Future productivity of lodgepole pine stands following mountain pine beetle outbreaks

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Rationale

As a natural agent of disturbance the mountain pine beetle (MPB) outbreaks play an important role in forest ecosystems. However, having infested over 14.5 million hectares of lodgepole pine forests the current beetle outbreak is unprecedented in scale.

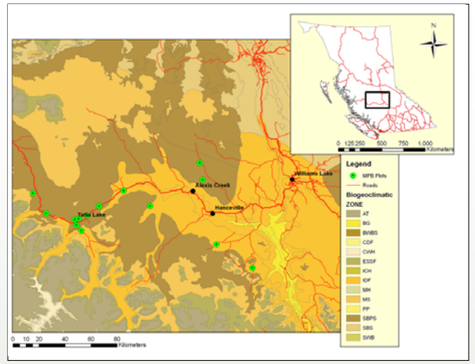
As the outbreak continues forest managers will need to develop strategies to manage the large areas left unsalvaged. For this they need to quantify the basic stand dynamics processes associated with MPB outbreaks, such as level of tree mortality by age class, post-outbreak stand growth, recruitment rates and species composition following MPB outbreaks.

Study Objectives

To quantify how unsalvaged lodgepole pine stands develop following MPB outbreaks in the Cariboo region of central B.C.

Methodology

- Re-measured fifteen permanent plots in the Chilcotin Plateau, established in 1987
- Quantified stand processes associated with MPB outbreaks (eg. tree mortality, regeneration, and fuel accumulation)
- Conducted forest measurements; diameter, height, mistletoe rating, and MPB status in 10 sub-plots per stand for overstory and understory trees.
- Conducted coarse woody debris and fine fuels measurements on 10 transects per stand
- Collected overstory increment cores, basal discs from saplings and seedlings, coarse woody debris to date stand origin, dominant tree and understory establishment, and growth rates
- Forecasted stand conditions using MoFR TASS model to estimate future stand volumes



Location of CFS permanent sample plots on the Chilcotin Plateau by BEC zone

Natural Disturbances and Structural Complexity

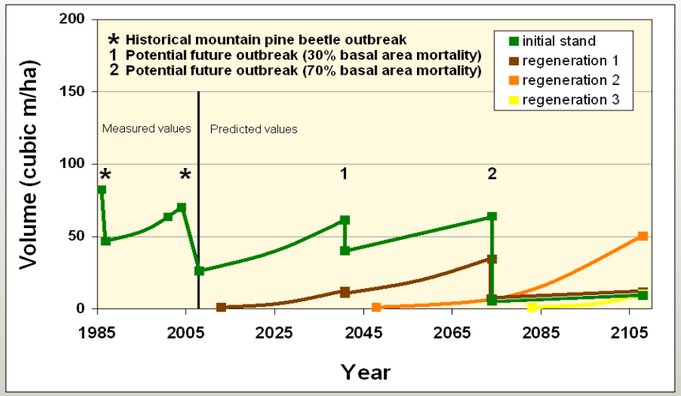
- Mixed severity fires were common before the 20th century in the Chilcotin. These fires created a mosaic of even and uneven-aged stands across the landscape.
- Low severity fires thinned stands from below, removing smaller diameter trees. Consecutive MPB outbreaks have thinned from above, removing large canopy trees.
- Chilcotin Plateau forests reflect these disturbances. In the absence of fire, MPB has increasingly directed stand structure, favoring the retention of smaller diameter classes.

Changes in stand structure over the course of 2 MPB outbreaks

Overstory mortality during the current outbreak

Coarse woody debris from the 1980s outbreak

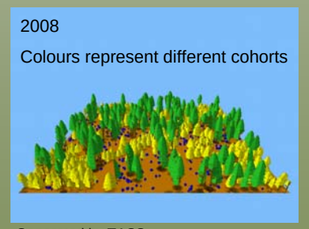
Regeneration of pine in response to canopy thinning



Stand 129 historical values and volume projection (TASS) 100 years into the future, assuming a moderate mountain pine beetle outbreak in 33 years and a severe outbreak in 66 years.

Forecasting future stand conditions

Using the Ministry of Forests and Range Tree and Stand Simulator (TASS), average stand volumes were predicted 100 years from now. A number of disturbance regimes were applied to the stands, including multiple mountain pine beetle outbreaks varying in intensity and a surface fire. After each disturbance, seedlings were established in stand openings.



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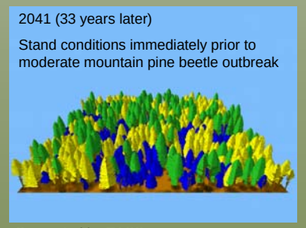

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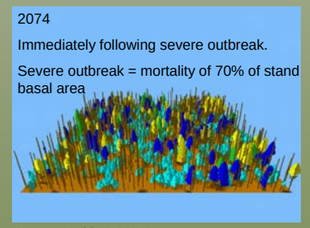

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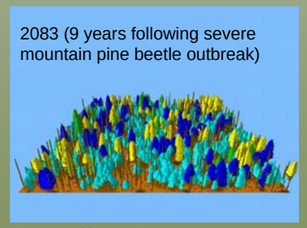

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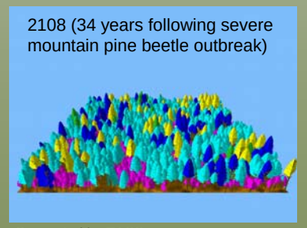

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Conclusions

- In the absence of fire disturbance MPB plays a more frequent role in directing stand dynamics and structure in the lodgepole pine forests of central British Columbia;
- Multiple mixed severity fires created complex structures resulting in uneven-aged pine stands with small even-aged patches; multiple MPB disturbances have favoured the regeneration of self perpetuating lodgepole pine;
- There is significant secondary structure present in central interior stands which is likely to survive the current outbreak.

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