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Differences in the Composition of Vascular Plants, Bryophytes, and Lichens Among Four Successional Stages on Southern Vancouver Island

Introduction

The purpose of this investigation is to provide a preliminary assessment of the vegetation composition and the relationship of bryophytes and lichens to substrate in four successional stages of Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) stands located on southern Vancouver Island.

Methods

A total of 24 plots, each 3600 m^2, were established by Pacific Forestry Centre personnel in stands representing four stages of forest succession [R - regeneration (3-9 years), I - immature (32-43 years), M - mature (66-99 years), and O - old growth (200+ years)] in six locations: three on the east side of Vancouver Island and three on the west side. Eastern Vancouver Island plots occur in the Very Dry Maritime Coastal Western Hemlock Subzone (CWHxm) of the Biogeoclimatic Ecological Classification (BEC) whereas western Vancouver Island plots occur in the Submontane Very Wet Maritime CWH Variant (CWHvm1) (Green and Klinka 1994). Most plots belong to the zonal site series within their respective subzones but several were assigned to other site series (see Trofymow et al. 1997).

Plant species, including bryophytes and lichens (hereafter referred to as cryptogams), occurring on humus, coarse woody debris, rock, and mineral soil were identified. Epiphytic species were not sampled. Visual cover estimates were made of each species. In addition, cover estimates were made for each type of substrate (humus, coarse woody debris, rock, mineral soil) on which each cryptogamic species was present.

Results

A total of 337 species comprising 14 trees, 32 shrubs, 130 herbs, and 161 cryptogams were recorded for all sites. All successional stages of eastern plots had a larger number of species than their western counterparts, particularly on forested plots where eastern plots had about twice the number of species as those found to the west (Figure 1). Differences in the total numbers of species between successional stages were much greater among western plots than eastern plots. The western regeneration plots had the largest number of species (152) followed by a sharp decline on forested plots. Much of the decline in the number of species arose from a reduction in the number of vascular species, i.e. from 64 species on regeneration plots to 32 or fewer species on forested plots. On eastern plots, the largest number of species (168) occurred on regeneration plots whereas the lowest number of species (143) occurred on old-growth plots. Although a similar reduction of vascular species, from 110 to 76, occurred on the eastern plots, the number of cryptogamic species increased from 58 to 83 species thus maintaining a large total number of species.

The cover and number of cryptogamic species, varied between substrate types and successional stages. Although the cover of cryptogams was highest on humus on eastern plots, wood and rock substrates generally supported the largest number of species (Figure 2). On western plots, cover values of cryptogams on humus and wood were generally higher than those of rock and mineral soil, whereas wood and rock substrates generally supported the largest numbers of species.

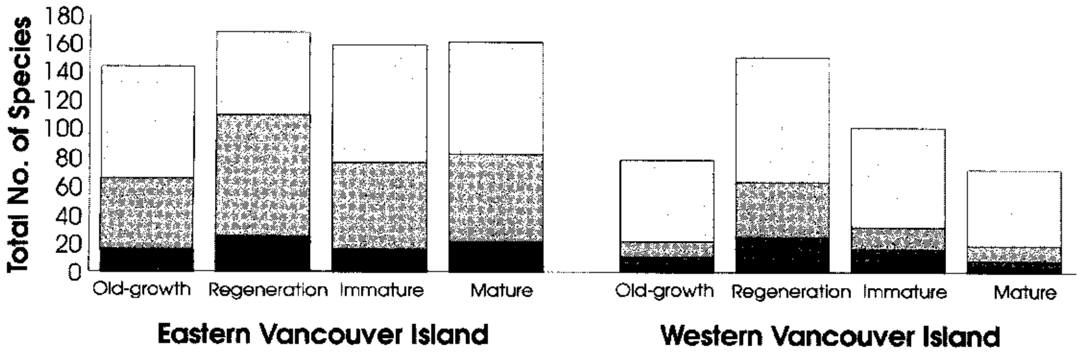

Figure 1. Total number of species recorded for each successional stage on eastern and western Vancouver Island plots (■ trees, ■ shrubs, ▩ herbs, □ cryptogams).

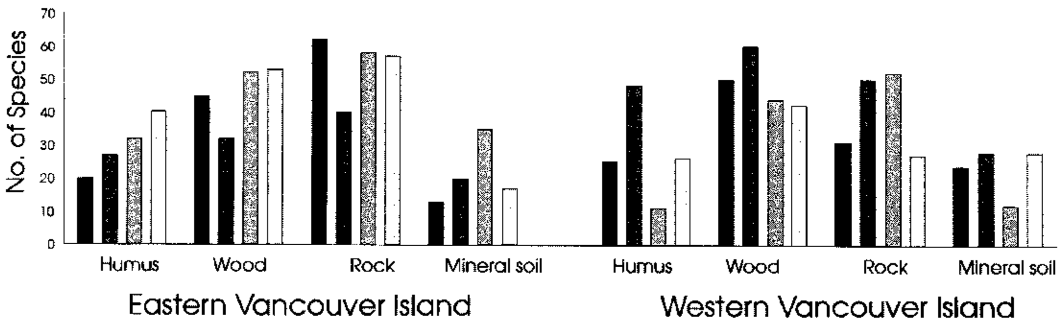

Figure 2. Number of cryptogamic species recorded for each successional stage on four substrate types (■ old-growth, ■ regeneration, ▩ immature, □ mature).

There were distinct differences in the number of species that were restricted to one or two successional stages. The largest number of species restricted to a single successional stage occurred on regeneration plots, with 35 and 65 species for eastern and western plots, respectively. These results reflect the large number of species that invade disturbed sites but are subsequently eliminated by canopy closure. Both eastern and western plots exhibited a decreasing number of restricted species with increasing age so that immature forest plots had a larger number of restricted species than those of mature and old-growth forests. All species restricted to western mature and/or old-growth plots were bryophytes except for the orchid, rattlesnake-plantain (*Goodyera oblongifolia*). Of the seven vascular species restricted to mature and/or old-growth plots on eastern Vancouver Island, four were achlorophyllous species.

Discussion

Given the limited number of plots and the variation in vegetation composition between plots, it is difficult to make strong inferences to other forested areas on Vancouver Island. About half of the species occurring in forested plots were cryptogamic species; and, although humus, and in some instances coarse woody debris, supported a large cover of cryptogams, coarse woody debris and rock generally supported the largest number of species. These results suggest that coarse woody debris and rock substrates are important in maintaining high cryptogamic species richness.

The two study areas exhibited very different patterns of species distributions between successional stages and care must be taken in applying information about species distributions, patterns, and tolerances from one forest type to another. The strong reduction in the total numbers of species between western regeneration and forested plots likely reflects the effects of the dense forest canopy which eliminates all but the most shade-tolerant understorey species. Alternatively, eastern forested plots did not have a continuous dense forest canopy, and the number of understorey species remained high on immature and mature forested plots. These results suggest that old-growth forests cannot be treated as a homogenous unit in management plans, and that the composition and structure of the vegetation must be considered in designing and implementing forest practices. It is likely that the assemblage of species restricted to old-growth stands will differ in other forest types or regions.

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