Foothills Growth and Yield Association
Quicknote 11

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Effects of trembling aspen on lodgepole pine growth

Background

Trembling aspen (Populus tremuloides) is a common competitor in regenerating lodgepole pine stands in western Alberta. Aspen grows more rapidly than lodgepole pine on most sites, and beyond certain threshold densities it's shade will reduce the growth of the young lodgepole pine. However, at lower densities, aspen may improve the productivity of pine forests through its influences on nutrient cycling and other factors. Understanding these influences of aspen abundance on pine growth provides a knowledge base for management of these mixed pine/aspen stands. For these reasons the FGYA, in collaboration with the University of Alberta, initiated a pine-aspen density management study in 2006 as part of its "Enhanced Management of Lodgepole Pine" project supported by a FRIAA Open Funds award (FRIAA Project OF-02-06). Data collected and relationships examined in this study support the development of growth and yield models such mixed stands.

A key objective of this study is to develop models for estimating effects of amount of aspen on growth of lodgepole pine. Specific questions to be addressed include:

- How serious are the effects of aspen on pine growth and what are threshold densities?
- Are the effects similar in the Upper foothills and lower foothills?
- What variables (and competition indexes) are useful for modeling competitive effects?

Methods

During 2006 and 2007 a total of 18 installations were established in 6 Forest Management Areas. Six were placed in each of the three selected age classes (10-20, 20-30, and 30-40 years old). To compare the lower and upper foothills ecological subregions, 9 of these installations (3 in each age class) were located in each subregion.

Within each installation 6 sample plots (9.77 m radius) were established across the gradient from lowest to highest aspen density. Within each, 12 "SUBJECT" pine were selected as the focal trees and all trees measured and their location mapped. These data are used to calculate various measures of aspen competition. Three installations in each age class were identified for destructive sampling. In each of these, 3 plots were selected and pine subject trees (and a sample of aspen) were cut and cross-sectional "cookies" measured to determine diameter increment pine in 3 plots.

Details and locations of the installations are described in the project Establishment Report (Enhanced Management of Lodgepole Pine (EMLP2) Installation Establishment, November 2007) available on the FGYA website (www.foothillsresearchinstitute.ca).

For more information on this or other FGYA Quicknotes, please contact: Robert Udell, Udell Consulting, Tel.: (780) 865 – 4532, Email: udellconsulting@shaw.ca, or visit www.foothillsresearchinstitute.ca.

Results

Initial study results indicate that stems/ha is the best competition index for explaining variation in height growth, while Stand Density Index[1] (SDI) and basal area/ha work best for estimating pine diameter growth Crown length was found to be a useful variable for explaining variation in growth when used in combination with basal area or other competition measures.

They also suggest that competitive effects of aspen and pine on pine growth can be modeled using basal area or other simple competition measurements. The addition of crown length to the models substantially improves their ability to estimate growth rates.

Aspen competition appears to be having stronger effects on pine diameter growth in the lower foothills than the upper foothills. Results also suggest that intraspecific competition from other pine in the plot has a stronger effect on diameter growth than does aspen competition. Spruce basal area is negatively correlated with pine growth. This may be reflecting spruce effects on soil temperature, however other factors may also be involved.

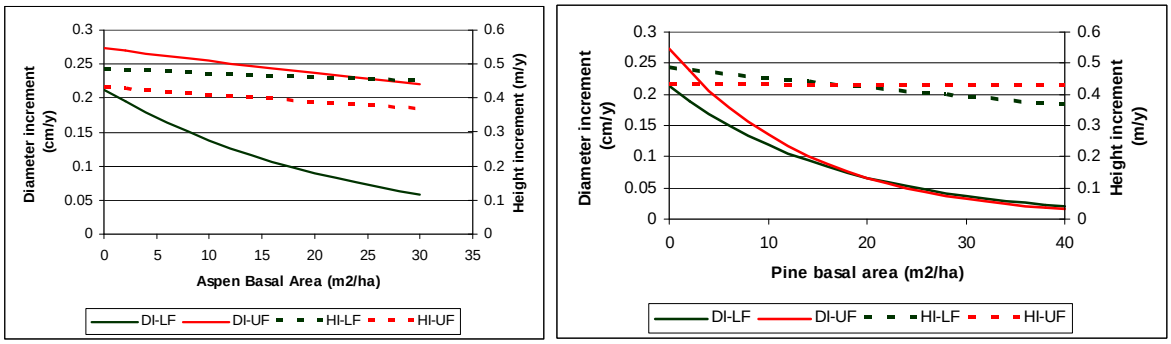

Figure 1. Illustration of aspen and pine effects on diameter and height increment.

Discussion

Preliminary results from this study suggest we are well on our way to answering the 3 questions of the key study objective. Further analysis and modeling will include separation of the effects of competitors that are taller and shorter than the subject tree, comparison of distance dependant and distance-independent competition indexes, and plot size effects.

If you have comments or questions regarding this note, or would like more information, please contact:
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[1] SDI is a measure of the degree to which a stand is occupied by trees, taking into account both their number and size