

Ecological Characteristics of Inland Rain Forests

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SUMMARY

BRITISH COLUMBIA'S RAIN FORESTS

Within the northern hemisphere a major proportion of the world's rain forests at temperate latitudes occur along the west coast of North America. Fronting the Pacific Ocean, and centred in British Columbia at 43°N to 61°N (see also Alaback 1991), these coastal rain forests are characterized by a highly oceanic climate, with heavy precipitation, high overall humidity, moderate temperatures, and relatively infrequent thunderstorm activity (Agee 1993). Related to the above, they are also characterized by a low incidence of wildfire (Agee 1993, Arsenault 1995), a preponderance of old-growth forests, a biomass virtually unequalled in other terrestrial ecosystems (Waring and Franklin 1979), and a rich epiphytic nonvascular flora. Outside of British

Columbia, the coastal rain forests narrow southward into Oregon, and northward into southeast Alaska.

The coastal rain forests of western North America have long provided an international flashpoint for environmental concern. By contrast, their inland counterparts—the rain forests of intermontane British Columbia—are still poorly known, even to researchers. Located between 51°N and 54°N along the windward slopes of the Columbia and Rocky mountains (Fig. 1), the inland rain forest phenomenon is unique to British Columbia. It is restricted to a region of anomalously humid climate, in which a plentiful snowmelt during late spring is followed by ample rainfall during the height of the growing season. More specifically, inland rain forests are confined to the wettest subzones of the Interior Cedar–Hemlock zone (i.e., the ICHwk and ICHvk); in no other region of the world has a similar integration of humidity and continentality been documented.

THE RAIN FOREST PROJECT

In 1995 we initiated a project funded by Forest Renewal British Columbia (FRBC) to compare and contrast inland rain forests with their coastal counterparts. This project had 2 components: 1) to study similarities and differences in disturbance ecology and forest dynamics; and 2) to discern differential patterns of lichen and bryophyte diversity. This project evolved from earlier work on pattern and process in the coastal temperate rain forests (Arsenault 1995, Arsenault and Bradfield 1995), and on the distribution of rare macrolichen species (Goward 1994, 1996; Goward et al. 1994).

We adopted a multiple-scale approach in order to gain a comprehensive understanding of rain forest dynamics and species distribution. The first author examined disturbance ecology and forest dynamics at 3 scales of ecosystem organization: 1) at a within-stand scale assessing gap-phase dynamics; 2) at a meso-scale using forest chronosequences to compare stands of different ages; and 3) at a landscape scale examining the distribution of major disturbances and plant communities. Our study of lichens was similarly organized: 1) at a within-stand scale examining microdistributional ecology (Arsenault and Goward 2000); 2) at a meso-scale focusing on differences in species distribution and abundance in forests of different ages; and 3) at broader geographical scales developing predictive tools for the recognition of

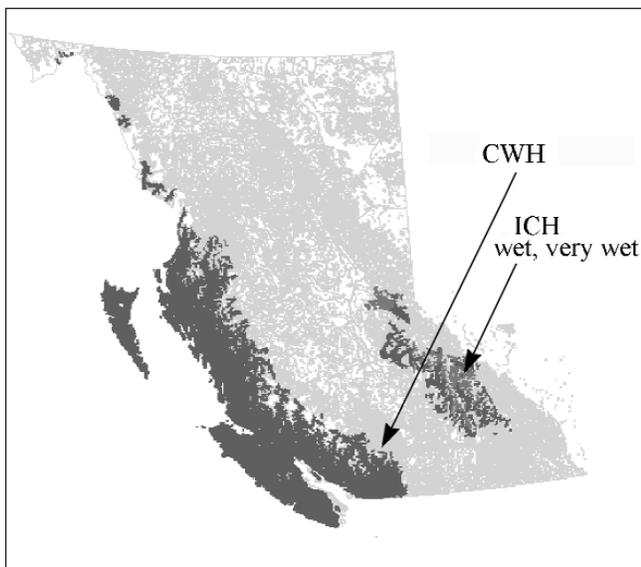


Figure 1. The occurrence of coastal and inland rain forests in British Columbia (CWH = Coastal Western Hemlock biogeoclimatic zone; ICH = Interior Cedar–Hemlock biogeoclimatic zone).

lichen hot spots (Goward and Arsenault 2000). A similar approach was used for bryophytes in a collaborative study with colleagues from the University of Alberta.

OCEANIC SPECIES

By their high ambient humidity, inland rain forests favour colonization by numerous oceanic species, that is, species more often associated with maritime environments. For example, hanging moss (*Antitrichia curtispindula*) forms thick hanging mats on the boughs of western redcedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*) trees. A number of oceanic vascular species also occur here, including deer fern (*Blechnum spicant*) and red huckleberry (*Vaccinium parviflorum*). Perhaps most fully represented, however, are various oceanic epiphytic lichen genera, including *Chaenotheca*, *Chaenothecopsis*, *Collema*, *Fuscopannaria*, *Lichinodium*, *Lobaria*, *Nephroma*, *Parmeliella*, *Polychidium*, *Pseudocyphellaria*, *Sphaerophorus*, and *Sticta*. Many species belonging to these genera are old-growth-dependent in this portion of their range, and are rare or infrequent in British Columbia as a whole.

FOREST DYNAMICS

Dominated at maturity by western redcedar and western hemlock, inland rain forests closely resemble coastal temperate rain forests in the complexity of their architecture, and the lushness of their understories. They differ, however, in their respective disturbance regimes and regeneration dynamics. Although rain forests as a whole are characterized by a low frequency of catastrophic disturbance, inland rain forests are proportionately much more susceptible than coastal rain forests to fire, wind, insects, and avalanches.

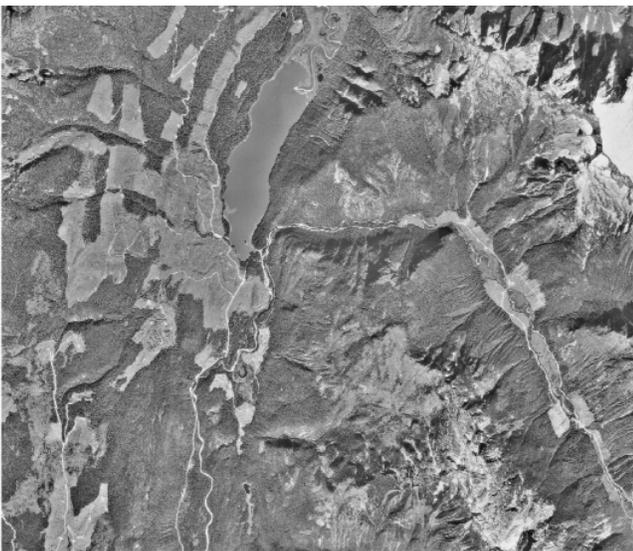


Figure 2. Landscape mosaic in the Upper Adams River Valley.

Related to this, the age-class structure of inland rain forest landscapes is somewhat less weighted to old growth (Fig. 2 and Fig. 3), and even less to “antique” forests, that is, forests that have escaped catastrophic disturbance for a period longer than the age of the oldest trees within them (Goward 1994).

MANAGEMENT IMPLICATIONS

Perhaps our most significant finding to date is that rare species are not uniformly distributed in old-growth forests, but tend to associate with forests characterized by us as antique. Similarly, antique inland rain forests are themselves not distributed randomly across the landscape; rather they are situated in gullies, toe positions, and other moist to hygic sites that tend repeatedly to escape wildfire. This observation would seem to have important implications for the establishment of future old-growth management areas.

We suggest that the oldest old-growth rain forests of inland British Columbia are at risk. More specifically, their future contribution to biological diversity may be diminished as a result of several interacting factors, including: 1) their restricted historic distribution; 2) their association with highly productive sites; 3) their accessibility to resource extraction; and 4) their past and ongoing fragmentation as a result of timber harvesting, natural disturbance, and flooding for dam construction. The insights generated by our project have already assisted in the designation of protected areas; we hope they will continue to contribute to landscape unit planning and future forest practices.

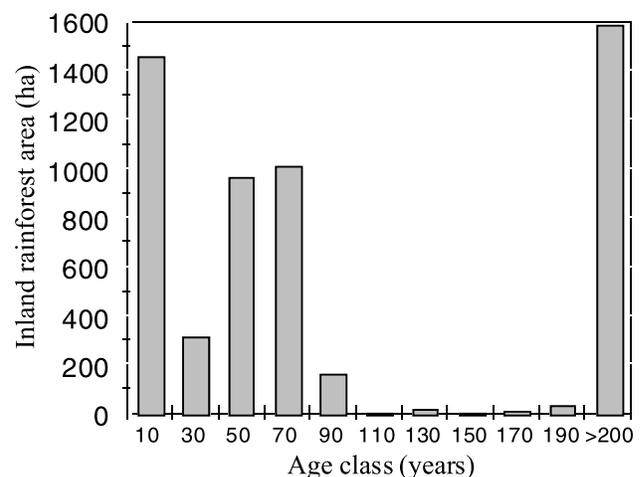


Figure 3. Stand age distribution for the ICHwk and ICHvk (Interior Cedar–Hemlock wet and very wet) subzones, Upper Adams River Valley. The first age class (0–20 yr) results from recent clearcut harvesting. Most of the stands between 40–120 years old originate from catastrophic fire that burned substantial portions of the area near Tumtum Lake.

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