Patterns of lichen diversity and distribution in old and young forests of the Interior Cedar-Hemlock Zone of British Columbia.

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Lichens and bryophytes although relatively small in size form a significant component in many forest ecosystems. In addition to their large biomass and valuable role in ecosystem function (i.e. biogeochemical cycles) bryophytes and lichens represent a large portion of forest biodiversity. Several species of bryophytes and lichens (particularly epixylics; species growing on wood) are dependent upon old-growth forests for their survival. The conversion of a large proportion of the landbase to second-growth forests may eventually result in the loss of these species. A better understanding of the patterns of bryophyte and lichen diversity, and of the relationship between sensitive species and their habitat, will provide a rare opportunity to minimize the impact of forestry operations on biodiversity.

A project investigating the patterns of lichen and bryophyte species diversity as well as species-habitat relationships in coastal (CWH) and interior cedar-hemlock (ICH) forests was initiated in 1996. The main objectives are: 1) Compare the patterns of bryophyte and lichen diversity of coastal and interior cedar-hemlock forests of different age, 2) Develop species concepts for undescribed lichens (mostly crustose lichens like the Calciales) inhabiting coastal and interior cedar-hemlock forests, 3) Compare bryophyte and lichen species-habitat relationships in interior and coastal cedar-hemlock forests of different ages, 4) Compare the floristic composition and affinities between the coastal and inland rainforest bryophyte and lichen floras.

In the first field season a total of one hundred ICH stands were sampled for the bryophyte study (Collaboration with Steve Newmaster, René Belland, and Dale Vitt from the University of Alberta) and a total of nineteen ICH stands for the lichen study. The high discrepancy in the number of stands between the two studies results from the inclusion of the crustose Caliciales in the lichen study which required much more effort in the field and in the lab. For this reason the lichen study was more restricted in the types of sites investigated, while the bryophyte study covered a wider range of site series and forest ages. The study area is located in the spectacular forests of interior wet-belt of British Columbia and followed a gradient from the moist warm ICH forest (ICHmw3) located at the entrance of Wells gray Park to the wet cool (ICHwk1) and very wet cool (ICHvk1) forests of the Mad, Upper Adams and Upper Seymour river valleys and of Azure lake. The following is a brief account of the methods and results from the lichen portion of this project.

Our study was initially designed to permit examination of lichen diversity in matched pairs of young (70-140yr) and old (250-900yr) forest stands. This comparison was made between 7 old and 7 young forests located in southern Wells Gray Park in relatively wet sites of the ICHmw3 associated with toe, lower slope, or depression topographic positions. In addition we

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investigated the wetter end of the ICH gradients by placing plots in old ICHvk1 forests as well as forests in the sprayzone of waterfalls. A comparison of young and old forests in this more humid portion of the study area, where wildfires are less frequent, was not possible.

The relative abundance of macro-lichens and a few selected crusts ,using a five point-scale, was estimated on 21 substrate units distributed on living trees, standing dead trees, shrubs, and on the forest floor. This was done in plots of 100 meter radii. Crustose Caliciales were only recorded as present or absent and the substrate they lived on was also noted. In order to capture the maximum information on lichen distribution at each site, we also conducted a larger survey around each plot (approx. 1 ha.) noting species not recorded in the small more detailed plots.

One hundred and fifty one lichen species, including members of the Caliciales, were recorded from old and young forests. The data reveal that macro-lichen diversity (as expressed by mean total numbers of species) in young forests and in old forests is not significantly different although old forests display higher overall diversity (Total number of species). By contrasts both mean and overall species diversity in the Caliciales are significantly higher in old forests. An ordination of the macro-lichen data based on multivariate analysis has clearly segregated young and old forests. Macro-lichens most strongly correlated with old forests had oceanic affinities and included species like *Sphaeophorus globosus* while species most correlated with young forests were mostly epiphytes associated with drier conditions. Several species are exclusively or primarily found in old-growth forests. Living trees, snags and large tip-up mounds are the most important substrates, accounting for a large proportion of total lichen diversity, and for most species judged to be old-growth-dependent. Numerous other lichens are recorded only from sites subject to high levels of nutrient enrichment, especially the spray zones of waterfalls and the drip zones of *Populus*. It is postulated that existing levels of lichen diversity at the stand level correlate at least in part with regional patterns of ecological continuity. Lichen diversity in the ICH will be maintained at current levels only through the preservation of existing nodes of high lichen diversity, and through wise management of old-growth legacies (i.e. landscapes, stands and components of these).

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