



Chris Stockdale

Mountain Pine Beetle Effects on Wildfire Rate of Spread and Landscape Fire Risk

There is growing concern and evidence that mountain pine beetle (MPB) epidemics are significantly increasing landscape-level wildfire risk, which is defined as the likelihood of fire occurrence combined with the impact of a fire if it does occur. There is no simple answer to this problem, however, as it depends upon whether one is investigating how MPB affects fire frequency, size, rate of spread, intensity (heat produced by the fire), severity (mortality caused by the fire), smoke production, or short and long range ember transport (which can start new fires). Further complicating the matter is the question of how the different stages of beetle attack (red, gray, down) affect these variables. While considerable research has been invested in some of these questions, until recently, few fires have actually occurred within the first few years following MPB outbreaks. Because of this, there has been relatively very little landscape available to study the interactions of fires following MPB attack. This situation has now changed markedly following the 2017 wildfire season in BC which burned more than 1.2M ha. A very large portion of these fires occurred in areas that had experienced MPB-attack. Observations made by fire behaviour analysts indicate that these fires burned larger, spread faster, and burned more intensely than they would have in the absence of the MPB-affected fuels. These recent observations have yet to be quantified, and it is our intent to study these fires (and all fires since 2001) to advance our knowledge with regard to understanding how MPB—killed trees affect the rate of spread of fire, and how this in turn affects the relative burn probability of the landscape.

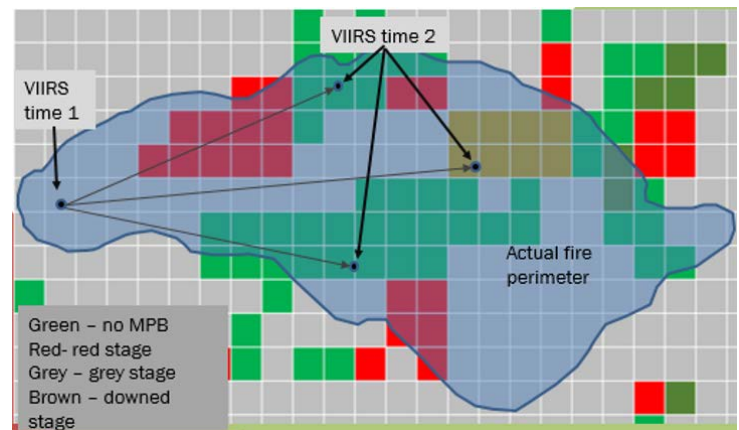


Figure 1: Hypothetical example of using satellite (VIIRS) hotspot data to derive rate of spread of fires occurring in different stages of MPB attack.

Questions

1. How do MPB-killed trees affect the rate of spread of wildfires?
2. How do MPB-killed trees affect the size of subsequent wildfires?
3. How do MPB-killed trees affect landscape burn probability?



Methods

To answer the first question, we will use satellite observations (MODIS, VIIRS) to measure the rate of spread of fires that have occurred since 2001 in MPB-affected landscapes in British Columbia, determine the effect of the MPB-attack stage (red, grey, or down, using BC's Aerial Overview Survey) on the rate of spread (Figure 1), and then compare how this rate of spread differs from what we would have expected in the absence of beetle attack.

This leads to the second question, where we can then model fire growth using the "normal" rates of spread and compare this to the MPB-affected rate of spread to determine how much larger fires would be expected to grow in the presence of MPB (Figure 2).

Finally, we can model a large number of fires to determine the effect of a landscape mosaic of various stages of MPB kill on landscape level fire risk. The findings of this study will be useful to all people working in wildfire risk analysis and fire behavior prediction in landscapes that have been, or will be, affected by MPB.

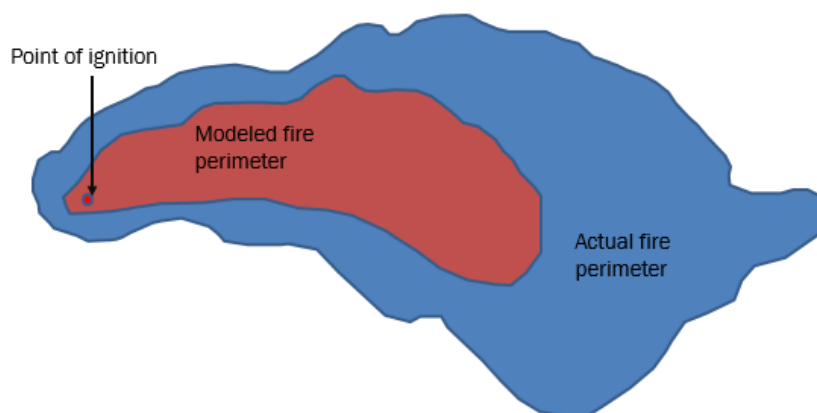


Figure 2: Conceptual diagram comparing actual fire perimeter from fire that burned in MPB-affected landscape to modeled fire that assumes no MPB attack.

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