QuickNotes

Science summaries from fRI Research

Assessment of Risk Factors Influencing Landscape Level Fire in MPB Forests

Dr. Christopher Bone, Dr. Khurram, and Steve Taylor

The recent mountain pine beetle has led to wide-spread mortality of millions of hectares of pine forest in western Canada since the mid-1990's. Landscapes of dead pine have fueled concerns that wildfire ignitions and total area burned will significantly increase for years to come. However, the complex nature in which MPB-induced mortality influences wildfire has created an incomplete picture of the MPB-wildfire relationship. A substantial body of literature has recently emerged on the topic, yet findings remain inconsistent as to whether MPB exert significant influence on wildfire behaviour. For example, while some studies have found that MPB epidemics do not affect subsequent wildfires, others have found evidence for effects on fire extent or burn severity.

An underlying challenge with understanding the MPB-wildfire relationship, and one that is absent from the majority of landscape-scale MPB-wildfire studies using empirical observations, is weather conditions during the time of wildfire events. Temperature, relative humidity, wind-speed, and precipitation are main drivers of wildfire metrics such as spread rates and intensity. As a result, weather can overshadow or, conversely, amplify MPB impacts. Studies contrasting differences in fire activity between affected and unaffected pine dominated forests, or contrasts before and after outbreak, are potentially confounded by variation in weather and ignitions. This situation is further amplified by climate change impacts that have led to increased annual temperatures and prolonged drought conditions, which has contributed to severe wildfire seasons in Alberta and British Columbia in 2016 – 2018. As such, grasping the full complexity of the MPB-wildfire relationship requires research that can account for the spatial and temporal variation

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.

Natural Resources Canada | Ressources naturelles Canada

Canada

Alberta Agriculture and Forestry

in fire weather and ignitions. This knowledge can help predict the likelihood of large (i.e. greater than 100 hectare) fires in pine forests at various MPB attack stages given existing and predicted weather conditions. This knowledge will provide significant value to the management of Alberta's pine resources where MPB is already established by minimizing the likelihood of significant wildfire events. Such predictions would generate new knowledge towards innovative management that can be utilized by the provincial FireSmart program for assisting forest communities impacted by MPB.

Photo Credit: United States Department of Agriculture.

Objectives

The goal of this project is to assess the risk factors influencing landscape level wildfire in MPB affected areas. Changes in area burned can arise from differences in the number of ignitions for fire size and severity. We take a multi-scale approach whereby we examine the degree to which wildfire ignitions have changed at a broad (20km) spatial scale since the onset of the most recent outbreak, and how various weather, forest stand, MPB outbreak and environmental characteristics at the stand scale can potentially lead to large wildfires in MPB affected areas. This will be accomplished through the following objectives:

1. Determine if the number of wildfire ignitions is significantly different pre- and post-MPB outbreak periods across the range of susceptible hosts in Alberta and British Columbia.
2. Determine the degree to which weather, stand characteristics, and year since MPB attack influence the probability of a large wildfire occurring in affected areas.

Expected outcomes

To address the first objective of our study, we will model the background rate of wildfire ignitions prior to MPB outbreak, and test whether fire occurrence has changed following MPB attack, while accounting for weather and other influences on ignitions. For the proposed project, we will utilize this model to assess whether fire ignitions and area burned have increased over time as a result of MPB outbreaks at a finer resolution than previously performed. Our second objective will be addressed by performing a conditional probability analysis using a pre-defined logistic regression approach and a random forest model. Our aim here is to determine the degree to which weather, stand structure and MPB outbreak characteristics influence the likelihood of a large fire event (>100 ha) across the MPB susceptible range, given that a wildfire ignition has occurred.

Implications for Land Management

The outputs from this project will provide new knowledge for understanding the landscape-level impacts of MPB outbreaks on wildfire in Alberta. From an operations and risk assessment perspective, the findings from this project will assist wildfire planning and management by demonstrating hot spots of large wildfire potential given seasonal

weather and local-level environmental conditions. Knowing where large wildfires have a higher probability of occurring allows management to prioritize fire mitigation efforts through fuel reduction approaches, as well as ensure that communities close to large wildfire potential are equipped to deal with such risks.

Expected Social, Economic, and Ecological Value

The project findings will provide policy makers with a more complete picture of the impacts of MPB outbreaks on wildfire. Existing research, while extensive, has yet to attain a consensus on the landscape level role of MPB on wildfire, which this proposal suggests is due to the lack of weather-dependent analyses at the landscape scale. By directly including weather and other environmental characteristics in our analyses on the MPB-wildfire relationship, this project will provide additional knowledge in how policies should be developed to address post-MPB outbreak risks. In addition, this project will generate new knowledge towards innovative management that can be utilized by the provincial FireSmart program for assisting forest communities impacted by MPB.

Expected date of completion of the project

December 2023