



Foothills Growth and Yield Association *Quicknote # 3* **Post-harvest Stand Development**

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Over the last 20 years, evidence has accumulated that lodgepole pine stands, regenerated after harvesting, differ considerably from their fire-origin predecessors in terms of productivity and other characteristics. In 2002 the Foothills Growth and Yield Association (FGYA) compared site indices¹ in fire-origin stands with those in stands regenerated after harvesting (see Quicknote # 2). In August 2003 the Association shared the results of this and related studies with foresters and researchers from Alberta and B.C. Aided by Weldwood of Canada and the Canadian Forest Service (CFS), the Association conducted a field tour and follow-up meeting in the Hinton area. Contributors to the meeting, in addition to FGYA representatives, included Dr. Shongming Huang of Alberta Sustainable Resource Development (ASRD), Dr. David Price (CFS), Dr. Jim Goudie (B.C. Ministry of Forests), and Dr. Jim Thrower (J.S. Thrower & Associates). The purpose was to review evidence, possible causes, and monitoring of productivity changes in post-harvest stands. Tour participants visited 8 sites including: an example of a Weldwood permanent growth sample plot; an FGYA trial installation for monitoring regeneration growth response to specific site and treatment factors; paired sample plots located in regenerated and mature stands growing on equivalent ecosites; and the CFS Gregg River spacing trial.

The FGYA site index comparison indicated an average upward shift in site index of about 23% (3.5 m) in stands regenerated after harvesting. Post-harvest stands also appeared to be regenerating at lower densities (stems per ha), and exhibiting higher tree diameter growth and taper, than their fire-origin predecessors. The shifts were not the same on all sites. Little or no site-index increase was observed on “rich” sites (classified as having high soil nutrient status), while on “poor” sites increases reached over 60%. The Gregg River spacing trial in Alberta and research in B.C. suggest that the site index increase can be attributed to lower initial densities in post-harvest versus fire-origin stands (and hence less height repression resulting from inter-tree competition). Climate change, such as a temperature increase over the past 100 years reported by the CFS, may also be contributing to the effect.



Tour participants compare post-harvest regeneration (left) with a residual portion of the original fire-origin stand growing on the same ecosite (right). Photographs: G. Behuniak, Weyerhaeuser Company

¹ Site index is a measure of the potential timber productivity of a site based on the height of the 100 largest-diameter trees per ha, indexed at 50 years breast-height age.



Observed differences between fire-origin and post-harvest stand development may have important implications for forest management and silvicultural practice. The FGYA Technical Committee met in Edmonton on December 4, 2003, to discuss what work is required to better assess these implications. Below are listed questions that the Committee considered highest priority for further investigation, together with potential sources of information.

1. *Will observed increases in site index be maintained in future?* Only long-term monitoring, as provided for by the FGYA regenerated lodgepole pine (RLP) project (see Quicknote # 1), other trials, and the permanent sample plots of member organizations, will answer this question with absolute certainty. In the meantime, studies conducted by ASRD, the CFS and other research partners will yield insights into the effects of climate change on the productivity of lodgepole pine.
2. *How do post-harvest stands differ from fire-origin stands in structure and dynamics?* Permanent sample plot data (already made available by FGYA members for the site index comparison) provide an opportunity to explore these differences. Depending on results, we may proceed to acquire additional paired-plot data, and / or low-level aerial photography, for comparing fire-origin and post-harvest stands on similar sites and at similar ages. Answering this question would not only assist in explaining productivity changes, but also provide a basis for assessing differences in fire hazard, biodiversity, and wood quality.
3. *What levels of site occupancy (proportion of area occupied by trees) and density (trees per ha) are being achieved following harvest and will be maintained over the rotation, and what levels should we be targeting?* Several existing data sets and ongoing trials will help to address these questions, including the FGYA's RLP project, ASRD's stand dynamics data, CFS spacing trials, and various ingress studies in both Alberta and B.C. We are also considering re-sampling stocking in selected stands where regeneration surveys were previously conducted.
4. *Why is the shift in site index not apparent on rich sites and greatest on poor sites, and how does control of competing vegetation influence growth response on different sites?* Extending paired-plot sampling (used in the FGYA's site index comparison) to rich-site stands that have undergone strict control of competing vegetation may provide some quick answers to these questions. In the longer term, the RLP experimental trial will shed important light on the relationships between growth response, vegetation control, density management, and site.
5. *How is susceptibility to irregular mortality and damage affected?* Research by the CFS suggests that biotic damage by gall and blister rusts, mammals, root rot, root-collar weevils, and pitch blister moths, can be of serious concern in immature post-harvest lodgepole pine regeneration. Damage and mortality are being closely monitored in the RLP trial. Forecast stand structures will also be linked to risk rating systems and spread models being developed for mountain pine beetle under the Foothills Model Forest Natural Disturbance Program.
6. *What are the implications of the observed differences in post-harvest stand development for enhanced forest management practices such as fertilization, thinning, and tree improvement (e.g. will the effects be additive)?* Answering this complex question will require not only addressing the preceding questions, but also working closely with experts in tree improvement and forest nutrition.

The mission of the Foothills Growth and Yield Association is to continually improve the assessment of lodgepole pine growth and yield in managed stands. If you have comments or suggestions regarding this note, or would like more information, please contact:

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