New findings guide management in boreal mixedwood forests

Richard Kabzems, George Harper, and Peter Fielder

The benefits of growing boreal mixedwoods are numerous, including increased resilience to damage from pests and insects, reduced effects of climatic extremes, and the potential for higher yields. Mixedwood management is more likely to sustain the diversity of non-timber values and to increase site- and landscape-level productivity than pure conifer or pure broadleaf management. What kind of management of boreal mixed stands is most likely to support this diversity of values?

The wide variety of starting conditions, treatments, and possible outcomes of species mixes creates both opportunities and dilemmas for silviculturists in boreal mixedwoods (Lieffers et al. 1996; Comeau et al. 2007).

Spacing treatment 3 years after aspen density was reduced to a target 1200 stems per hectare.

The study

The goal of Experimental Project 1192.01 (FSP Y091079) is to examine fine-scale manipulation of aspen density and distribution on sites where both aspen and white spruce are being regenerated after clearcutting. The pre-harvest stand consisted of a white spruce and aspen mixture with both species having dominant trees in the canopy (136 and 138 years old). The study site lies in the Fort Nelson variant of the Boreal White and Black Spruce subzone (BWBSmw2).

White spruce was planted in 1998, the first summer after harvest. Six different experimental treatments were then applied, starting in 2001.

1. Manual complete removal of aspen
2. Chemical (backpack glyphosate application)
3. Manual spot (1.25 m radius removal)
4. Chemical spot (1.25 m radius, basal bark application of triclopyr)
5. Aspen spacing (2005 treatment application, 1200 stems per hectare retained)
6. Untreated control

Key results to date

After 11 growing seasons on-site, we found that survival and initial growth of spruce and aspen were similar across the range of treatments. Ground-level diameters for spruce were greater where aspen had been chemically controlled or uniformly spaced.

The 1.25 m radius treatments made a visually obvious change in the stand structure when applied 4 years after harvest; however, the spot treatments, control, and manual complete treatment are now converging in light environments and white spruce growth responses as the regenerating aspen in the control self-thins with age.

Light measurements separated the aspen density treatments into better-defined groups than measures such as broadleaf density or spruce height growth.

A predictable relationship exists between light availability in aspen stands and quantifiable stand characteristics such as basal area and height in the aspen canopy.

Management implications

Would any of the treatments in this study create a mixedwood stand similar to the one that was present before harvest? Three key elements for regeneration of a similar boreal mixedwood stand are necessary:

1. simultaneous regeneration of aspen and white spruce;
2. growing conditions suitable for rapid growth of some white spruce into the canopy as dominants; and
3. over 135 years of development after the last stand-replacing disturbance (Kabzems and Garcia 2004).

With no further manipulations, the treatments in this experiment appear to have created a relatively narrow portion of the boreal mixedwood spectrum. To increase the spruce component of a mixedwood, longer rotation ages could be applied—which would increase the relative contribution of spruce when measured by volume, stems, or basal area—and (or) more than one manipulation could be completed. Also, the much-improved survival of spruce planting stock since the 1980s will increase the success for stand manipulations in mixedwoods.

Clear management objectives at all levels—stand, landscape, and region—are needed to help direct the most cost-effective activities in space and time. The great variety of species combinations and structure in the boreal forest should inspire a similar variety in the silviculture techniques that are applied. Just as we are familiar with forest planning over long periods, our approach to funding and applying silviculture techniques should also use a time frame longer than current free-growing time frames.

For more information on this project, visit *http://www.for.gov.bc.ca/hre/forprod/fordyn/projects/ep1192/ep119201.htm*

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Discussion of treatment effects and future stand development during September 2009 tour.

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Contact Information

Richard Kabzems is a Research Silviculturist with the B.C. Ministry of Forests, Lands and Natural Resource Operations based at 9000–17th Street, Dawson Creek, BC V1G 4A4. Email: Richard.Kabzems@gov.bc.ca

George Harper is a Research Scientist with the B.C. Ministry of Forests, Lands and Natural Resource Operations, Victoria, B.C.
Email: George.Harper@gov.bc.ca

Peter Fielder is a Research Biologist with the B.C. Ministry of Forests, Lands and Natural Resource Operations, Victoria, B.C.
Email: Peter.Fielder@gov.bc.ca

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