

Lichens of Alaska's South Coast



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WHAT IS A LICHEN?

Lichens are specialized fungi that “farm” algae as a food source. Unlike molds, mildews, and mushrooms that parasitize or scavenge food from other organisms, the fungus of a lichen cultivates tiny algae and / or blue-green bacteria (called cyanobacteria) within the fabric of interwoven fungal threads that form the body of the lichen (or **thallus**). The algae and cyanobacteria produce food for themselves and for the fungus by converting carbon dioxide and water into sugars using the sun’s energy (photosynthesis). Thus, a lichen is a combination of two or sometimes three organisms living together.

Perhaps the most important contribution of the fungus is to provide a protective habitat for the algae or cyanobacteria. The green or blue-green photosynthetic layer is often visible between two white fungal layers if a piece of lichen **thallus** is torn off. Most lichen-forming fungi cannot exist without the photosynthetic partner because they have become dependent on them for survival. But in all cases, a fungus looks quite different in the lichenized form compared to its free-living form.

HOW DO LICHENS REPRODUCE?

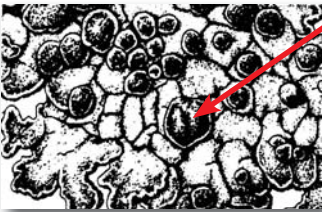


Figure 1. *Apothecia*, fruiting bodies

Lichens sexually reproduce with fruiting bodies of various shapes and colors that can often look like miniature mushrooms. These are called **apothecia** (Fig. 1) and contain spores that germinate and grow into the fungus. Each fungus must find the right photosynthetic partner in order to become a lichen.



Figure 2. *Soralia*, small openings on *thallus* surface.

Lichens reproduce asexually in several ways. Some lichens have openings on the **thallus** surface called **soralia** (Fig. 2). Inside, tiny dust-like granules called **soredia** (Fig. 3) are produced. **Soredia** contain algae and fungal cells that escape from the parent lichen and grow into a new lichen **thallus**. Other lichens produce outgrowths that break off and grow into the same lichen they came from. These are called **isidia** (tiny, cylindrical



Figure 3. *Soredia*, dust-like granules.

projections, Fig. 4) or **lobules** (little flaps of tissue, Fig. 5). These structures are often very important to notice for the proper identification of lichens.

DIVERSITY AND ECOLOGY

Lichens come in many shapes, sizes, and colors. A lichen *thallus* has one of three general growth forms: foliose, fruticose, or crustose. Foliose lichens are leaf-like with different upper and lower surfaces. Fruticose lichens are hair-like or bushy with no obvious difference between upper and lower surfaces. Crustose lichens are so closely attached to a surface, like paint spots, that the lower surface is not easily observable.

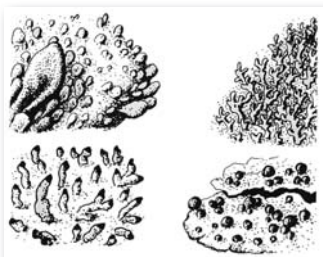


Figure 4. *Isidia*, tiny projections.

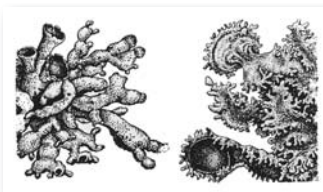


Figure 5. *Lobules*, flaps of tissue.

Lichens have specialized features enabling them to survive long periods of drought. In a dehydrated, inactive state they can resist extreme high and low temperatures and still function optimally whenever conditions become just right. Well adapted for life in marginal habitats, lichens produce more than 500 unique biochemical compounds that serve to control light exposure, repel herbivores and microbes, and discourage competition from plants. Among these are many pigments and antibiotics that are useful to humans.

Lichens are considered to be nature's pioneers because they colonize newly exposed surfaces. Lichens containing cyanobacteria fix their own nitrogen from the air into a form usable by other plants as a form of fertilizer. This form of nitrogen is released into the environment as rain washes over the lichens or when lichens die and fall to the ground. These lichen types tend to live in nitrogen-poor habitats such as bare rock surfaces, the forest canopy, or on sandy soils.

Lichens provide food for many animals including flying squirrels, black-tailed deer, and mountain goats. Many invertebrates use lichens for food or for shelter.

The diverse ecosystems along the south coast of Alaska provide abundant habitats for the more than 1,000 different lichens known to occur here. Some are very rare and cryptic. Many lichens are generalists and can grow in more than one

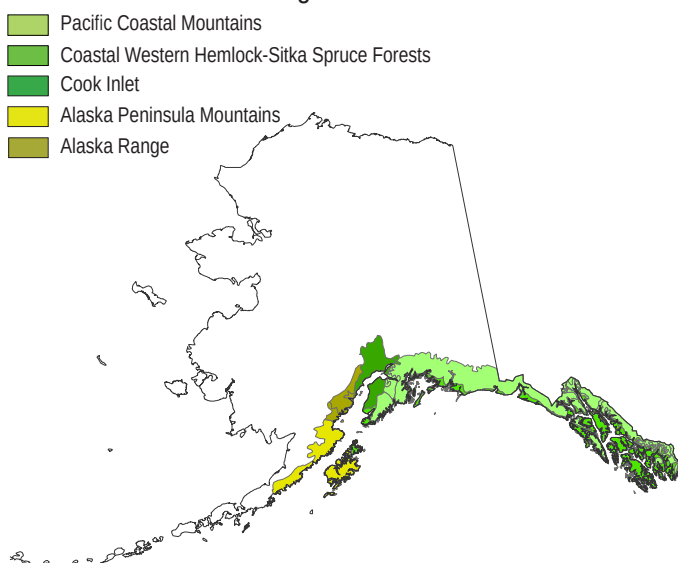
habitat. Some lichens only grow in specific habitats such as upper tidal rocks, conifer forests, alpine, or sandy soils near glaciers.

LICHENS AND AIR QUALITY MONITORING

Lichens are not protected by bark, nor do they possess an external waxy layer to prevent water loss like plant leaves. Lacking roots and other structures to transport food and water, lichens absorb moisture into the *thallus* directly from the humid air or rainfall, and can become quickly saturated like a sponge. Lichens dry out by losing moisture through evaporation when windy or dry conditions exist. As drying occurs, elements and compounds that entered with moisture from the surrounding environment become concentrated in the lichen. During high rainfall periods, mobile nutrients and pollutants are slowly leached from the lichen. In this way lichens serve as dynamically representative samples of the environmental conditions in which they are growing. Lichen species differ in their tolerance to air pollutants, with responses ranging from relatively resistant to highly sensitive. Measurements of metals, nitrogen, and sulfur content in lichens at different locations indicate the relative amounts of pollution in the air. Noted in this brochure are the lichens used for determining and monitoring air quality on some federally-managed land along the south coast of Alaska.

The lichens featured in this brochure are arranged by the three general growth forms described above: foliose, fruticose, and crustose.

Alaska's South Coast Ecoregions



Source: Nowacki, G., P. Spencer, M. Fleming, T. Brock, and T. Jorgenson. 2002
Unified Ecoregions of Alaska: 2001. USGS Open File Report 02-297

Foliose

Beaded Tube lichen

Hypogymnia apinnata

Thallus made up of tube-like lobes, constricted at intervals, usually has a hole at the tip of each lobe; white upper surface and black underneath. *Apothecia* raised and brown. Occurs in forests of all types (conifers and hardwoods), but not in deep shade. Used in air quality monitoring. Thirteen species of *Hypogymnia* occur in this region.



Gray lungwort

Lobaria halli

Large leaf-like *thallus*, light gray when dry, dark gray when wet. *Soralia* brown to gray and sometimes ring-like on upper surface. Contains cyanobacteria. Found in Sitka spruce and hardwood forests, but more common on sites with cottonwood, birch, and alder. Nine species of *Lobaria* occur in this region.



Cabbage lungwort

Lobaria linita

Large leaf-like *thallus*, green or brownish-green when dry, bright grass-green when wet. Often with abundant, orange *apothecia* on upper surface. Contains cyanobacteria. Used as winter forage by mountain goats. It grows in shady coniferous forests on the lower part of tree trunks.



Foliose

Lettuce lichen

Lobaria oregana

Large leaf-like *thallus*; pale yellowish-green on top, white and tan on the bottom. Lobe margins decorated with tiny, flat *lobules*. Contains cyanobacteria. Occurs in the canopy of old-growth forests and along natural forest edges. Used in air quality monitoring.



Lungwort

Lobaria pulmonaria

Large leaf-like *thallus*; pale brown to olive-brown when dry, bright green when wet. Strongly pitted upper surface with *soralia* on lobe margins. Contains cyanobacteria. Occurs in riparian Sitka spruce forests, hardwood forests, and maritime beach forests.



Arctic Kidney lichen

Nephroma arcticum

Large *thallus*; yellowish-green when dry, bright green when wet. Broad, flat, gray bumps on surface that contain cyanobacteria. Lower surface pale tan at the edge. Large orange-brown *apothecia*. In coniferous forests and occasionally on the forest floor or old logs. At least nine species of *Nephroma* occur in this region.



Foliose

Pimpled kidney lichen

Nephroma resupinatum

Medium-sized *thallus*; upper surface brown to grayish-brown, lobe tips with woolly appearance. Lower surface pale, fuzzy with scattered whitish bumps. Contains cyanobacteria. Grows in humid forests on hardwoods and conifers.



Salted shield lichen

Parmelia saxatilis

Small *thallus* of tiny flattened lobes; 2–4 mm wide, pale green to gray. Upper surface with small net-like ridges and *isidia*, underside with black rhizines (small stiff hairs). *Apothecia* brown, but not always present. In many habitats including coniferous and hardwood forests, rocks and logs in upper tidal zones and alpine areas. Seven species of *Parmelia* occur in this region.



Flaky freckle pelt

Peltigera britannica

Large *thallus*; brownish-green when dry, grass green when wet. Underside has raised veins with tiny rhizines. Lobes have small granules that rub off easily and contain cyanobacteria. In humid forests on tree trunks, branches, and mossy soil. Over twenty species of *Peltigera* occur in this region.



Foliose

Tree pelt lichen

Peltigera collina

Medium-sized *thallus*; gray to dark brown. Upper surface smooth with bluish-gray *soredia* usually covering lobe margins; lower surface pale with small raised veins and tufted rhizines. *Apothecia* are reddish brown when present. Contains cyanobacteria. In humid forests on conifers and hardwoods.



Photo by Linda Geiser

Varied rag lichen

Platismatia glauca

Medium-sized *thallus*; pale greenish-gray, often brown at the edges. Lobe margins very frilly with *soredia* and *isidia*. Lower surface shiny and brown with white patches. In the canopy of coniferous forests and on hardwoods. Used in air quality monitoring. Four species of *Platismatia* occur in this region.



Crinkled rag lichen

Platismatia lacunosa

Medium-sized *thallus*; pale green to almost white. Upper surface deeply pitted and ridged with a dark grey color in the pitted areas. *Apothecia* are brown but not always present. In coniferous forest canopy and on hardwoods.



Foliose

Dimpled specklebelly lichen

Pseudocyphellaria anomala

Medium to large *thallus*; chocolate to reddish-brown. Upper surface with a network of ridges and dimples; ridges set off by white and gray *soredia*. Lower surface with conspicuous raised, white dots. In humid forests on conifers and hardwoods. Five species of *Pseudocyphellaria* occur in this region.



Orange chocolate chip lichen

Solarina crocea

Medium-sized *thallus*; olive-brown to olive-gray on upper surface, lower surface bright orange with veins and scattered rhizines. *Apothecia* are brown and sunk into upper surface. Contains cyanobacteria. On soils in moist areas under late snow patches or seepage areas in cold, open habitats. Four species of *Solarina* occur in this region.



Rock tripe

Umbilicaria spp.

Thallus small, flat, and wrinkled, circular in shape; brownish-gray and brittle when dry, greenish-black and rubbery when wet. Attached from a single point of the *thallus* to the rock. On rock in open, cold habitats. At least fifteen species of *Umbilicaria* occur in this region.



Fruticose

Witch's hair

Alectoria sarmentosa

Thallus long, hanging loosely, often twisted and somewhat flattened strands; pale greenish with small, raised white ridges on surface. Occasional brown *apothecia*. On conifers and hardwoods in all forest types, from sea level to alpine. Important winter food for blacktailed deer. Used in air quality monitoring. Three species of *Alectoria* occur in this region.



Gray horsehair lichen

Bryoria capillaris

Thallus long; pale gray to dark smoky brown, hanging in clumps, with slender strands containing long narrow slits on the surface. In old-growth forest habitats and forested peatlands on conifers and hardwoods. Important genus for wildlife forage and nesting material. At least fifteen species of *Bryoria* occur in this region.



Toy soldiers

Cladonia bellidiflora

Small *thallus* made up of pale, yellow-green and frilly lobes. Contains small, erect, branch-like stems ending in cup-shaped tips rimmed with bright red *apothecia*. On rotting stumps and logs, bare soil, and among mosses in the open and in all forested habitats. Over 60 species of *Cladonia* occur in this region.



Fruticose

Smooth cladonia

Cladonia gracilis

Small *thallus* of green frilly lobes containing variable sized, erect, branch-like stems. The smooth, pointed stems do not contain *soredia* and are greenish to olive, becoming browned in exposed habitats. On ground and rocks in exposed habitats.



Gray reindeer lichen

Cladonia rangiferina

Thallus branching or tree-like form; white to silver gray, somewhat browned tips of branches. Main stems and side branches commonly occur in twos and threes, sometimes fours. On the ground in open, humid habitats like muskegs, growing among mosses and other lichens. Principle winter food for caribou in North America.



Photo by Linda Geiser

Devil's matchstick

Pilophorus acicularis

Small *thallus*; pale gray-green and granular. Erect stalks protrude from *thallus* and end with shiny, black spherical *apothecia*. Contains cyanobacteria. On rock surfaces in open habitats at all elevations. Five species of *Pilophorus* occur in this region.



Photo by Rick Turner

Fruticose

Dotted Ramalina

Ramalina farinacea

Thallus short and bushy; pale yellow to yellowish-green branches, narrow and flat with rounded *soralia* containing powdery *soredia* along branch margins. On conifers, hardwoods, and shrubs in humid forests. Sometimes on rocks in sheltered humid areas. At least eight species of *Ramalina* occur in this region.



Waterfingers

Siphula ceratites

Thallus made up of white, dented stalks, mostly unbranched, in dense clumps. On soil or mud in sun-exposed seeps in muskegs and alpine areas. Sometimes submerged in water. This is the only species of *Siphula* occurring in North America.



Photo by Rick Turner

Coral lichen

Sphaerophorus venerabilis

Thallus forming erect tufts up to 10 cm diameter; variable in color from cream in shady habitats to copper-brown in exposed habitats. Main stem with shallow surface depressions and very few branchlets. Stems often ending with globe-like *apothecia* that are slit open to reveal sooty black spores. In forested habitats on bark and wood. Four species of *Sphaerophorus* occur in this region.



Fruticose

Foam lichen

Stereocaulon spp.

Thallus medium-sized; pale gray to white branch-like stalks with tiny, frilly *lobules* and pink or brown wart-like structures that contain cyanobacteria. Stalks of some species may be tipped with black or brown *apothecia*. On soil and rocks in open habitats. Important pioneer species in disturbed areas. Over twenty-eight species of *Stereocaulon* occur in this region.



Tundra spaghetti

Thamnolia subuliformis

Thallus occasionally forming upright, white to creamy, stringy turfs but usually prostrate or sprawling. *Thallus* strings are roundish in cross section with tapering ends and have simple branching. On soil and rock crevices in sub-alpine to alpine areas. Two species of *Thamnolia* occur in this region.



Methusula's beard

Usnea longissima

Thallus often long (up to 2 m or more); pale greenish. Hanging freely, with one long main branch and many short, perpendicular side branches, all cylindrical. Surface often with circular cracks and white patches. On conifers and hardwoods in humid and open forest habitats within a few miles of salt water. Sensitive to air pollution, especially sulfur dioxide and acid rain. At least fifteen species of *Usnea* occur in this region.



Crustose

Bull's eye lichen

Placopsis ssp.

Thallus pinkish-white to yellowish-brown, often turning pale green at the edges when wet; large brown spots containing the cyanobacteria are almost always present near the center of the round *thallus*. Scattered *apothecia* are pink to brown disks with a white rim. On rock in open areas. Often a primary invader of newly exposed rock surfaces like roadsides and glacial areas. Three species of *Placopsis* occur in this region.



Fairy barf

Icmadophila ericetorum

Thallus pale to grey-green with pink to brown *apothecia*. On old stumps and logs in shady habitats. This is the only species of *Icmadophila* occurring in North America.



Photo by Rick Turner

Orange boulder lichen

Porpidia flavocaerulescens

Thallus bright orange, sometimes with gray patches, and without *soredia*. *Apothecia* black or greyish. On exposed rocks in splash zone of marine beaches to alpine. Many species of *Porpidia* occur in this region.



Crustose

Yellow map lichen

Rhizocarpon geographicum

Thallus of yellow bumps with black *apothecia* tucked between the bumps. On rock surfaces in open, cold alpine habitats and near glaciers. Used in estimating the ages of recent geomorphic exposures, particularly glacial moraines. At least eleven species of *Rhizocarpon* occur in this region.



Exposed rocks are good habitats to look for colorful crustose lichen displays (shown are in the genera *Porpidia*, *Ochrolechia* and several others).

Further readings about lichens: Macrolichens of the Pacific Northwest, Second Edition, 2009, by Bruce McCune and Linda Geiser; Lichens of North America, 2001 by Irwin Brodo, Silvia Duran Sharnoff, and Stephen Sharnoff; Lichens of British Columbia, Illustrated Keys, Part 1 and 2. 1994 and 1999, by Trevor Goward; American Arctic Lichens 1. The macrolichens, 1984, 2. The microlichens 1997, by John W. Thomson.

This brochure highlights 31 of the more than 1,000 lichens found across the south coast of Alaska (from Kodiak Island to Ketchikan). This region includes the Tongass and Chugach national forests, the Glacier Bay, Lake Clark, Katmai, and Wrangell-St. Elias national parks and preserves, the Klondike Gold Rush and Sitka national historical parks, Kenai Fjords National Park, and the US Fish and Wildlife Service Kodiak, Kenai, and Maritime national wildlife refuges.

This brochure was prepared by the botany program of the Forest Service, Alaska Region. Photographs are by Karen L. Dillman unless otherwise noted. Drawings are by Alexander Mikulin.

The Forest Service maintains a website on air quality and lichens for the Pacific Northwest region that includes Alaska at <http://www.fs.fed.us/r6/aq/lichen/welcome.htm>.

Lichens are used in air quality monitoring in Alaska.

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