The Drip Zone Effect: New Insights Into the Distribution of Rare Lichens

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EXPANDED ABSTRACT

Nearly half of British Columbia's rare tree-dwelling macrolichens have a cyanobacterium as photobiont. Such species can be referred to as epiphytic cyanolichens. As a group, epiphytic cyanolichens have a requirement for nutrient-rich substrates with a pH above about 5.0 (Gauslaa 1985); they tend to be absent from acidic substrates, including the bark of conifers. Viewed from this perspective, the copious presence of cyanolichens over the bark of pines, spruces, hemlocks, and other members of the Pinaceae in some portions of northwestern North America would seem anomalous. We propose that this phenomenon must reflect nutrient enrichment from sources extraneous to the trees themselves. Enrichment may derive, for example, from airborne dust, aerosols associated with the spray zones of waterfalls, or from nutrients present in the soil.

Our work in various subzones of the Interior Cedar–Hemlock biogeoclimatic zone suggests that nutrient transfer from the soil into the canopy is mediated at least in part by the roots of cottonwood trees and trembling aspen. We hypothesize that such trees can effectively function as "nutrient pumps." The nutrients transported into the canopy by them are later released into the surrounding forest in what may be called a "drip zone effect" (Fig. 1). Though cottonwood and aspen do not themselves support diverse assemblages of epiphytic cyanolichens, they do permit the development of impressive nodes of cyanolichen diversity on conifers growing adjacent to them. By their presence, they indirectly provide habitat for many of British Columbia's rarer epiphytic species. If it is true that nitrogen-fixing cyanolichens play a significant role in the nitrogen budgets of some forest ecosystems (Pike 1978), then aspen and cottonwood should be considered "keystone" organisms.

Viewed globally, the ability of cyanolichens to colonize conifers has probably declined during the past 2 centuries. In most parts of Europe, for example, acid rain has been on the rise for more than 100 years, and conifers no longer support epiphytic cyanolichens (Gauslaa and Holien 1998). Instead, epiphytic cyanolichens are restricted to the bark of deciduous trees with a high buffering capacity (Rose 1988).

The situation is very different in most portions of British Columbia. Here, air quality remains high, and cyanolichens continue to thrive in at least some conifer woodlands (Goward and Arsenault 2000). We tentatively conclude that the study of conifer-cyanolichen relationships in western North America may yield important insights into pre-industrial epiphytic ecology over large portions of mid-latitude North America and Europe. Moreover, the intricate relationship between *Populus* and cyanolichen/nitrogen distribution may be expected to have significant implications for silvicultural practices in British Columbia. These ideas will be developed more fully elsewhere.

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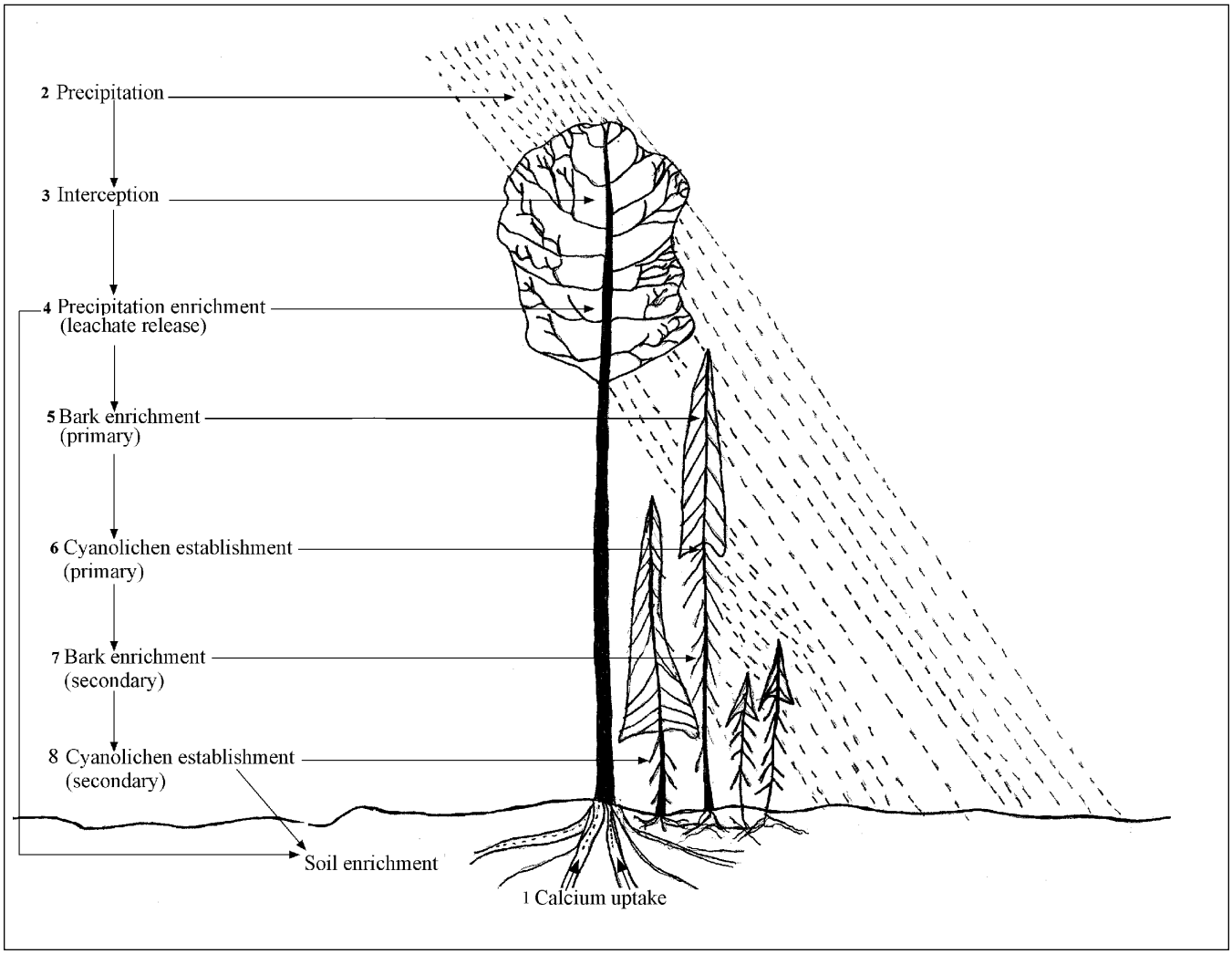

Figure 1. The drip zone hypothesis.