

LICHENS AND OAKS: A DEEP PARTNERSHIP

By Stephen Sharnoff
Photographs by Stephen and Sylvia Sharnoff



In winter, and especially when things are damp, lichens almost seem to glow with internal light. These oaks are in the Carmel Valley. *Monterey County*



In this part of the Carmel Valley, deer have gotten used to eating lichens, and they've created a visible browse line on the small oak trees; the only lichens left are the ones too high to reach. *Monterey County*



Several species of Beard lichens in the genus *Usnea*, some of them shrubby and others pendant, grow on these branches. *Usnea* lichens are among the most common inhabitants of oak tree branches throughout California.

Have you ever wondered what all that "stuff" was on the trees and rocks? Without a name or a concept, it just seems to be part of the texture of things. Learning to recognize lichen as distinct life forms, and being able to distinguish one from the other, will enlarge your understanding of the complexity of a rock surface or the texture of an oak tree.

Looking at oaks, especially on a damp day, you might see delicate patches of green, gray, or even bright orange on the trunks and branches, or you might see pale green strands hanging down from the twigs. If you look closely, you might also see tiny round dots in a variety of colors. Most often these will be some kind of lichen, one of the most decorative, but poorly understood, elements in the landscape.

California has a diversity of habitats, and oak trees are a big part of many of them. Everywhere that oaks live, a varied community of lichens grows on them, from the moist coastal forests of the northwest to the dry southern mountains. On a recent visit to the Los Osos Oaks Reserve in San Luis Obispo County, a forest of ancient live oaks, the abundance and diversity of lichens covering the trunks and branches was striking. Even though there are some pioneer species, lichens are mostly associated with old-growth forests, and relatively undisturbed ecosystems. They are a big part of why old forests *feel* old.

Lichens are also indicators of clean air, since many species are intolerant of air pollution. Because of this, most cities are often lacking in lichens. Only a few species can put up with the car exhaust, power plant emissions, and other noxious chemicals. The exactness of different species' response to pollutants allows scientists to use lichens as monitors, and to map patterns of air quality with precision.

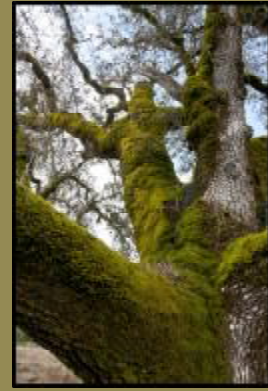
Oaks and lichens have a mutually supportive relationship. The trees give lichens a place to grow, and the lichens provide a number of services in return. Only some species of lichens find oaks to be a proper substrate, and they can be particular as to just which part of the tree is suitable. The degree of acidity of the bark is a big factor; most lichen species have definite preferences for a pH within a certain range. The degree of moisture, and the amount and timing of sunlight or shade, also influence whether lichens will grow on the tree, or on which side of it, or whether they grow on the trunk or only on the upper branches. The roughness or smoothness of the surface is an important factor too; some lichens prefer the convoluted terrain of an older trunk, while others will only grow on the smooth bark of young trees or on the outer branches.

Lichens don't harm the trees. If anything they help a tree ward off fungal infections and invasive insects. They encourage the presence of animals by offering food, or material they can use for camouflage or nest building. Often a tree that is dying or dead will have an especially conspicuous covering of lichens. This is because the lichens respond to the higher levels of light on a tree without leaves. As a tree dies, the lichen species mix on it will change, and hard, bare, dead wood will often be colonized by lichens that otherwise might grow on rock.

Just as oak trees are part of an incredibly complex web of ecological relationships, so the lichens that live on them contain multiple layers of partnership within themselves. The traditional concept of lichens is that of a fungus, usually an ascomycete cup fungus, that incorporates a layer of algae within; the algae is photosynthetic, producing carbohydrates that the fungus can absorb. As one scientist has put it, "Lichens are fungi that have discovered agriculture." The fungus and algae together form a distinctive and unique structure, a lichen "thallus" that doesn't resemble either component alone. It is an ancient symbiosis, perhaps more parasitic than mutualistic. The name of a lichen refers only to the fungal component, and fungi that are "lichenized" are never found free-living in nature. Thus, it is an obligate symbiosis.

As with many older concepts in biology, the real situation is more complicated than Freddie fungus marrying Alice algae. Instead of a colony of algae inside, some lichens have cyanobacteria. These used to be called "blue-green algae" and, like true algae, they are photosynthetic. It is thought that in the early stages of the earth's evolution, cyanobacteria were the primary organisms responsible for increasing the oxygen level in the atmosphere to approximately its present level. Some lichen species have both green algae and cyanobacteria inside, and recent work indicates that lichens also contain complex communities of fungi, different species from the one forming the primary partnership, as well as diverse forms of bacteria. These tiny organisms play roles in the life of a lichen that are not yet understood.

When dry, lichens are fairly dormant. When moist, the uppermost layer of fungal cells becomes translucent, letting light through to the layer of algae. Then the algae becomes metabolically active, and its cells perform the amazing photosynthetic trick of turning sunlight, water and carbon dioxide into carbohydrates. Many lichens become greener and brighter when wet, and easier to see clearly.



This oak in Sonoma County has a luxuriant growth of moss, but no lichens are visible. People often confuse the two life forms, but moss is really a plant, whereas lichens, being primarily fungi, are thought to be more closely related to animals than to plants. Moss and lichens often share the same habitat, however, growing over one another in a competition for space. In moist, shady locations, trees or stones sometimes acquire a thin, bright green coating without any apparent structure; this is likely to be free-living green algae.



The upper lichen, with orange-brown fruiting bodies, is *Pseudocyphellaria anthraspis*, and the lower one, with whitish lines of "soredia", a kind of vegetative propagule, is *Pseudocyphellaria anomala*. These are considered to be a "species pair", very similar in structure, but one of them fertile, i.e., producing fungal spores, and the other not. They are often found next to each other in moist forests, often on mossy branches or the trunks of oaks, or bigleaf maples. *Klamath Range, Oregon*



The round disks in the middle are the fruiting bodies of *Lecanora pacifica*, a crustose lichen, growing on an oak branch along with at least four other lichen species. The deep colors indicate that all of these lichens are fairly wet. *Contra Costa County*

Flavoparmelia caperata is one of the most common species on oaks, perhaps the most common, or at least the most conspicuous, foliose lichen species in California. It often grows on fences, especially Japanese style ones with boards at a 45° angle on top, or on sloping shingle roofs.



Somewhat less common, *Flavopunctelia flaventior* often grows alongside *Flavoparmelia caperata*. *F. flaventior* is a slightly darker and more bluish shade of green, and it has white spots on the surface.



Another lichen named for oak trees is *Pyrrhospora quemea*, the greenish one in the middle with black fruiting bodies. The pale gray disks around it belong to a species of *Lecanora*, possibly *Lecanora caesiurubella*, a common inhabitant of oak bark. From the Channel Islands.



There are several species of lichens that have such a strong association with oaks that it's reflected in the scientific name. This lichen is currently called *Parmelina coleae*, after the co-author of the first guidebook to California lichens, but its earlier name was *Parmelina quercina*. The photo shows the lichen as it looks when damp. From the central Coast Range.



This is *Evernia prunastri*, Oakmoss lichen, sometimes also called Antler lichen, or Staghorn lichen. It is quite common on oaks in California, also growing frequently on shrubs in somewhat dry habitats. In France, it is used commercially as an additive to fine perfume; it helps to "fix" the scent and it also adds an herbal fragrance of its own.



Sierra Nevada foothills

There are around 1,500 species of lichens in California. Some, called "fruticose" are shrubby, either erect or pendant. Others are "foliose", with more-or-less rounded lobes. Still others, the "crustose" lichens, form thin patches on the surface of rock or bark that cannot be easily removed. Certain other kinds are referred to as "squamulose"; these form masses of tiny, overlapping lobes, and some kinds of squamulose lichens, in the genus *Cladonia*, send up stalks like tiny golf tees or miniature trees. Many lichens are dotted with round disks on the surface, often with distinctive rims. These are "apothecia", fruiting bodies of the lichen, and they produce fungal spores. Other species have powdery or granular patches on the surface or edges that release vegetative propagules; these can blow away in the wind, wash off with rain, or become attached to the feet of animals and spread to new areas.

Lichens live on sunlight, air and water, so they don't need soil, but most species are very slow growing and they require a stable surface, such as oak bark, or rock to grow on. Redwood trees, for example, don't have many lichens on the lower trunk because the bark is too shaggy, and Eucalyptus peels too much. Many species have tiny hair-like holdfasts that they use to grab onto the substrate. Lichens can easily get enough moisture from fog and are spectacularly abundant in foggy locations along the coast. Since they aren't dependent on their substrate for nutrients, lichens can grow on just about anything that's stable. They've been seen flourishing on old paint, rusty metal, bone, glass, plastic, old shoes, and the fabric on the tops of cars that have been parked in the same spot for years. Some grow on moss or other lichens, on leaves or conifer needles, even on living insects.

There are often inquiries about cultivating lichens. Typically, someone has put "moss rock" in their yard on stones that have lichens (and sometimes moss) on them. They like the texture this adds to their landscaping, but they're concerned about keeping the lichens alive. Alas, there's no reliable way anyone has found to keep lichens going once they've been relocated. What typically will occur, assuming the new location has clean enough air, is that some of the lichens will die out, but others will take their place, so the species mix will change over time. We can't tame lichens; as Irwin Brodo has said, in *Lichens of North America*¹, "...lichens are the essence of wildness."

¹ Brodo, Sharnoff and Sharnoff, Yale University Press, 2001

In many parts of the state, mule deer have become accustomed to eating lichens, sometimes rearing up on their hind legs to reach them. Lichens are low in protein, but fairly high in carbohydrate, and can be an important food, especially in winter when other food is scarce. Lichens are also collected by birds and used to camouflage their nests; the birds seem to be good taxonomists and collect only certain species. Lichens were also used by Native Americans as a source of dye for clothing and baskets, for medicines, and one species, at least, was used as a poison.

On your next walk in a place that has some wildness to it, California Oaks urges you to notice the variety of textures around you, and the fine details at their heart. It helps to come equipped with a loupe, or "hand lens" to look at the details of lichens; about 10x is good.

Observing and appreciating lichens can be a door into a world – not another world – but our own.

"...lichens are the essence of wildness"

A quote by Irwin Brodo in *Lichens of North America*



Stephen Sharnoff is a photographer and occasional author. He and his late wife Sylvia did the photographic work for *Lichens of North America*.¹ His photographs of lichens and other subjects have appeared in numerous other books, magazines and exhibits. He is currently working on a field guide to California lichens and on a guide to Sierra Nevada wildflowers with botanist Joanna Clines. He is the author of *Restless Peace; Images from the Cemeteries of Paris* (published through amazon.com) and is a Research Associate at the Missouri Botanical Garden and the University and Jepson Herbaria, University of California, Berkeley. He is a lifelong resident of Berkeley; a selection of his photographic work may be seen online at <http://www.sharnoffphotos.com/index.html>.



Tiny stalks of *Cladonia macilenta* are often found on the mossy base of trees, or sometimes on rotting logs and stumps.



The orange lichen is *Teloschistes exilis*, a fairly uncommon species. The shubby green one is a species of *Usnea*, and the pale gray foliose one is a species of *Parmotrema*. From an oak tree in western Sonoma County.



Ramalina menziesii Close-up / Seen close up, lace lichen shows off its structure of nets, the only species in North America to form these patterns. The round disks are fruiting bodies of the lichen. *San Luis Obispo*



Long strands of Lace lichen, *Ramalina menziesii*, hang from an oak over a stream in Oregon's Willamette Valley. This lichen often prefers riparian habitats, where the air is more moist than on open hillsides.



Many species of birds camouflage their nests with lichens. This is an **Anna's hummingbird** family, at home in a *Pittosporum* in Berkeley.



Even though it's just a mass of tiny granules, with no visible structural features, the brilliant chartreuse color of ***Chrysothrix granulosa*** makes it stand out. This lichen also sometimes grows on fences.
Central Coast Range

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