive reasonable estimates across an area the size of California, despite the paucity of field data; for example, we could estimate stand height in the average pixel with an accuracy better than 3 metres".

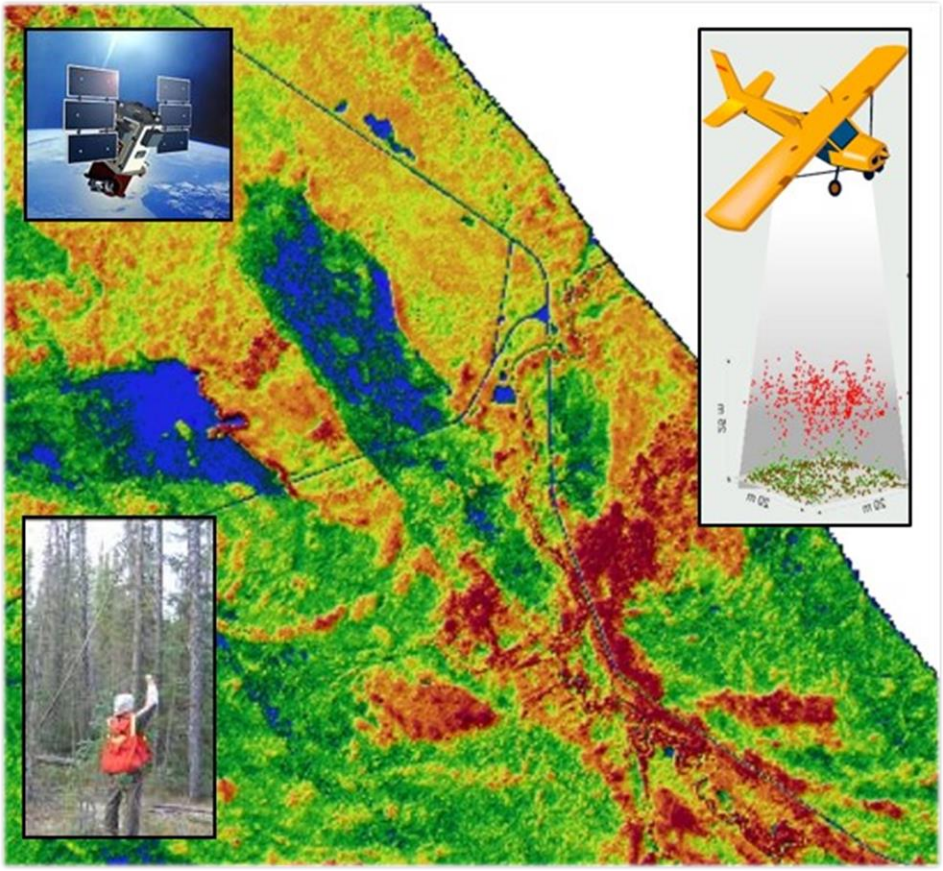

Figure 2: Full-coverage maps of forest inventory characteristics, such as stand height, are produced using ground-based, aerial, and satellite data.

The GNWT is using the MVI to identify burned areas that would be best suited for salvage logging, as well as to enhance the territorial Ecological Land Classification program and to improve suitability analyses of caribou habitat. *The MVI project team was a recipient of the 2018-19 CFS Merit Award for collaboration.*

Contact: Guillermo Castilla (guillermo.castilla@canada.ca)

Aussi en française

To subscribe to *Northern Notes*, please contact:
Ray Darwent, Natural Resources Canada, Canadian Forest Service,
Northern Forestry Centre, Edmonton, AB, Canada
780-435-7279 • nrcan.nofc-cfn.rncan@canada.ca• www.nrcan.gc.ca/forests

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