Examining mature Interior Douglas-fir single tree retention

by Bruce Rogers, BC Ministry of Forests and Range

Why do we retain secondary structure during forest harvesting and how successful are we at doing it? There are many reasons for retention, and its success is rooted in achieving objectives and outcomes around desired future forest conditions. One valuable method of tree retention in the Interior is to keep single Douglas-fir trees after clearcut, a process that attempts to mimic a natural disturbance attribute. To project the value of this structure to future stands, planners must be able to predict the success/survival of this retention. Recently, standing mortality has been observed in many of these single Douglas-fir retention trees (Figure 1). Subsequent research has been carried out to investigate its probable causes (Rogers 2006) and is summarized in this article.

Bruce Rogers photo

Figure 1. *Cutblock in the Sub-Boreal Spruce moist cool (mk1) subzone variant of central BC with high post-harvest mortality of Douglas-fir leave-trees 5 years following logging.*

Accelerated salvage harvesting rates in mountain pine beetle-killed stands have resulted in the immediate use of timber volume that would have normally contributed to the mid-term timber supply of the province. This has raised the need to consider options on some sites such as retaining natural secondary understorey structure that may provide for acceptable stocking and prevent silvicultural intervention. Other forms of variable retention such as seed-tree and shelterwood systems are also intended to help meet future timber-supply targets. From a habitat perspective, reserves and buffers around riparian zones and wildlife retention patches are a means to preserve habitat attributes that are important to fish, wildlife, and other resource values. Their success in contributing to habitat quality assumes not only their future presence, but their condition as well.

Douglas-fir are at the northern extent of their range in North America in central British Columbia, and occur in a patchy distribution primarily on warmer aspects across the landscape (Delong 1999). They are long lived, and thus, in relation to other conifer species, provide vertical structure with unique habitat values. These values are recognized by government, and current policy acknowledges Douglas-fir's importance, especially its contribution to critical ungulate winter range (UWR) for mule deer. In the Prince George Timber Supply Area (TSA), UWR is located primarily in Douglas-fir leading stands (BC Ministry of Forests 2005; BC Integrated Land Management Bureau 2006; BC Ministry of

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Figure 2. *Large mature single tree Douglas-fir fire veteran within a younger lodgepole pine-spruce stand in the drier Sub-Boreal Spruce zone in the Prince George TSA.*

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Environment 2007). However, much of the Douglas-fir in the Prince George TSA occurs as a secondary component in lodgepole pine-leading stands that are currently targeted for salvage harvesting after mountain pine beetle attack. As a result, significant single mature-tree retention is taking place on the landscape.

In natural wildfire-originated stands at the extent of its range, Douglas-fir generally occurs as island remnants or single trees. Single tree-fire veterans most often result from the trees' inherent ability to survive fire. Since they are usually much older and larger than the surrounding stand, they provide a unique contribution to vertical and horizontal structure and are important for habitat diversity (Figure 2). To address provincial biodiversity objectives over the past 10–15 years, the retention of single mature Douglas-fir trees (leave-trees) has been carried out by forest companies with the expectation of long-term leave-tree survival. However, within the Sub-Boreal Spruce zone, the short-term survival of dispersed single mature Douglas-fir leave-trees that are not associated with obvious modes of mortality, such as bark beetle, has been variable.

Recent research findings

Recent research in the Prince George TSA (Rogers 2006) and Alberta (Bladon *et al.* 2005) has shown that a variety of mature tree species retained in single dispersed patterns following harvest are under greater water stress. Because of the increased evaporative demand and changes in microenvironment, these trees are at higher risk for mortality compared to trees in the adjacent unharvested forest. If Douglas-fir leave-tree mortality occurs shortly after harvest, then the single-tree retention silviculture system has failed to meet the long-term objective of providing sizeable live structure through ensuing stand development.

Operational and research recommendations

If management objectives are to maximize survival of leave-trees, then recent research suggests retaining untouched clumps of forest to preserve the micro-environment around the leave trees. Conversely, in plantations, if management objectives include recruiting standing and downed large-size deadwood soon after harvest, the single-tree dispersed method of retention may provide predictable deadwood recruitment. To help planners effectively predict the success of Douglas-fir leave-tree survival or deadwood recruitment strategies, a greater understanding of variability in post-harvest leave-tree mortality across a wider range of ecosystems at landscape levels and verification of the spatial distribution of the species is necessary. The uncertainty around the long-term success of retention strategies in general is rationale for using a variety of Douglas-fir variable retention approaches to meet strategic objectives. This should provide a more diverse range of opportunities for success, while more closely emulating the natural range of variability associated with natural disturbance.

Master's Thesis

A UNBC masters study entitled "An investigation of Douglas-fir leave-tree mortality in the Sub-Boreal Spruce zone: A temporal assessment of water relations under pre and postharvest conditions" (Rogers 2006) was concluded in September, 2006. Findings revealed that single dispersed Douglas-fir retention trees on cutblcoks were more frequently under physiological water stress than those in adjacent unharvested areas. These findings were similar to those of research done by the University of Alberta (Bladon *et al.* 2005) on spruce, aspen, and birch trees.

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