Diminutive Forest Denizens: Ecological Primer on Mosses, Lichens, and Liverworts Found on Puget Sound Shorelines

Mosses, lichens and liverworts carpet forest floors and logs, hang in curtains from tree branches, adhere tightly to exposed rocks and cling to the banks of streams. Collectively known as non-vascular cryptogams, these organisms lack the vascular system found in seed plants, have hidden (crypto) sexual structures (gam) and reproduce via spores and fragmentation. Whereas mosses and liverworts are true plants, lichens result from a symbiotic relationship between a fungus and an algae or cyanobacterium. This association may be the reason lichens can exist on many surfaces not commonly inhabited by algae or fungi alone.

Cryptogams are sensitive to the physical environment because individuals are in intimate contact with their surroundings. They lack the protective epidermis found in higher plants, and cannot regulate moisture loss. Cryptogams also lack true roots and cannot actively access soil water and nutrients. They must rely on nutrients in the air or those dissolved in rain, fog, and runoff from other surfaces. Many species have adaptations to withstand complete dessication for extended periods of time, and then resume activity within seconds of hydrating. Partly because of their sensitivity to microclimate, substrate chemistry, and pollutants, cryptogam communities differ by habitat and substrate. For example, different species occupy the bark of deciduous versus coniferous trees, streamside rocks versus other rocks, shaded areas versus exposed sites, and soils with different properties.

Despite the small size of individual cryptogams, their combined biomass is significant, and they are key members of Pacific Northwest ecosystems. Mosses and liverworts contribute to microclimate control because they are able to hold vast quantities of water between their branches and leaves, and within cells. Evaporation of this water helps keep the air cool and humid long after rainfall ends. Cryptogams also provide nesting material and hiding places for birds and small critters. Lichens such as *Bryoria* and *Nephroma* are food sources for herbivores including deer, elk and slugs. Lichens that have cyanobacteria (e.g., *Sticta, Leptogium, Lobaria, Pseudocyphellaria,* and *Nephroma*) are nitrogen-rich and add this essential nutrient to soils when they decay. Moss sporophyte capsules may be eaten by birds, rodents, and insects. Whereas moss leaves are not considered nutritious, moss mats catch and hold nutrients from fallen debris creating a reserve. In another role, some cryptogams help break down rock and woody debris into soil.

Humans have found many uses for cryptogams as well. Historically moss was used for everything from bedding to wound dressings, disposable diapers, and cabin insulation. Today moss is valued by the floral industry for lining flower baskets and making decorative sculptures. Lichens are an ingredient in some deodorants, shampoos and herbal remedies. Lichens that are intolerant of atmospheric pollution can be used to detect changes in regional air quality because a decline in their abundance indicates an increase in pollutants. Heavy metal pollution can be estimated by comparing the content of lichens collected today with that of older samples stored in herbarium collections.

For more information, see the USGS Fact Sheet included in your workshop packet.

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