



Lichens of the National Forests in Alaska



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What is a Lichen?

You can think of lichens as fungi that have discovered farming. Instead of parasitizing or scavenging other organisms for a living (such as molds, mildews, mushrooms), lichen fungi cultivate tiny algae and/or blue-green bacteria (called cyanobacteria) within the fabric of interwoven fungal threads that form the lichen body (or **thallus**). The algae and cyanobacteria produce food for the fungus by converting the sun's energy into sugars through photosynthesis. Perhaps the most important contribution of the fungus is to provide a protective habitat for the algae or cyanobacteria. Thus, lichens are a combination of two or three organisms that live together intimately. The green or blue-green photosynthetic layer is often visible between two white fungal layers if a piece of lichen thallus is torn off.

In some cases, the fungus and the photosynthetic partner that together make the lichen may be found living separately in nature. However, many lichen-forming fungi cannot exist by themselves because they have become dependent on their photosynthetic partners 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?

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

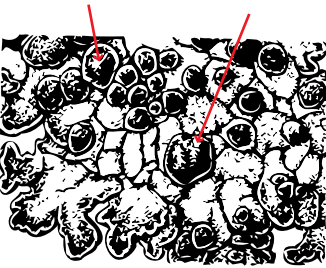


Figure 1. Apothecia, fruiting bodies.

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



Figure 2. Soralia, small openings on thallus surface.

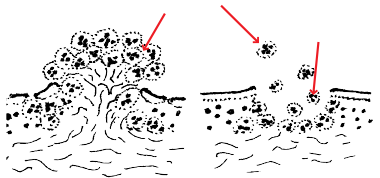


Figure 3. Soredia, dust-like granules.

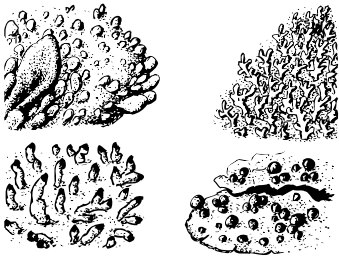


Figure 4. *Isidia*, tiny projections.

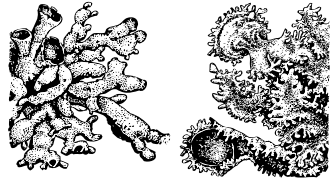


Figure 5. *Lobules*, flaps of tissue.

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 projections, Fig. 4) or ***lobules*** (little flaps of tissue, Fig. 5). These structures are often very important 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.

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.

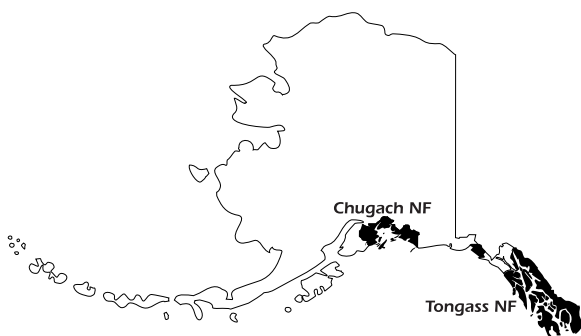
Lichens are considered to be nature's pioneers because they colonize newly exposed surfaces. Lichens containing cyanobacteria fix their own nitrogen from the air into a form usable by other plants. This form of nitrogen is released into the environment as rain washes the lichens or when lichens die and 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 national forests in Alaska contain a myriad of habitats where more than 500 species of lichens thrive. A few lichens are generalists and can be found across many different habitats, while most are very habitat specific.

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 continually 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 leached from a 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. The Forest Service uses lichens to monitor air quality on both national forests in the Alaska Region, primarily in wilderness areas. Lichens used for air quality monitoring in the Alaska Region are noted in this brochure.



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

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 the Alaska 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 the Alaska 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 lower 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 forest edges. Also grows on hardwood trees. 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. Nine species of *Nephroma* occur in the Alaska Region.

Foliose

Pimpled kidney lichen

Nephroma resupinatum

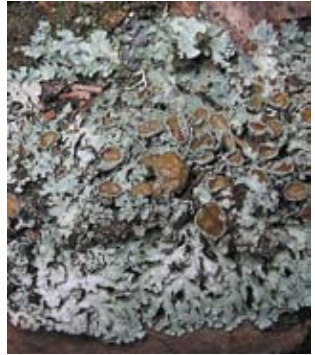
Medium-sized thallus; upper surface brown to grayish brown, lobe tips with woolly appearance. Lower surface pale, fuzzy with scattered whitish bumps. Contains cyanobacteria. In humid forests on hardwoods and conifers.



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. In exposed and shaded habitats including coniferous and hardwood forests, and on rocks in upper tidal and alpine areas. Seven species of *Parmelia* occur in the Alaska 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. Twenty-two species of *Peltigera* occur in the Alaska 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. Contains cyanobacteria. In humid forests on conifers and hardwoods.



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 the Alaska Region.



Crinkled rag lichen

Platismatia lacunosa

Medium-sized thallus; pale green to almost white. Upper surface deeply pitted and ridged. 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 the Alaska 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 the Alaska 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. Fifteen species of *Umbilicaria* occur in the Alaska 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 black-tailed deer. Used in air quality monitoring. Three species of *Alectoria* occur in the Alaska 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. Fifteen species of *Bryoria* occur in the Alaska Region.



British 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 the Alaska 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 among mosses and other lichens. Principal winter food for caribou in North America.



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 the Alaska Region.



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. Eight species of *Ramalina* occur in the Alaska Region.



Waterfingers

Siphula ceratites

Thallus made up of white, dented stalks, mostly unbranched, in dense clumps. On soil or mud in sun-exposed seeps. Sometimes submerged in water. One species of *Siphula* occurs in the Alaska Region.



Coral lichen

Sphaerophorus globosus

Thallus short and shrubby, variable in form and color from pale, greenish-white in shady sites to copper-brown in exposed habitats. Branchlets often ending with spherical apothecia that are slit open and have sooty-black spores. In all forested habitats on conifers and hardwoods and in alpine areas on rocks and soil. Two species of *Sphaerophorus* occur in the Alaska 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. Twenty-eight species of *Stereocaulon* occur in the Alaska Region.



Tundra spaghetti

Thamnolia spp.

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 in sub-alpine to alpine areas. Two species of *Thamnolia* occur in the Alaska Region.



Methuselah'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. Very sensitive to air pollution, especially sulfur dioxide and acid rain. Fourteen species of *Usnea* occur in the Alaska Region.



Crustose



Fairy barf

Icmadophila ericetorum

Thallus pale to grey-green with pink to brown apothecia. On old stumps and logs in shady habitats. One species of *Icmadophila* occurs in the Alaska Region.



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. Eleven species of *Rhizocarpon* occur in the Alaska Region.



Bull's-eye lichen

Placopsis sp.

Thallus pinkish white to pinkish to yellowish brown, often turning greenish when wet at the edges; large brownish 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 most rock types in open areas. Often a primary invader of newly exposed rock surfaces. Three species of *Placopsis* occur in the Alaska Region.



Nitrogen-tolerant lichens on rocks frequented by birds and mammals.



Lichens used in air quality monitoring in the Alaska Region.

Lichens of the National Forests in Alaska highlights 30 of the more conspicuous lichens found in the Alaska Region of the USDA Forest Service. This Region includes the Tongass National Forest; the nation's largest at 17 million acres, and the 5-million acre Chugach National Forest. The Tongass encompasses most of southeastern Alaska, and the Chugach roughly surrounds Prince William Sound.

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The USDA Forest Service maintains a website on air quality for the Pacific Northwest region that includes the Alaska region (<http://www.nacse.org/lichenair>) which includes more information on lichens.

Cover photograph: Methuselah's beard lichen (described inside) and devil's club growing at the edge of a maritime beach forest on the Tongass National Forest.

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