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Lichens

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Lichens. Anyone that has ever walked in the forest or in rocky alpine regions has seen them; multi-colored splashes clinging to rocks and trunks of trees, gray-green cascades swaying from branches, bursts of color and fantastic shapes growing high in the forest canopy.

Lichens are ancient organisms, with the oldest recorded lichen fossil dating to around 400 million years ago. This huge group of widely diverse organisms occupies almost every habitat on earth and is the dominant vegetation in approximately eight percent of terrestrial ecosystems. Of the 14,000 species of known lichens, 3,600 of them occur in North America.

Most lichens are temperate or arctic, though there are many tropical and desert species. Lichens will colonize almost any stable and reasonable well-lit surface. Trees, as well as the surfaces of wood, rock, soil, leaves, bone, antlers, and even abandoned cars (if left undisturbed long enough) all provide places for lichens to colonize and thrive.

Lichens that grow on plants are *epiphytes*. Epiphytes are organisms that grow on other plants, attaching themselves by roots, rhizomes, or fungal strands. Epiphytes are not parasitic and do not harm or feed on the plants they are perched on - instead they use these plants as platforms to grow on. Other types of epiphytes include orchids, bromeliads, and some species of ferns. Outside coastal rainforests and the tropics, lichens are the most important epiphytes of forest trees and shrubs.

Lichens are made up of two, and sometimes three, different organisms that form a symbiotic relationship for their mutual benefit and survival. The dominant member is an ascomycetous fungus (Kingdom *Fungi*). Inside this visible part of the lichen are cells of an alga (Kingdom *Protista*) or a cyanobacterium, once known as blue-green algae (Kingdom *Eubacteria*), or both.

Lichens are currently classified in Kingdom *Fungi*.

Each member of these symbiotic organisms play a crucial role. The algae and cyanobacteria (*photobionts*) are photosynthetic and supply the fungus with carbohydrates and vitamins, while the fungus (*mycobiont*) extracts necessary water and minerals from the air and colonized surfaces. The components of a lichen can be separated and grown apart in a lab, but when married, form a new association that is long-lived and unlike any of the components in structure or form.

Able to withstand long periods of drought, lichens are self-sufficient; taking what few minerals and little water they need for survival from dust and available moisture. They contain their own source of carbohydrates and their *propagules* (a sexual or vegetative reproductive unit) are tiny, enabling them to become established on all but the smoothest



Different types of lichens growing on a dead branch.

Photo by Joseph O'Brien, USDA Forest Service,
Bugwood.org

surfaces. Because of this, lichens are often referred to as “nature’s pioneers”.

Lichens reproduce vegetatively. Pieces containing both the fungus and algae and/or cyanobacteria are blown in the wind or carried by water and establish new colonies where they land. Lichens have the ability to not simply dehydrate, but completely dry up when moisture is unavailable, becoming quite brittle. Once moisture becomes available, they fully hydrate to their former state.

Filaments from the fungal component of the lichen surround and grow into the algal cells and provide the majority of the lichen’s physical bulk and shape. Lichens vary tremendously in size, shape, and color. Some lichens are familiar, such as lace lichen that grows on many trees in the Northwest. Some are many meters in length while others are less than a millimeter tall. They can stand erect and look like little shrubs, drape gracefully from tree limbs, or lie flat, looking like little more than a black spot on a rock. And they transverse the color spectrum, from brilliant yellows, reds, and greens to barely noticeable grays and whites.

People have long used lichens in a number of ways. Horsehair lichens have been eaten by the native people of the Interior Northwest and are listed as a favorite food of the Interior Salish of the Okanagan-Colville language group. Fibrous lichens have been incorporated into clothing and many species of lichens are used throughout the world to make beautiful dyes. Others are used ornamentally. Lichens have been used as ingredients in personal



Lace lichen (*Ramalina menziesii*).

Photo by David Stephens, Bugwood.org

products such as perfumes and can be found today in many commercial products such as deodorants and toothpastes. Over the centuries, many cultures have used lichens as medicines and poisons. Lichens are known to be antibacterial, antifungal, and antiviral, and also show antioxidant and antitumor activity.

Contrary to what some people think, lichens do not injure trees. Forest habitats actually benefit greatly from lichens that inhabit trees. As rainfall and fog passes through forest canopies, resident lichens intercept and absorb nutrients that have been shown to have an influencing effect on the composition and concentration of nutrients in forest soils below. Lichens also increase humidity by absorbing moisture during precipitation events and releasing it afterwards.

One of the most important functions of lichens in forest environments is their ability to fix nitrogen. Atmospheric nitrogen cannot be used by plants for growth nor are useable forms of nitrogen abundant in native minerals or soils. *Nitrogen fixation* is the domain of a small group of bacteria and cyanobacteria that are able to convert atmospheric nitrogen into nitrates or ammonium compounds that are available to plants for growth. Nitrogen fixed by lichens becomes available to surrounding plants when the lichens die and decay, or when nitrogen compounds leach from living lichens.



Lichens with lichen-dyed fabrics.

Photo from the California Lichen Society, <http://california-lichens.org/2014/point-reyes-dye-lichens/>

In addition, lichens growing on rocks have been found to release chemicals that speed up the process of decomposition and the production of new soils. On the down side, these same lichens can cause damage to ancient, fragile rock carvings and paintings when colonizing their surfaces. This has created a tedious process of removal and maintenance for those responsible for preserving archeological and cultural treasures.

Lichens can harbor insects, though most of these are harmless. An exception to this rule is the western hemlock looper (*Lambdina fiscellaria*), which lays its eggs on mosses and lichens that are anchored on tree limbs and trunks. The last outbreak of western hemlock looper was in north-central Idaho in 2002-2003 and, though this insect does not cause widespread mortality, it does cause severe defoliation.

Lichens are high in carbohydrates and many animals, from mites to musk oxen, use them for food or shelter. For example, some birds and small mammals such as squirrels use lichens to build and line nests and many small mammals live in nicely camouflaged, lichen covered habitats. Lichens make up 90 percent of the winter diet of caribou and reindeer, and white-tail and mule deer, moose, elk, mountain goats, and pronghorn antelope all include lichens in their diets.

In recent years, a new use for lichens has emerged. As a group, lichens prefer unpolluted landscapes and are now being used as early warning systems to detect declining air quality and as indicators of ancient forests. To quote Irwin M. Brodo, one of the authors of *Lichens of North America*, "To find them in abundance is to find a corner of the universe where the environment is still pure and unspoiled."

This fascinating group of symbiotic organisms we call lichens are not only elegant and interesting, but important and useful to humans, plants, and animals



The five basic types of lichens can be used to assess air quality.

Download a free app from <http://www.apis.ac.uk/nitrogen-lichen-field-manual>

in so many ways. From food to fiber and dyes, promising medicines, nitrogen-fixers, and as early warning systems for ecosystem degradation, it is safe to say that there is much to like about lichens.

Authors note:

Portions of this article have been excerpted from *Lichens of North America* by Irwin M. Brodo, Sylvia Duran Sharnoff, and Stephen Sharnoff. 2001. Yale University Press. This is an informative and detailed book about lichens and includes over 900 fantastic colored photographs of lichens in their many and varied habitats.

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Lichens do not harm the trees they live on.

Photos from *Tree-Dwelling Lichens* by G.H. Daniels and N. Polanin, Rutgers Cooperative Extension, The State University of New Jersey, New Brunswick, NJ