FIA–FSP Forest Science Corner

Improving the prediction of species composition for aspen/white spruce stands

This study provides post-harvest, stand-composition data which can be used in stand-level growth models. It also provides initial quantification of stand-level, pre- and post-harvest transition probabilities.

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Applying a range of silvicultural prescriptions is a more effective way of achieving objectives for boreal mixedwood management. To implement this mixedwood strategy, it is essential to predict how management activities affect the amount, type, and spatial distribution of stands across the landscape. The main objective of our project was to develop predictive empirical models of compositional changes in managed aspen and white spruce stands as a function of stand composition, management, and spatial context.

In most timber supply analyses, all leading-species stands are assumed to regenerate according to simple stand yield curves. Although the general principles of forest stand development (Oliver and Larson 1996) and spruce-aspen mixedwood succession are well understood (Lieffers *et al.* 2003) the developmental trajectory and fate of any particular patch of mixedwood forest remains difficult to predict. Process models in a landscape context may eventually synthesize the needed information in a reliable manner, but many more years of ecosystem-level research are needed to address all relevant factors. Even when completed, process models will need empirical datasets to allow validation and verification. The statistical description of state transition probabilities provides a simple alternative to process modelling, similar to analysis by Weir and Johnson (1998) for boreal mixedwoods in Saskatchewan.

We used the BC Ministry of Forests and Range Reporting Silviculture Updates and Land Status Tracking System (RESULTS) to identify populations of promptly regenerated, managed stands of aspen or white spruce at least 15 years old in the boreal forests of northeastern BC. We sampled 230 ha of spruce stands in the Peace District, 198 ha of managed aspen stands in the Fort Nelson area, and 418 ha of the same at Dawson Creek. In the Dawson Creek area, the population of managed aspen stands was stratified into two groups based on relative abundance of white spruce seed sources within 100 m of the managed-stand boundary. Sampling intensity averaged one 50 m^2 plot per 10 ha for composition and structure, and one plot per 5 ha for spruce natural regeneration in aspen stands.

Vegetation management made a difference in early tree species composition of the harvested spruce stands. The basal area summaries indicated strong white spruce dominance for openings which had a history of broadcast herbicide application. These stands did have a variety of tree species present, which was identified with the stem count stand descriptions. The broadleaf component in these stands was usually less than 2 m tall among white spruce which were 4 m tall or greater. The broadleaf species are likely to maintain themselves in conifer gaps and provide a diversity of species composition into the future. In contrast, the stands with no vegetation management treatment had a co-dominant or dominant broadleaf presence, which will be a prominent feature of stand structure well into the future. These results are consistent with studies which document the resilience of boreal plant communities to vegetation management treatments, particularly where only a single treatment entry occurs.

At these early stages of succession, the cutblocks which had been pure aspen or aspen-dominant had a very minor presence of white spruce post-harvest. Using the proportion of basal area for comparison, the white spruce component had decreased in the aspen-dominant stands 15 to 20 years post-harvest. At later stages of succession, the combination of aspen mortality and white spruce growth may increase the proportion of white spruce in these stands. The degree of change over time would need to be tested by simulations using mixed species growth models.

White spruce natural regeneration was present for more than 90% of the aspen cutblocks where a white spruce seed source could be identified on the opening perimeter. Distribution of white spruce natural regeneration was more irregular in the Dawson Creek stands. In the Fort Nelson District, distance and direction to a seed source, plus harvest disturbance, were not useful predictors for presence and density of white spruce natural regeneration. Proximity of seed sources in Fort Nelson may

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Study provides post-harvest, stand-composition data for growth models

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explain the non-significant relationships for these variables. The ability to predict white spruce natural regeneration characteristics was better in the Peace District. The presence of a receptive seedbed and the location of seed source relative to prevailing winds were the most important predictors for both white spruce presence and density. The equations, while statistically significant, had a low predictive ability. The low predictive ability reflects stochastic events, as well as loss of identifiable predictive variables over time, such as post-harvest seedbed conditions.

This study provides post-harvest, stand-composition data which can be used in stand-level growth models. It also provides initial quantification of stand-level, pre- and post-harvest transition probabilities. The initial quantification of these relationships enables landscape-level mixedwood modelling, based on current landscape condition and characteristics of individual stands.

References

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