An Introduction to the Coastal Forest Chronosequences

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Throughout the Program we adopt undisturbed forests as the standard by which human interventions are judged. Landscapes rich in these forests establish the baseline for biodiversity, by ecosystem and species diversity and by population structure and dynamics. Such forests are self-perpetuating, maintaining essential ecological processes that conserve energy, nutrients, and organic matter in both living and non-living forms.

In the Pacific and Yukon Region there is an added dimension: in coastal areas in particular, mild climates and infrequent or moderate fire favour longevity. The resulting old-growth forests are admired the world over for the magnificent landscapes they furnish. In essence, they epitomize harmony, stability, and diversity, although in fact they are highly dynamic and evolve continuously in response to natural global change. Perhaps their most singular characteristic is their propensity for organic matter accumulation, especially as coarse woody debris. This is the basis for carbon, nutrient, and water conservation, and sets in motion food chains that support rich biological diversity.

The changes caused by the conversion of old-growth temperate forest to second growth form a sharp focus for public concern. Important questions raised over the past decade include: What are the impacts on species diversity following conversion, and does the diversity recover in older second-growth forests? Does conversion lead to changes in the site carbon balance, resulting in net releases of carbon to the atmosphere (Harmon *et al.* 1990, Kurz *et al.* 1992)? Does conversion lead to a loss of nutrient capital on a site and hence threaten future productivity (Kimmins 1985, Kimmins *et al.* 1990)?

These questions are especially relevant in coastal British Columbia. Forestry Canada's biomass inventory has clearly identified this province as having a large amount of live biomass (and hence carbon). And while biomass concentrations rarely exceed 200 t/ha outside British Columbia, they can reach 1100 t/ha on the west coast (Bonnor 1985). Organic debris can exceed these quantities. When old growth is harvested, high rainfall and mild temperatures may lead to high losses of carbon and nutrients through accelerated decomposition and leaching (Kimmins 1985), and seriously diminish the essential nature of the ecosystem.

Harvesting over the last 100 years, and other disturbances, have created a mosaic of successional stages in British Columbia forests, often alongside unharvested old-growth areas. These sites present researchers with a special opportunity to study the changes occurring during forest succession and the extent to which old-growth conditions are restored as forests mature. The study of age sequences, with old-growth and successional stands in close proximity, can separate the effects associated with stand development from those resulting from between-site variability. Since conditions in old-growth stands change more slowly over time, compared to those in the first 90 years of secondary stand succession, these stands can serve as controls for between-site variability and represent conditions in the pre-harvest stand. The effects of climate on successional processes can also be inferred, through a comparison of age sequences from two biogeoclimatic zones.

The Establishment of Coastal Forest Chronosequences

In 1991, the Forest Ecosystem Dynamics Program initiated research into changes occurring as a result of conversion of old-growth to second-growth forests in the Coastal Western Hemlock (CWH) zone of southern Vancouver Island. Investigations will be conducted to characterize soil fauna, mycorrhizal fungi, small vertebrates and plant diversity, as well as changes in carbon and nutrient fluxes in seral stands representing four stages of development: regeneration, immature, mature, and old growth. A basic suite of four sites (a chronosequence) is delineated at each of a number of locations, representing specific forest types.

The network will conduct most of its research at three locations, readily accessible from the Pacific Forestry Centre, and all within the Very Dry variant of the zone (CWHxm). These core locations are referred to as Victoria Watershed South, Victoria Watershed North, and Koksilah. A summary mensurational survey

of these plots is included (Blackwell and Trofymow, in these proceedings). It should be noted that the CWHxm subzone is one of the most threatened forest landscapes in the Region. Furthermore, two of the core locations lie within the Greater Victoria Water District, the scene of intense current debate on logging and the fate of old growth. A more extensive sample of stands was considered necessary to quantify changes in carbon and nutrients with stand age, given the range of climates found within the CWH zone. Two additions were made to the three core locations in the CWHxm subzone. Another five are located on west Vancouver Island in the Very Wet Coastal Western Hemlock subzone (CWHvm1) (Figure 1). The specifications and locations chosen were as follows:

East side: Douglas-fir dominated stands (small components of hemlock or redcedar acceptable), midslope under 600 m elevation.
Locations: Greater Victoria Watershed South, Greater Victoria Watershed North, Koksilah, Nanaimo River, Loon Lake.

West side: Western hemlock dominated stands (secondary components of amabilis, redcedar or Douglas-fir acceptable), midslope under 600 m elevation.
Locations: Renfrew, Red/Granite Creek, Nitinat, Klanawa, Mt. Ozzard.

Each chronosequence lies within a 5 x 5 km or smaller area and contains stands of four ages (reference year 1990) on similar slope, elevation (within 200 m) and aspect:

Seral stage	Age in 1990	Period of origin
Regeneration	3-8 years	1982–1987
Immature	25-45 years	1945–1965
Mature	65-85 years	1915–1925
Old growth	>200 years	pre-1790

Although most second-growth stands were of harvest origin and burned, some of the mature stands were of wildfire or landslide origin. In those cases, stands with veterans were excluded. In some situations the second-growth stands within a chronosequence were sufficiently spread apart that it was necessary to include a second old-growth plot as a control for site variation.

Chronosequence location maps and plot descriptions for all 10 locations are detailed by Blackwell (1992). The report includes maps, road directions and distances to plots at each location, forest cover maps identifying individual plots, and basic site description data for each plot.

References

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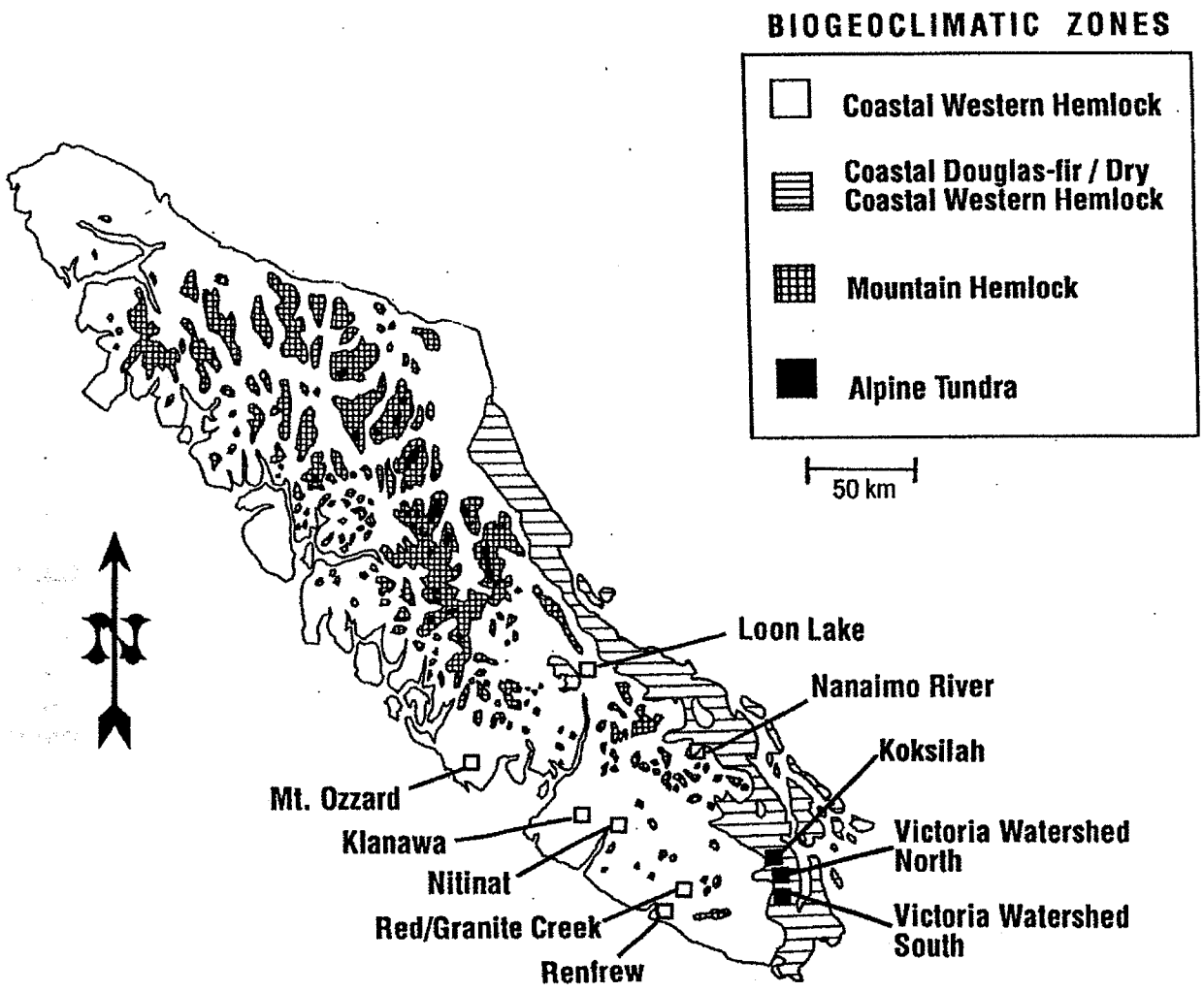

* The western part of the Coastal Douglas-fir zone has recently been transferred to the Dry Coastal Western Hemlock zone (see Meidinger and Pojar 1991)

FIGURE 1. Locations of the 10 coastal forest chronosequences on Vancouver Island. Solid squares indicate locations of intensive study.