Climate and Ecosystem Dynamics Research Laboratory

UNIVERSITY of GUELPH

Multiproxy reconstructions of mixed-severity wildfire dynamics in the Alberta Foothills

PhD Pilot Study 2012
Vanessa Stretch

The forested landscapes of the Alberta Foothills (Figure 1) are shaped and will continue to be shaped by wildfire disturbances under future climate and management scenarios.

Figure 1. Alberta foothills landscape.

It is therefore important to understand the underlying and overarching processes and patterns driving wildfire in these landscapes. Many of these landscapes experience both low and high severity fires occurring over differing time spans. This mixed regime makes it difficult to implement concrete management decisions. The aim of an ongoing research project, being conducted by a PhD student at the University of Guelph, is to use a paleoecological multiproxy research approach to understand the drivers of mixed fire dynamics in the Alberta Foothills. The three objectives of this research are: (1) to establish a fine-scale and long-term reconstruction of frequency and severity of wildfires; (2) to analyze the climatic and landscape controls of wildfire; and (3) to calibrate the macroscopic sedimentary charcoal record of fire with the tree ring record.

Dendrochronology, the study of tree rings, can provide a fine scale reconstruction of wildfire dynamics across a landscape. Stand establishment years, indicating when the last high-severity fire occurred and stand regeneration began, can be calculated from collected core samples from live trees. Lake sedimentology can also be used to extend the length of a wildfire record by providing a longer-term reconstruction using macroscopic sedimentary charcoal. Remnant charcoal found in lake sediments can be precisely dated to denote fire frequency. These two paleoecological techniques will be used to provide a comprehensive reconstruction of wildfire dynamics in the Alberta Foothills project.

Methods

A pilot study was undertaken in the northern portion of the Hinton Wood Products FMA in June and July 2012 (Figure 2a).

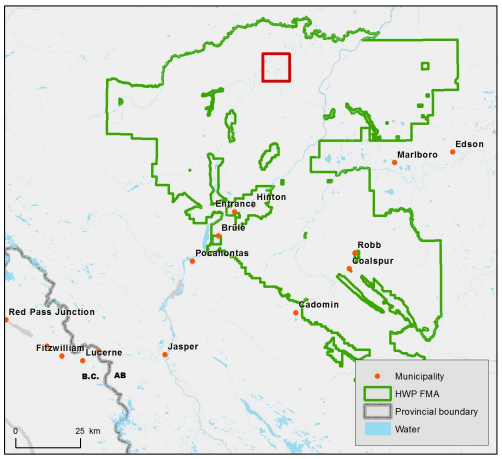

Figure 2a. Hinton Wood Products (HWP) Forest Management Area (FMA). Selected region of study is noted in red.

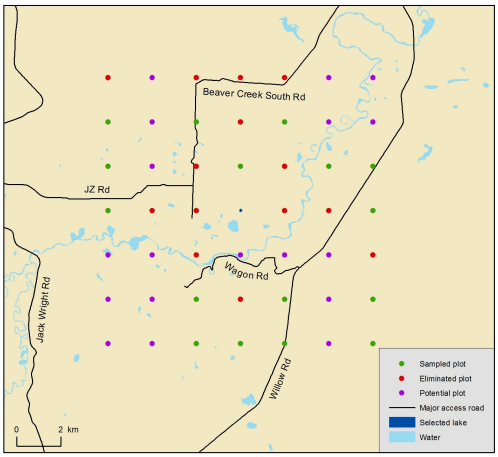

Figure 2b. Sampling grid. Dark blue lake at centre of the grid was selected as optimal lake.

Over this time, the field crew searched for suitable lakes for sediment analysis (to be collected in the summer of 2013). A sampling grid was established surrounding one suitable lake. Sites were selected from the 2km by 2 km grid, which extended up to 6 km from the centre of the lake (Figure 2b). Twenty-nine grid point sites were accessed for this pilot study. Sixteen sites were sampled and 13 sites were eliminated due to evidence of recent logging activity (Figure 2b).

At each sampling location, site and stand characteristics and evidence of disturbance

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were documented. The plot centres were permanently marked and the 10 closest canopy and 10 closest subcanopy (if present) trees to plot centre were flagged for sampling (Figure 3a). One sample per tree was taken at the base of the tree (Figure 3b). In the case of obvious evidence of fire (charred logs, snags or fire scars on live trees), disc samples or partial cross sections were taken (Figure 3c & 3d). A total of 240 cores and 42 disc or partial cross sections were collected.

Figure 3. (a) Permanently marked plot centre. (b) Field crew member Theresa Dinh taking a core sample from an understory tree. (c) Evidence of fire on a charred snag. (d) Field crew members Kerry Schutten and Vanessa Stretch taking a disc sample from a charred snag.

Laboratory analysis is currently being conducted in the Climate and Ecosystem Dynamics Research (CEDaR) Lab at the University of Guelph. Tree age and stand age will be estimated from the live samples. Dead samples with fire evidence will be crossdated to determine fire years and estimate frequency as well as severity.

Ongoing research: Summer 2013

The field crew will return to the study area in the summer of 2013 and sample remaining grid sites, as well as sites around a second lake. The two lakes will also be cored for sediment analysis. A full report on this research will be available in the summer or fall of 2014.

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