

Title: Evaluation of regeneration delay, release of advance regeneration, future growth rates, and stand dynamics after a 40-50 year old MPB attack in sub-boreal forests around Takla Lake.

FSP No.: M08-5196

Project Description: The overall objective of this project is to quantify selected forest ecosystem attributes in order to provide a field-based assessment of natural regeneration and overall ecosystem recovery following Mountain Pine Beetle (MPB) disturbance in northern sub-boreal spruce subzones. This objective will be accomplished through the examination of the development of an area attacked by the MPB 40-50 years ago. Our intent is to characterize the amount, quality, and growth rate of natural regeneration as well as the ecological condition and level of ecosystem recovery in these areas. Ecosystem attributes to be assessed will include tree species composition, growth and yield, understory composition, and stand structure.

There is currently limited understanding of how longer-term forest dynamics will be affected by the MPB epidemic. Large areas of MPB attacked forests will remain unsalvaged and undergo natural stand development. To ensure sustainable forest management in these unsalvaged areas, and to provide data for projections of future stand development, methods must be found to gather information on (1) the length of the regeneration period, (2) expected growth rates of the new regeneration, (3) release potential of secondary structure (seedlings, saplings and sub-canopy trees expected to survive a MPB attack), and (4) overall stand development. An effective method to acquire such data is to undertake retrospective studies in areas attacked by the MPB in the past

We intend to use destructive sampling and stand reconstruction techniques to answer questions around (1) the regeneration delay period, (2) the abundance and size of secondary structure at the time of attack, (3) the release potential of the secondary structure, and (4) subsequent growth rates of all trees. We are especially interested in determining the potential of regeneration and secondary structure for providing mid-term timber supply relief in the present MPB infestation

Project Objective: Long Term Objectives:
(1) To better understand stand dynamics, especially the regeneration delay for new individuals and the growth dynamics of existing secondary structure, after MPB attack in sub-boreal forests.
(2) To use our better understanding of stand dynamics in MPB damaged stands to aid our choice of silvicultural strategies in the present MPB epidemic.
(3) To use growth projections obtained from this retrospective study to aid in decisions around Timber Supply and future AAC determinations in management units affected by the present MPB epidemic.

Current Year Objectives:

- (1) To select appropriate stands for destructive retrospective sampling that will best answer the many pressing regeneration, growth and yield, and stand dynamics questions currently needing answers in the present MPB epidemic area.
- (2) To undertake destructive sampling of selected sample stands.
- (3) To complete ring analysis and stand reconstruction for sampled stands.

Experimental Design and Methods: An office-based assessment will be conducted to identify potential sampling locations within the generally selected area. We will use the Canadian Forest Service Forest Insect and Disease Survey (FIDS) data to help locate known areas of old MPB killed stands. Aerial and ground reconnaissance will be conducted to determine the potential of selected areas. Actual sampling of the plots is very labour-intensive and suitable ground access is a requirement for cost-effective implementation. The number of stands selected for sampling will depend on access. In larger stands more than sample plot will be established. Some helicopter access may be required.

Sampling Procedures:

There will be 5 main areas of data collection made at each plot location. These include:

1. Full ecosystem description: The procedures for completing the ecosystem plots are provided in detail in the Field Manual for Describing Terrestrial Ecosystems (Land Management Handbook 25), B.C. Ministry of Forest and B.C. Ministry of Environment, Lands, and Parks, 1988.

2. Cruise plots and sub-canopy regeneration plots: Two standard variable radius cruise plots are completed at each location to assess all trees >7.5cm DBH. Procedures follow those outlined in the BC Ministry of Forests and Range, Revenue Branch Cruising Manual (2005), Chapter 3: Field Procedures, Section 3.4: Variable Plot Cruises. In addition, two cruise-plot-centred fixed radius plots will be established to assess sub-canopy regeneration (<7.5cm). Saplings (1.3 m tall to <7.5cm) will be recorded in a 5.64 m radius plot and individual trees will be counted by species and dbh class: 0-2.5 cm dbh, 2.6 to 5cm dbh and 5.1 to 7.5cm dbh. Seedlings (10 cm – 1.3 m tall) will be recorded by species in a 3.99 m radius plot.
3. Coarse Woody Debris (CWD) transects: Two 24m long CWD transects are located at right angles to one another within each sample plot. Procedures for laying out the CWD transects and conducting the measurements are also detailed in LMH 25.
4. Full stem analysis collection: One healthy, undamaged, tree of each species from the dominant canopy layer, subcanopy and understory will be selected for destructive analysis. Trees are marked at 0.0, 0.3, 0.7, 1.3, and 2.0 m above the point of germination and at 5 m intervals there after, decreasing to 2 m intervals in the upper portion of the main crown. If branches or knots interfere with disc location the cut height is moved up the tree (10 cm +) and the adjusted height is recorded. One side of each cut disk is labelled with the tree number and sample height (in meters). Samples are transported back to the lab for microscopic measurement and ring counting.
5. Limited stem analysis collection: An additional 10 trees per canopy position and species will be randomly selected and destructively sampled. A disc at ground level will be taken to determine age and another disc will be taken a 1.3 m for age and growth analysis before and after MPB attack.

Data analysis:

A wide variety of data analysis methods will be employed with the data to address different questions. We will quantify growth rates pre- and post- MPB attack and develop predictive equations (models) that describe expected growth rates of trees post-MPB attack based on tree characteristics (e.g., species, tree size at time of attack). We will compare growth rates of trees that existed at the time of MPB attack to growth rates of trees established after MPB attack. We will look for evidence of how growth rates change over time as the dead overstory pine trees lose needles and branches and fall. We will quantify what proportion of the live tree sample existed prior to MPB attack, post-MPB attack and the rate of ingress over time post-MPB attack. Every effort will be made to develop predictive equations (models) that can be used in stand-level simulation models to predict MPB dynamics in sub-boreal forests.

We expect to use a combination of standard frequentist statistics and maximum likelihood methods.