Litterfall and soil characteristics in canopy gaps occupied

subsequent regeneration of these sites by conifers. As the stand develops around the vine maple patches, a canopy gap appears in the mid to late successional stages.

Canopy gaps may have greater nutrient availability due to a smaller sequestration of nutrients associated with lesser biomass, and to the increase in rates of decomposition and mineralization associated with higher levels of light, temperature and moisture (Pickett and White 1985). Vine maple litter is believed to provide a rich supply of nutrients to a site (Haeussler et al. 1990), and is thought to be associated with high rates of nutrient cycling (Krajina et al. 1982). Compared with Douglas-fir litter, vine maple litter has a higher concentration of N (Triska and Sedell 1976).

The goal of this study was to determine if rates of litterfall, and litter decomposition, and properties of the forest floor and mineral soil, in vine maple gaps differ from those in the surrounding forest. These properties may provide an indication of how vine maple gaps influence site productivity, and may help to explain the long-term impact of priority vine maple gaps on forest soils. The objectives of the study were:

1. To compare the following properties between vine maple gap and conifer canopy sites:
a. Rates of vine maple leaf and conifer needle litterfall, and nutrient inputs in litterfall.
b. Decomposition rates of vine maple leaf litter and conifer needle litter.
c. Properties of the forest floor (depth, mass per unit area, pH and nutrient concentrations) and mineral soil (bulk density, pH, organic matter and total N concentrations and C/N ratio).
2. To compare nutrient concentrations and decomposition rates between vine maple leaf litter and conifer needle (*Tsuga heterophylla*

corresponds to the period in which all vine maple litter fell. The autumn collections were made weekly to minimize

in other studies of litterfall in similar forest types. In a summary of studies of litter production in western Washington Douglas-fir stands, Gessel and Turner (1976) report typical leaf litter values of 2100 kg ha^{-1} yr^{-1}. Dimock (1958) reports annual rates of litterfall of 1800 kg ha^{-1} in a 45-yr-old Douglas-fir stand in Washington State and Trofymow et al. (1991) report annual rates of litterfall of 1890 kg ha^{-1} in Douglas-fir stands located near Shawnigan Lake, British Columbia.

As expected, nutrient concentrations were found to be higher in vine maple leaf litter as compared with conifer needle litter. Concentrations of N, P, Ca, Mg, K, Fe, and Zn, in vine maple leaf litter were significantly higher than those of conifer needle litter, suggesting that over time, vine maple may improve the nutritional status of soils. These findings are consistent with those of Triska and Sedell (1976) who found higher concentrations of N in vine maple litter as compared with Douglas-fir litter and Russell (1973) who found vine maple foliage to be rich in N, P, Mg, Ca, Na, and K.

We had hypothesized that nutrient inputs in litterfall are higher in vine maple gaps compared with conifer canopy sites, but this was not found. Over the autumn time period, the total amounts of all measured nutrients input in litterfall did not differ significantly between vine maple gap and conifer canopy plots. Although the nutrient concentrations of vine maple litterfall were significantly greater than those of conifer litterfall, conifer litterfall contributed significantly greater amounts of nutrients to the forest floor in vine maple gaps over the autumn time periods than did vine maple litterfall. This is consistent with the finding of Russel (1973) that although vine maple makes an important relative contribution to the total understory biomass, the relative biomass contribution of vine maple may be low when all forest vegetation layers are considered.

Litter Decomposition

Consistent with findings from other studies on hardwood-conifer comparisons (Challinor 1968; Gessel and Turner 1974; Tappeiner and Alm 1975; Fried et al. 1990), we found that vine maple litter decomposes faster than conifer litter. It is likely that vine maple litter decomposes more rapidly than conifer litter due to a lower lignin content, higher nitrogen concentration and thin leaves (Haeussler et al. 1990). The rapid decomposition of vine maple litter — as postulated for bigleaf maple litter (Fried et al. 1990) — could benefit both maple and the surrounding conifers because nutrients rapidly become available to tree roots rather than being sequestered in the forest floor, as is the case under conifers.

There was no significant difference in the mass loss between vine maple leaf litter and conifer leaf litter at the end of 2 yr of decomposition on the vine maple gap plots. Edmonds (1980) found significant differences in mass loss after 1 yr, but not after 2 yr among different species. For the litter types in this study and in the study by Edmonds (1980), it is likely that only the very slowly decomposable material such as lignin remains after 2 yr of decomposition.

For both litter types, the greatest percentage of mass loss occurred within the first 5-mo period. After 2 yr of decomposition, there was no sizable increase in mass loss in either litter type compared with the mass loss reached after 1 yr of decomposition. Litter typically ha,TgTj heria (rapipu1kc8o omi.049e maple gap and conifer canopy plots. Therefore, the lack of differences in decomposition rates between vine maple gap and conifer canopy plots may be partly explained by the lack of differences in environmental conditions on the sites. Similarities in environmental conditions between the two site types are likely due to the relatively low diameter to height ratios of the gaps. The microclimate of gaps with low

In a similar study on bigleaf maples, Fried et al. (1990) found no consistent differences in the concentrations of P, K, Ca, or Mg in the upper mineral soils beneath bigleaf maples compared with those beneath Douglas-fir. They postulated that nutrients are cycled more rapidly in the bigleaf maple systems, and the rates of uptake of nutrients by bigleaf maple roots and the storage of nutrients in woody tissues could be sufficient to utilize the additional input of nutrients from litter. Fried et al. (1990) suggested that there may be more nutrients stored in the biomass of maples than conifers.

Since vine maple litter had higher concentrations of bases than conifer litter, pH levels were expected to be higher in vine maple gaps than in conifer canopy plots. The pH was found to be significantly higher in vine maple gap plots than in conifer canopy plots in the forest floor; and there was a weak tendency for higher pH values at 5, 20 and 50 cm depths. Similarly, pH in the upper 10 cm of mineral soil tended to be higher (not significantly) under bigleaf maple as compared with under Douglas-fir by Fried et al. (1990).

Due to the rapid rate of decomposition of vine maple litter, the relatively high N concentrations in vine maple litter, and possibly greater soil organism activity beneath vine maple, it was expected that organic matter and nitrogen concentrations would be higher and the C/N ratio would be lower beneath vine maple than beneath conifers. Surprisingly there were no significant differences in organic matter or nitrogen concentrations or in C/N ratios at either the 5 or 20 cm depths between vine maple gap and conifer canopy plots. However, there was a weak tendency for higher total N concentrations and lower C/N ratios in vine maple gaps at the 5 cm depth. In contrast to this study, Fried et al. (1990) found that total C and N concentrations were significantly greater under bigleaf maple, which is probably due to the large amount of litter produced by bigleaf maples. Fried et al. (1990) found no consistent difference in the C/N ratios in the surface mineral soil beneath bigleaf maple and Douglas-fir. In our study, larger clones had significantly lower C/N ratios in the upper 10 cm of mineral soil and therefore may have had higher N availability than smaller clones.

CONCLUSIONS

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