QuickNotes

Science summaries from fRI Research

Introducing: Generation of Tree level Fire Fuel Information across MPB Infestation Mosaics

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MPB infestations alter microclimate and fuel availability, and as a result, can have potentially significant impacts on fire behavior. Concurrent with this change in fuel availability brought about by increases in tree death, we are seeing record breaking fires occurring in western Canada, resulting in a "new normal" of increased fire occurrence and severity. Thus, there is increasing focus in the fire modeling to improve our understanding of forest fuels and their effective management. The increased focus on fuel availability, as well as recent computational advances, have seen the development of next generation fire spread models which, rather than relying on stand measurements, can predict how fire moves through a stand using information on individual trees. These new approaches have the capacity to increase both the accuracy and applicability of these spread models for understanding fire behavior in MPB impacted stands.

Objectives

1. To locate a series of typical MPB mosaic stands of green, red and gray attack trees across Western Alberta, covering a range of initial forest type and environmental conditions.
2. Acquire existing contemporary LiDAR or fly UAV based LiDAR data over transects at these sites to capture changes in fuel availability
3. Apply, derive and verify the models that extract a series of individual tree based attributes shown to be highly relevant to fuel assessment

Federal-Provincial MPB Research Partnership

Mountain Pine Beetle remains a severe threat to Alberta's pine forests despite the province making positive progress in controlling its spread within the province and reducing the risk to the rest of Canada.

Natural Resources Canada and Alberta Agriculture and Forestry have provided funding to a suite of projects with the goals of limiting the spread of Mountain Pine Beetle and mitigating damages where it has already invaded.

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4. Develop look up tables which describes these tree-level attributes by stand composition, degree of attack, and other environmental conditions, and provide these to fire ecologists for improved model parameterization.

Expected Outcomes

1. Produce exemplar datasets of high-density LIDAR data from air or by drone over sites as both fine scale rasters, as well as full point clouds which will be publicly available for use by other researchers interested in understanding individual tree structures across MPB infested forests
2. Look up tables developed for fire ecologists and fire modelers which describe individual tree level structures of fuel stratified by of MPB infestation, surface fuel conditions, species composition and local environment.
3. Peer reviewed publications on verification and accuracy of these individual tree metrics for MPB fuel assessment and the second on generation of look up tables and how these tree level attributes vary across landscapes and implications for fire severity and spread.

Implications for Land Management

A key benefit of moving to individual tree, fire fuel and spread models is that it allows trees to be characterized by their health (or attack) status and to better represent the variations in mosaics of green, red and grey trees over the landscape associated with MPB infestation. This project is designed to meet the needs of the call by improving our understanding the mosaic of MPB tree death and the subsequent implications for forest fire fuels. By developing spatially explicit representations of fire fuels at the tree level across these mosaics, we have the potential to better inform fire spread models and understand how these mosaics impact both severity and occurrence of fire.

Social, Economic, and Ecological Value

The increased need to better understand forest fire fuels resulting from MPB infestation for next generation spatially explicit models of fire behavior is critical. Currently the simplest and most commonly used fire behavior modeling system in Canada is the FBP system, which predicts fire based on weather, topography, and fuel types. One major issue with this model is the limited number and static nature of fuel types, with only 16 defined for all of Canada, none of which take into account MPB status or mosaic of attack. The value proposition for this project is large. We are not proposing wall to wall acquisition of new data; rather, we will focus on key stands that have varying mosaics of green, red and gray attack across a variety of forest types. We will build look up tables of characteristic tree and surface fuel loads across different mosaics, resulting in a very cost effective approach that avoids the cost of huge data acquisitions. By building a library of fuel characteristics and MPB attack status at the individual tree level across a variety of stand types, which can be used as input into fire behavior models, we will be better able to predict fire frequency and severity over the landscape. Information gained therefore becomes useful to a variety of managers. It is useful to fire modelers who are improving models of fire behavior, as well as forest managers who have the capacity to change harvesting techniques to produce stands that are more fire resistant.

Expected Completion Date

August 2023

For more information on this project, contact Dr. Nicholas Coops at Nicholas.coops@ubc.ca.