Scientia Silvica

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Natural Regeneration on Clearcuts at the Lower Limit of the Mountain Hemlock Zone

Introduction

The Mountain Hemlock (MH) zone includes all subalpine forests along British Columbia's coast. It occurs at elevations where most precipitation falls as snow and the growing season is less than 4 months long. The zone includes the continuous forest of the *forested subzones* and the tree islands of the *parkland subzones* (Figure 1). Old-growth stands are populated by mountain hemlock, Pacific silver fir, and Alaska yellow-cedar, and are among the least-disturbed ecosystems in the world. Canopy trees grow slowly and are commonly older than 600 years, while some Alaska yellow-cedars may be up to 2000 years old.

Early regeneration failures followed slashburning and the planting of unsuitable species. Currently, the most successful and feasible option for reforesting cutovers is natural regeneration with a mix of the three main tree species, but uncertainties remain about the temporal and spatial pattern of regeneration, changes in species composition, and the time required for stand establishment after cutting. Our study addressed these concerns by examining regeneration patterns on 6 sites that were clearcut 11-12 years prior to sampling and left to regenerate naturally. The sites were located at the lower limits of the zone in the Tetrahedron Range, near Sechelt, at elevations from 1060-1100 m.

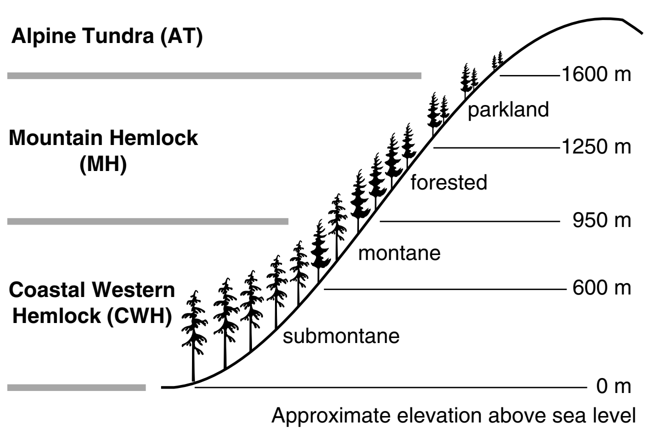

Figure 1. Elevation sequence of biogeoclimatic zones and subzones in southern coastal British Columbia.

When does regeneration establish?

Most trees taller than 100 cm established before logging (Figure 2). Trees that established 2 or more years before logging (residuals) accounted for 35% of all trees and their mean height at the time of logging was 50 cm. Trees that established in the 3-year window from 1 year before logging to 1 year after logging (germinants) formed a surprisingly high proportion (45%) of regeneration. Most residuals were Pacific silver fir while almost half of germinants were Alaska yellow-cedar (Figure 3). There was little ingress 1 year, and none 8 years after logging. These results show the importance of trees that established in the previous old-growth forest, especially when clearcutting removes all nearby seed-producing trees.

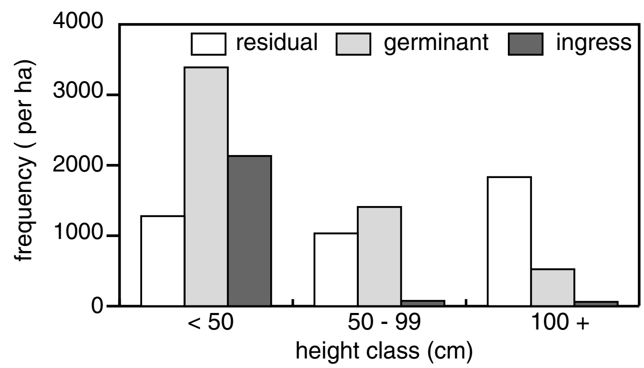

Figure 2. Age class distribution by height class. Age classes are based on year of establishment: residuals - 2 or more years before logging; germinants - within 1 year of logging; ingress - 2 or more years after logging.

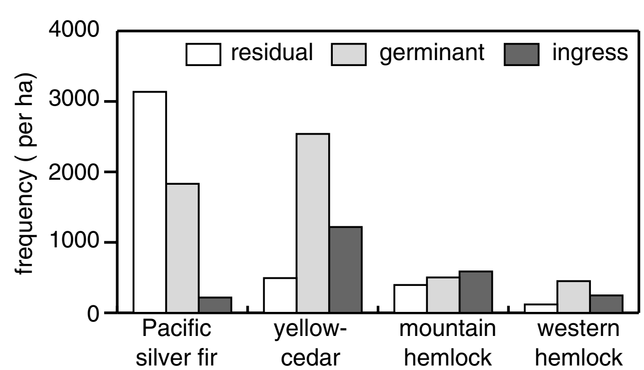

Figure 3. Age class distribution by species.

Where does natural regeneration grow?

Logging resulted in a sharp decrease in the cover of undisturbed forest floor substrates (Figure 4). In spite of covering less than 50% of the ground surface, undisturbed forest floor supported approximately 90% of regeneration, regardless of age or height class. Regeneration was less common on mounds than in adjacent old-growth stands, probably because mounds were the microsites most likely to be disturbed during logging.

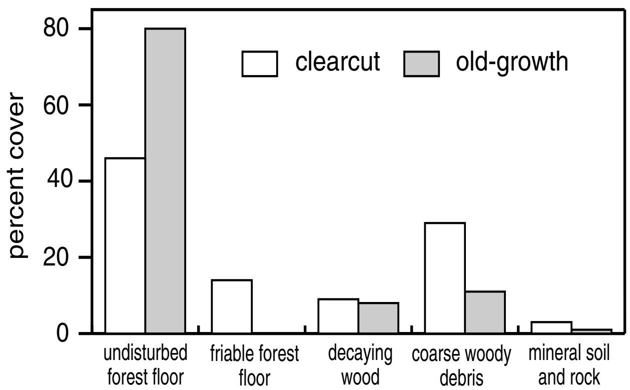

Figure 4. Percent cover of substrates on clearcuts compared to adjacent old-growth stands.

Does blueberry impede regeneration?

The dense cover of blueberry shrubs on many cutovers in the MH zone can give the impression that these shrubs impede tree establishment and survival. On our sites, however, 84% of regeneration was growing with blueberry (Figure 5) and there was no indication that blueberry decreased survival or height growth. This neutral or positive effect of blueberry was due to at least two factors. First, blueberry was more common on undisturbed substrates, which in turn were related to more abundant regeneration; and second, blueberry likely helped protect regeneration from snow damage.

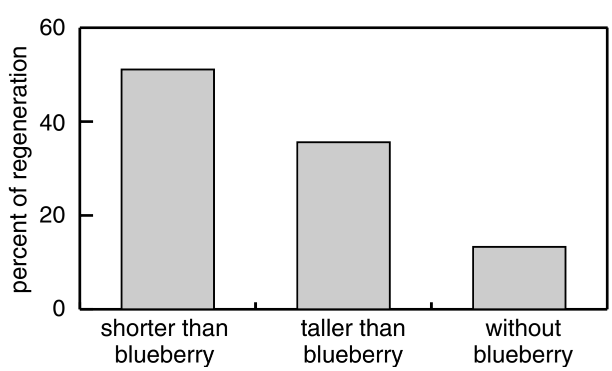

Figure 4. Percentage of trees growing with blueberry shrubs.

Management Implications

With some exceptions, clearcut sites at the lower limit of the MH zone will regenerate naturally, though often accompanied by a shift to Pacific silver fir and a more clumped spatial pattern than in old-growth stands. New stands will also have lower structural diversity since they will be essentially single-storied.

Our parallel study in adjacent old-growth stands (*Scientia Silvica* Extension Series, Number 6) showed that deeper snow increases the proportion of regeneration that requires the protection of an overhead canopy – a property most commonly associated with high-elevation tree islands. This tendency is most evident where snow melts latest, for example, on cool-aspect and flat sites. Regeneration is usually absent in large canopy gaps where snow remains into June. We can therefore expect that deeper snow at higher elevations will cause regeneration problems without the protection of an overhead canopy.

Given these climatic conditions, any form of clear-felling (clearcutting, patch-cutting, seed-tree cutting, or strip- or group-shelterwood cutting) is biologically inappropriate since it creates adverse conditions for the establishment, survival and growth of trees. In stands where regeneration is feasible, a simple form of selection cutting could be used that maintains much of the overhead canopy by retaining some live and dead canopy trees and most sub-canopy trees. Such cutting would reduce the changes in species composition and simplification of stand structure that accompany clearcutting and would be repeated only at long intervals.

Reference

Brett, R.B. 1997. Regeneration patterns on some old-growth and clearcut sites in the Mountain Hemlock zone of southern British Columbia. M.Sc. thesis, Forest Sciences Department, University of British Columbia, Vancouver, BC. 96 pp.

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