

Regeneration Dynamics of Old-growth Forests on the North Coast of British Columbia

Introduction

The North Coast Timber Supply Area (TSA) is situated on the northern coast of British Columbia (BC), and the small communities within this area are strongly dependent on forest harvesting as an economic base. However, recent analyses show a long-term timber supply problem in that the allowable annual cut cannot be sustained at the current level. Presently, the allowable annual cut is based on an economically operable forest land base of 6% of the total TSA; one possible way to maintain the level of cut is to expand this land base into areas presently considered economically inoperable.

A potential area for expansion of the land base is into the low productivity forests that dominate much of the landscape of the outer coast in the central variant of the very wet hypermaritime Coastal Western Hemlock subzone (CWHvh2; Banner et al. 1993). With an increase in the market value and/or new specialty markets for western redcedar (*Thuja plicata*) and yellow-cedar (*Chamaecyparis nootkatensis*), two common species in the CWHvh2 variant, these low timber volume sites would be considered economical to harvest. However, the low productivity forests in this variant have not been extensively harvested in the past and there is very little experience or research to draw upon when assessing the impacts of forest management. The basic ecological information that is available suggests that forests on the north coast differ from those further south, and that it would be inappropriate to extrapolate harvesting and regenerating experience from the south to the mid and north coasts.

We present a general description of the area, an overview of the interdisciplinary research currently underway, and some interesting preliminary findings on regeneration.

Area Description

The CWHvh2 variant delineates an outer coastal lowland with a cool, very wet hypermaritime climate, and high rainfall and low evapotranspiration. This climate combined with the thick organic accumulations on the forest floor results in high water surplus and wet soil conditions throughout the year. The area is fundamentally forested, but is characterised as a dynamic bog-forest complex with a mixture of productive forests interspersed among low productivity bog forests, bog woodlands, and bogs. Wetlands occur in abundance and can cover 50-75% of the landscape (Banner et al. 1988). Depressional and flat bogs are widespread over the flat to gently rolling portions of the lowlands, and slope bogs occur on gentle to moderately steep slopes (10-60%). On level and gently sloping terrain, and in some portions of the zone on considerable slopes (15-60%), bog and bog woodland ecosystems are characteristic. On moderate slopes, scrubby forests of western redcedar, yellow-cedar, western hemlock (*Tsuga heterophylla*), and lesser amounts of mountain hemlock (*Tsuga mertensiana*) and shore pine (*Pinus contorta* var. *contorta*) prevail on wet Folisols or mineral soils having thick (20-70 cm) surface organic accumulations. Highly productive forests are restricted to edaphically favourable sites. Well-drained landforms support excellent forests of Sitka spruce (*Picea sitchensis*), western hemlock, western redcedar, red alder (*Alnus rubra*) and sometimes amabilis fir (*Abies amabilis*) (A. Banner pers. comm.). In this variant, yellow-cedar and mountain hemlock occur right down to sea level, whereas in southern BC they are largely restricted to high-elevation montane and subalpine forests. Fire plays a minor role in natural ecosystems, with wind being the major form of disturbance.

Although the lower productivity stands are potentially operable, the ecological conditions

responsible for the low levels of growth and productivity could also make these systems sensitive to disturbance. Therefore, we first need to assess the feasibility of harvesting such areas in a responsible and sustainable manner. A five-year interdisciplinary study was started in 1997 to better understand these ecosystems.

Overview of Current Research

The three areas of study undertaken are: (1) regeneration, growth, and productivity; (2) hydrology, geochemistry, and peat development; and (3) paludification and below-ground ecology. The first study attempts to determine whether these forests can be regenerated after harvesting, and whether the time period for replacement and subsequent growth is economically and environmentally acceptable. The latter two studies acknowledge that harvesting will affect site hydrology, and consequently may also influence ecosystem integrity, function, productivity, and possibly succession.

These studies are being carried out on a series of site types ranging from imperfectly to poorly drained, and grading from moderately productive western hemlock–redcedar–amabilis fir forest through less productive redcedar–yellow-cedar–western and mountain hemlock (zonal) forest, then through bog forest, bog woodland, and finally open bog. Two of the objectives of the regeneration study are to collect baseline information on growth rate, and on the mechanisms and patterns of regeneration across this sequence of forest types. In the first year of the study, we have focussed on the growth of regeneration under full light conditions in canopy gaps. In subsequent years, we will examine regeneration under closed canopy conditions, in a 22-year-old partial cut, and on recent clearcuts. Height, diameter and rooting substrate are recorded for all trees, saplings, and seedlings, and stem analysis is performed on trees and saplings. We can then compare growth rates of regeneration under open, partial, and full canopy conditions, and can examine patterns of suppression and release.

The results will include ages, heights, diameter class distributions, rooting substrate, and (pend-

ing the completion of ring counting) growth increments, by tree species. Patterns will be compared among a productive forest type, a low productivity zonal forest type, and (pending completion of ring counting) a bog forest.

Some Interesting Preliminary Findings on Regeneration

Most of the existing stands in the timber harvesting land base of the North Coast TSA are reported to be older than 280 years, and up to 390 years old (BCMOF 1994). Preliminary data suggest these ages may be underestimated. On zonal sites, some of the smaller trees in the canopy gaps are approaching or are within this age class already, despite being under 30 cm dbh. The relationship of height to age could prove to be weak because a lot of the regeneration examined so far show remarkable periods of sustained suppression. Seedlings only a few millimetres in base diameter can reach ages of up to 23 years, and many saplings under 2 m tall have existed in suppressed states for up to 200 years. After such periods of suppression, some small trees do show release, and on the more productive sites growth rates of the most vigorous trees approach 25–50 cm/y. On zonal sites, height growth rates generally appear to be below 10 cm/y. The capacity to regenerate does not appear to be a problem (seedlings and saplings are generally numerous), but growth and productivity can be low. The slow replacement times were also demonstrated in a 1975 partial cut near Prince Rupert where, 20 years after logging, regeneration from seed is less than 30 cm tall, and regeneration from vegetative reproduction (layering) is only a few metres tall.

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