PROJECT NATURE NEWSLETTER

PROJECT NATURE

FEBRUARY, 2020 ISSUE

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Events

Lichen You Very Moss
Blacklick Woods Metro Park - Nature Center
15th February 2:00 pm - 3:00 pm
Take a 1.5-mile hike to look for winter mosses and lichens

Weekly Bird Hike
Scioto Audobon Metro Park - Grange Insurance Audobon Center
15th, 22nd, 29th February 10:00 am - 11:30 am
Hike with experienced birders to find and learn about birds (Binoculars and field guides can be provided)

Project FeederWatch
Blendon Woods Metro Park - Nature Center
15th & 16th February 10:00 am - 2:00 pm
Help collect data for this important citizen science project that tracks trends in winter bird distribution and abundance. No Experience necessary!

Ironwood Wolves
Battelle Darby Metro Park - Nature Center
15th February 2:00 pm - 3:00 pm
Ironwood Wolves talk about the relationship between two mighty North American mammals the wolf and the bison. There will also be an opportunity to meet one of their ambassadors.

Great Backyard Bird Count
Sharon Woods Metro Park - Spring Hollow
15th February 10:00 am - 1:00 pm
Stop by and add birds to our list in this nationwide citizen science effort

Common Winter Birds
Inniswood Metro Gardens - Innis House
15th February 10:00 am - 11:00 am
Learn about birds on a guided walk and enjoy warm drinks after. Binoculars available

47th Annual Winter Hike Series
Three Creeks Metro Park - Confluence Area
15th February 10:00 am - 1:00 pm
Take a 1-, 3- or 5.6-mile hike along the creeks, followed by hot drinks and food

Winter Tree ID
Blendon Ravines - 5280 Cambria Way
16th February 2:00 pm - 3:00 pm
Explore this mature forest and learn how to ID trees by the bark and their uses. Park along the street.

Night at the Nature Center
Battelle Darby Metro Park - Nature Center
16th February 6:00 pm - 8:00 pm
See what animals awaken after dark in the 53-foot living stream

Signs of Spring
Battelle Darby Metro Park - Cedar Ridge
16th February 1:00 pm - 2:00 pm
Walk and watch for early signs of spring

Birds of Prey
Highbanks Metro Park - Nature Center
16th February 2:00 pm - 3:00 pm
Meet owls and hawks from Ohio Wildlife Center. Learn about their amazing adaptations for survival.

Stump the Naturalist
Battelle Darby Metro Park - Nature Center
16th February 2:00 pm - 4:00 pm
Learn about some weird things that have stumped our naturalist and check them out under the microscope. If you have something that you found but can't identify, bring it along!

Events

47th Annual Winter Hike Series
Slate Run Metro Park - Buzzards Roost Picnic Area
16th February 2:00 pm - 4:00 pm
Take a 2.5- or 5-mile hike through woods and fields

Meet the Critters Display
Blacklick Woods Metro Park - Nature Center
22nd & 23rd February 8:00 am - 6:00 pm
Many animals call Blacklick Woods Nature Center home. Meet Rocket the ratsnake, Splinter the box turtle and more. Learn how they came here and how their species behave in the wild.

Coffee, Cocoa & Birds
Blendon Woods Metro Park - Nature Center
22nd & 23rd February 10:00 am - 2:00 pm
Drop by and enjoy a steaming cup while watching birds at the viewing window

You Can Eat That!
Blacklick Woods Metro Park - Nature Center
23rd February 2:00 pm - 3:00 pm
Take a 1-mile walk to find wild edibles and try some samples

Skunk Cabbage Stroll
Blendon Woods Metro Park - Nature Center
23rd February 2:00 pm - 3:30 pm
Stroll off-trail behind the lake to search for this earliest of spring wildflowers. Expect to get muddy!

The Good, The Bad, and The Hungry: Dealing with Wildlife Conflict in Your Landscape
Battelle Darby Metro Park - Nature Center
23rd February 2:00 pm - 3:00 pm
Viewing wildlife species in your backyard can be enjoyable, but sometimes conflict arises—usually in the form of damage such as eaten plants, dug up bulbs, or holes in the lawn. Fortunately, most wildlife damage can be managed with the right techniques and strategies.

Bon AppéCreek
Battelle Darby Metro Park - Nature Center
29th February 1:00 pm - 2:00 pm
Enjoy the fish feeding frenzy as you help feed them worms, crickets, and other foods

Leapin' Lantern Stroll
Sharon Woods Metro Park - Spring Hollow
29th February 6:45 pm - 7:45 pm
Carry lanterns on a 1-mile walk to celebrate an extra day in February

Backcountry Hike
Clear Creek Metro Park - Thomas-Mathias Parking Lot
29th February 10:00 am - 12:00 pm
Take in winter views and learn about the history of Neotoma Valley on a 4-mile off-trail hike

Woodcock Watch
Three Creeks Metro Park - Confluence Area
29th February 6:00 pm - 7:30 pm
Celebrate leap day by taking a 1.5-mile round trip walk to watch the aerial courtship display of this unusual bird

Composting
Battelle Darby Metro Park - Nature Center
1st March 3:00 pm - 4:00 pm
Composting is nature's way of recycling. Discover easy ways to keep food scraps and yard waste out of landfills

Skunk Cabbage
Prairie Oaks Metro Park - Prairie View
1st March 1:00 pm - 2:00 pm
Skunk cabbage is one of the first wetland flowers to bloom even if there is snow on the ground. Enjoy a two mile hike in a variety of habitats.

Events

Night at the Nature Center
Battelle Darby Metro Park - Nature Center
7th March 5:00 pm - 6:00 pm
See what animals awaken after dark in the 53-foot living stream

Skydancer Saturday
Sharon Woods Metro Park - Apple Ridge Bulletin Board
7th March 6:30 pm - 7:30 pm
Witness the amazing aerial display of the American woodcock

Eagle Watch Weekend
Madison Church Prkng Lot - 3565 Bixby Rd, Groveport
7th March 10:00 am - 11:30 am, 1:00 pm - 2:30 pm
8th March 2:00 pm - 3:30 pm
Take a 1-mile off-trail walk to see the nesting bald eagles through a spotting scope

Maple Sugaring
Blacklick Woods Metro Park - Nature Center
7th March 1:00 pm - 2:00 pm
Learn how sap becomes syrup during this maple sugaring demonstration

Morning Coffee & Wildlife Watch
Blacklick Woods Metro Park - Nature Center
7th March 8:00 am - 10:00 am
View animals through the nature center windows and enjoy a cup of coffee

Project FeederWatch
Blendon Woods Metro Park - Nature Center
7th & 8th March 10:00 am - 2:00 pm
Help collect data for this important citizen science project that tracks trends in winter bird distribution and abundance. No Experience necessary!

Gardening for Bees
Inniswood Metro Gardens - Greenhouse Center
7th March 10:00 am - 12:00 pm
Learn about these beneficial insects, how you can encourage them to visit your plants, and then make a bee house to take home to your garden

Spring Forward
Blacklick Woods Metro Park - Nature Center
8th March 4:00 pm - 5:00 pm
Join a naturalist for a brisk 6-mile walk on all of the trails

Bird Hike: Waterfowl
Blendon Woods Metro Park - Nature Center
8th March 9:00 am - 10:00 am
Hike 1 mile on a paved trail to look for migrating ducks

Backyard Birds Open House
Highbanks Metro Park - Nature Center
8th March 11:00 am - 1:00 pm
Come enjoy the birds at the Highbanks bird feeders, and learn how to tell them apart. We might see Pileated Woodpeckers, Blue Jays, sparrows, hawks, and more.

Salamander Search
Glacier Ridge Metro Park - Shelter House
8th March 10:00 am - 11:30 am
Seek these elusive amphibians in the vernal pool. Bring rain boots or shoes you don't mind getting wet/muddy.

Fast-paced Full Moon Hike
Sharon Woods Metro Park - Apple Ridge Bulletin Board
8th March 7:45 pm - 8:45 pm
Take a fast-paced 2.8 mile hike along gravel, paved and natural surface trails

Lichen

There are many examples of symbiotic relationships in nature where two or more species mutually benefit from their interaction with one another. For example, the relationship between a flower and a pollinator. The pollinator, such as a butterfly or a bee, gets nectar or pollen from the flower, and in the process, pollinates the flower. Or the relationship between ants and aphids, where ants protect and tend to the aphids while benefiting from the honeydew that the aphids secrete. But there is no parallel in nature with the symbiotic relationship that exists in a lichen. In every other symbiotic relationship in nature, the member species (called ***symbionts***) maintain their individual identity. Lichens are a unique case where the participating species of the symbiosis lose their individual identity to form a whole new organism! According to the US Forest Service, lichens are a "bizarre organism"!

The Greek word ***symbiosis***, meaning "living together", was coined by German biologist Heinrich Anton de Bary, particularly to describe the cooperative partnership in a lichen, in his 1879 monograph "*Die Erscheinung der Symbiose*"! A lichen is a result of a partnership between a **fungus** (plural *fungi*) and an **alga** (plural *algae*) and/or a **cyanobacterium** (plural *cyanobacteria*). The fungal component of the lichen is known as ***mycobiont***, and the algal or cyanobacterial component is called ***photobiont***. The photobiont partners are capable of **photosynthesis** and produce food (in the form of carbohydrates) by making use of sunlight, water and carbon dioxide from the atmosphere. In majority of lichens, the photobiont partner is algae. The fungus, which is incapable of producing its own food, feeds on the food produced by the photobiont. The fungus, in turn, provides protection to the photobiont partner from the harsh ultraviolet rays of the sun by enclosing the photosynthesizing partner(s) within a protective ***cortex*** (or shell) with pigments that absorb the ultraviolet light. The mycobiont also helps its partners from quickly drying out. The fungus also gives a structure to the lichen. Until 2016, it was thought that lichens were comprised of only one species of fungus, but scientists have now discovered that some species of lichens have two species of fungi!

Lichens need a surface or a ***substrate*** to grow on. Since the lichen doesn't biologically interact with its substrate, the surface on which it grows doesn't need to be living. Hence, lichens grow on a variety of substrates, such as tree bark, soil, rock surface, buildings and even old abandoned vehicles. Lichens can grow almost anywhere where conditions are favorable!

Lichens are ubiquitous and the second most widespread organisms on the planet, after bacteria. It is estimated that approximately 8% of terrestrial earth is covered by lichens!

There are about 17,000 known species of lichens worldwide and 3,600 species in North America. In Ohio, we have about 480 species of lichens.

Plants, Algae and Cyanobacteria

Organisms that produce their own food through photosynthesis are called ***photoautotrophs***. Green plants, algae and cyanobacteria are the three types of photoautotrophs.

Plants Green plants are the most evolved photoautotrophs with several adaptations for life on land, including in some cases, complex vascular tissues.

Algae Algae are the simplest "plant-like" organisms found in damp soil and aquatic environment - both freshwater and marine. Algae vary widely in form, from unicellular and microscopic to multicellular and macroscopic.

Cyanobacteria Commonly known as the "*blue-green algae*" (because of their blue-green color), cyanobacteria are <u>not</u> algae! As the name suggests, cyanobacteria are bacteria! Cyanobacteria are the most primitive of organisms without a nucleus (algae have a nucleus), and it is believed that photosynthesis first evolved in cyanobacteria. The oldest known fossils (over 3.5 billion years old) are of the cyanobacteria! Cyanobacteria are credited for enriching the atmosphere of the young Earth with oxygen that helped shape the evolution of life on the planet! They are commonly found on the surface of both marine and fresh water. They are also present in the soil, on the rocks, wood and even on some living organisms. Some cyanobacteria are capable of nitrogen-fixation.

Vascular Tissues

Vascular tissues are ***xylem*** and ***phloem*** in a plant, and are responsible for moving water, nutrients and food produced by photosynthesis throughout the plant.

Fungus

Fungi are a diverse group of organisms (different from plants) and have their own kingdom - **Fungi Kingdom**. Fungi are more closely related to animals than plants! Mold, mushrooms, and yeasts are some examples of fungi we commonly encounter. Fungi do not possess chlorophyll and hence are incapable of photosynthesis to produce their own food. Most fungi consist of pale hair-like filaments called ***hyphae***, which are used by the fungi to acquire food by either secreting digestive enzymes externally and then directly absorbing the digested food, or through a parasitic or a symbiotic relationship with another organism. Most fungi reproduce by producing sexual spores. Spores are microscopic, single cells that can develop into a multicellular organism. Other fungi, such as yeasts, do not produce spores; instead they reproduce by ***fragmentation*** — a process in which a fragment of the parent breaks off and develops into an entirely new individual, genetically identical to the parent. Fungi play an important role in the ecosystem in decomposing organic matter. The study of fungi is called ***mycology***.

Nitrogen Fixation

Nitrogen fixation is the process of converting atmospheric nitrogen into ammonia (NH_3) and related nitrogenous compounds, such as nitrites and nitrates, which can be utilized by plants.

Types of Lichens

The vegetative portion of the lichen is known as the ***thallus***. Thallus forms the outer body of the lichen and is unknown in a non-lichenized fungus. There are four kinds of *thalli*

Foliose These are flat leaf-like lichens.

Fruticose These look like miniature shrubs. They have a wired and tufted appearance.

Foliose and Fruticose lichens are also sometimes referred to as **macrolichens** (because of their larger size compared to other kind of lichens).

Crustose As the name suggests, they look like crusts, and can grow on soil, on rock surface, on tree bark and even on roof shingles. They come in many bright and vibrant colors, such as yellow, orange, and red, as well as in grays and greens. These are microscopic and hence, sometimes referred to as the **microlichens.** However, colonies of crustose lichens are visible to the naked eye.

Squamulose These are scaly lichens made up of several small rounded lobes, and appear to be intermediate between foliose and crustose lichens.

Foliose Lichen (Speckled Greenshield Lichen)

Crustose Lichen (Genus Pyrrhospora)

Structure of Lichens

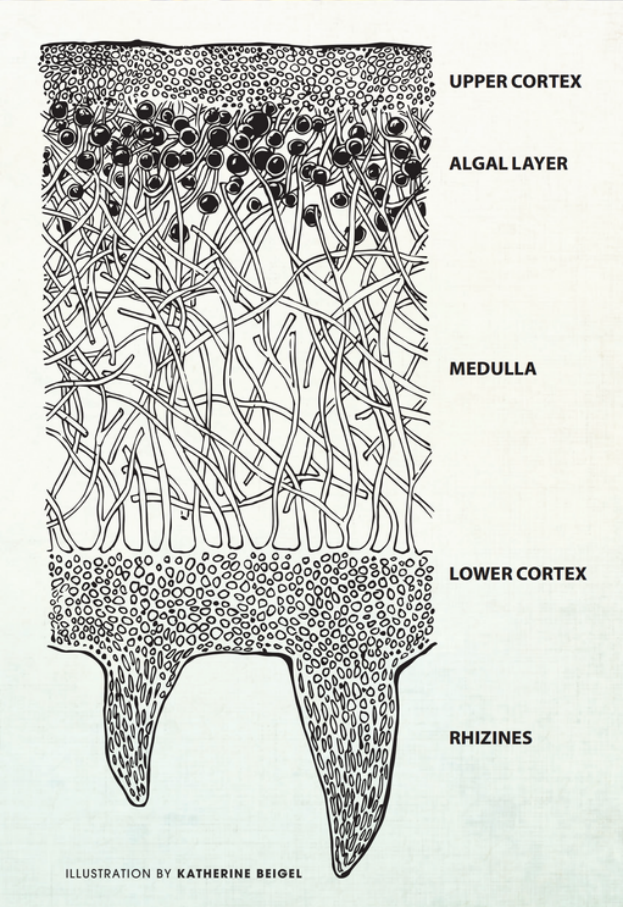
The cross section of the lichen looks stratified, with the mycobiont and photobiont components arranged in layers.

Cortex It is the outer layer, made of tightly packed fungal cells.

Algal Layer Below the cortex is the layer that houses the algal partner. When dry, lichens often appear drab and gray, assuming the color of the mycobiont. But they may almost completely transform their appearance when wet. Water can make the outer fungal layer transparent such that the algal layer shines through. Cyanobacteria, if present, can be in the layer below the cortex or in tiny pockets on top of the cortex. Green algae give the lichens bright green color while the cyanobacteria can render a dark green, brown or black color.

Medulla Below the algal layer is the medulla, which makes up the majority of a lichen thallus. Medulla is comprised of loosely arranged filament-like fungal cells, like a cotton-like substance.

Lower Cortex The bottommost layer is the lower cortex.



Cross-section of a typical lichen
Artist: Katherine Beigel
Source: Common Lichens of Ohio, ODNR Field Guide

Basal Attachment

Lichens have different mechanisms to attach themselves on to their substrate.

Rhizines These are fungal filaments that extend from the medulla and act as "roots" enabling the lichen to anchor on to its substrate. Rhizines do not function as the vascular roots in plants to transport nutrients.

Holdfast Instead of rhizines, some lichens have a central peg (or holdfast) that attaches to the substrate, usually a rock surface. These types of foliose lichens are called **umbilicate lichens**, because the holdfast resembles an umbilical cord.

An exception to the typical lichen thallus structure is the **jelly lichen**. Jelly lichens do not have a stratified or layered structure, and the mycobiont and photobiont components are packed in together in a single layer. In jelly lichens, the photobiont partner is cyanobacteria.

Fruticose Lichen (Ladder Lichen)
Photo Credit: Robert Klips

Squamulose Lichen (Common Clam Lichen)
Photo Credit: Robert Klips

A Stable Relationship

In evolutionary terms, for a symbiotic relationship, such as that of a lichen, to be successful, it needs to satisfy three conditions — **recognition**, **acceptance** and **fitness**. The mycobiont chemically "recognizes" a compatible photobiont partner. The two partners then need to "accept" each other. If one considers the other a parasite, it will fight against it and render the association unsuccessful. Finally, the partnership needs to pass through the "fitness" test of natural selection with a healthy growth and successful reproduction.

Even though lichens are formed of two or more species, the fungus is the dominant partner and has the greatest influence on the final form of the lichen's body and texture. Hence, the lichen species is identified by the species of the fungus that makes it, regardless of the photobiont partner, and is often referred to as ***lichenized fungus***. Consequently, lichens are classified as members of the Fungi Kingdom.

The fungus controls the lichen in such an extraordinary manner that some scientists call it "agriculture", where the fungal partner "farms" the growth of the photosynthesizing partner in a controlled manner — just as we grow our crops!

Usually, the mycobiont doesn't switch partners once an association has been established. However, as there are always some exceptions to the rule, in certain cases the mycobiont associates with a cyanobacterium in humid shady conditions to form a fruticose or small shrub-like lichen, but when the conditions get dry over time or within a short distance, the fungus associates with a green alga to form flat lobes of a foliose lichen.

While there are several species of fungi that can survive on their own, over the years of evolution, the species that form lichenized fungi have lost their ability to survive on their own. They necessarily need the photobiont partner for survival. The photobiont partners on the other hand can easily survive on their own. Hence, one could argue that in the symbiosis, the mycobiont is the more "desperate" partner! Ironically, it is the mycobiont that controls the association!

Lichens are such complex organisms that they are often described as "small ecosystems" in themselves!

There may be associations between a fungus and an alga or cyanobacterium in which each partner retains their individual identity. Such association is not a lichen. In a lichenized fungus, the thallus that forms is unknown to exist in non-lichenized fungi. In a lichen, the fungal partner also affects and changes the morphology of the photobiont.

Reproduction

Lichens reproduce both sexually and asexually. Most lichens reproduce vegetatively by spreading small fragments blown by the wind or dispersed by birds or insects. This is asexual reproduction. Lichens have structures specifically developed for the spread of fragments. The fragments contain all the partners of the lichen. Lichens with a spore-producing fungal partner, can produce sexual spores, which can be dispersed and germinate into a new growth of the fungus (not the lichen). This new fungus must immediately find a suitable photobiont partner to form a lichen, else it will die!

Resilient Lichen

Together, the fungi and the photosynthesizing partner are able to live in environments they might not be able to survive in individually. Most lichens grow slowly and have a long lifespan, perhaps because they live in habitats with limited water supply. Lichens have a remarkable resistance to drought, and a dry lichen can absorb water 3 to 35 times its own weight. They can also absorb water from the moisture in the air. They also dry out very slowly (thanks to the fungal partner) and hence make it possible for the photosynthesizing partner to continue producing food for as long as possible. This resilience of lichens has allowed them to grow in a variety of habitats and climates — from the Arctic to Antarctic. From the harshest environments such as desert and polar regions to the temperate regions and tropical rainforests, lichens can be found everywhere.

In an experiment conducted by the European Space Agency, a lichen was taken to space and exposed to the harmful radiation and zero atmosphere of outer space for 14 days. When it was brought back to earth, the lichen was found to be still thriving!

Lichens and Mosses

Lichens might often be confused with mosses. While both are non-vascular organisms, lichens are not plants. Mosses belong to the Plant Kingdom and are believed to be the ancestors of plants we see today. Mosses are included in the group of non-vascular plants called *bryophytes*. But mosses still have plant-like structures that look like and function as roots, stems and leaves. Lichens have neither. But both lichens and mosses tend to grow in similar environments and that's why one could find them both side by side, and easily get confused!

Role in The Ecosystem

The most important role lichens play in the ecosystem is that they are the decomposers of the ecosystem. Lichens break down the organic matter into nutrients that other plants can use. The cyanobacteria, if present, in the lichens helps with nitrogen fixation. The Lapp people living in the Arctic Circle in Scandinavia and Russia, harvest lichens to feed the reindeers. In the deserts of Libya, the sheep survive partly on the crustose lichens growing on rocks. Sometimes, even humans eat lichens. *Bryoria* is a common genus of lichen across United States and in times of scarcity of food, some Native American tribes would eat this lichen. Other lichens were used by some Native American tribes to make tea. Not all lichens are edible, and some can be poisonous. For example, the wolf lichen was used in the Europe to poison wolves, which was how it got its name. Some Native American tribes used wolf lichen to poison their arrowheads. In temperate regions, lichens are used by many birds as a nesting material for decoration, camouflage, insulation or to repel insects (because of their disinfectant properties). Birds like the Northern Parula, Ruby-throated Hummingbird, Blue-gray Gnatcatcher, and several others are known to use lichens to build their nests. European Starlings use lichens to decorate their nests to attract mates. Lichens also help produce soil. Lichens that grow on rocks, very gradually wedge it apart — by both pressure and chemical action — and break it into smaller fragments, ultimately making it into soil. Some of their acidic secondary products dissolve minerals from the rocks and mix it in the soil. Many species of insects protect themselves from predators by camouflaging like a lichen. Some predatory animals, such as the *giant lichen orbweaver* spider or the *lacewing larva* (also called *aphid lion*), camouflages itself as a lichen to ambush its prey. The *painted lichen moth* caterpillars feed only on lichens.

Lacewing larva aka "trash bug" covered in lichen
Can't figure out where the insect is? That's how well-camouflaged it is!

Photo Credit: Robert Klips

Lichens growing on tree bark do not harm the tree. In fact, if a cyanobacterial partner is present in the lichen, it actually benefits the tree. The cyanobacteria is capable of nitrogen fixation. Plants and trees need nitrogen but cannot use it in the form of nitrogen gas directly from the atmosphere. Cyanobacteria converts the atmospheric nitrogen into more usable form for the plant.

I'm Lichen It!

Lichens are extremely sensitive to air quality, and the degree of sensitivity depends on the species. Hence, lichens are a good **indicator species of air quality**. The presence (or absence) of lichens has been used to map concentrations of pollutants. Lichens absorb everything through their cortex - nutrients as well as harmful toxins and pollutants such as heavy metals, carbon and sulphur. Hence, they can be used to determine the levels of pollutants in the atmosphere. Through lichen biomonitoring since the 1970s, the US Forest Service maintains the **USDA Forest Service National Lichens and Air Quality Database and Clearinghouse**. Lichens are used to mimic trees in the layout for model trains. Lichens produce over 400 different chemicals, known as "secondary products" or secondary *metabolites*. Their role for the lichen itself is not certain but some of the functions could be providing the lichen with defense against parasites and make them taste unpleasant to animals, preventing it from freezing, or stopping seeds of other plants from germinating on its soft and most tissue. Some of these chemicals are used by humans for antiviral and antibacterial medicines. *Usnea* lichens are used for their antibiotic properties in the development of drugs. Some lichen extracts are used in salves, toothpaste, perfumes, and deodorants. Before the invention of synthetic dyes, lichens were used to dye woolen clothes. When mixed with another substance, such as pine sap or water, or burnt to ash first, lichens can produce an array of colors. They are still used in Navajo weavings. Lichens are used to make the litmus paper — to test the acidity of liquids.

While lichens are present year-round, winter is the best time to spot them because the lack of foliage makes the soil, rock surface and tree barks more visible. Also, winter storms bring down tree branches that are covered in lichens, which would otherwise be out of visual reach.

Lichens are all around us. We probably walk past them almost every day, but fail to take notice. Because of their sensitivity to air pollution, if one finds lichens growing around their house, one can rest assured that the air they are breathing is clean and of good quality!

Lichen Field Guide - Free!

A free ODNR (Ohio Department of Natural Resources) field guide of Common Lichens of Ohio can be downloaded from https://tinyurl.com/vxwgwvx

Alternatively, a physical copy can be picked up from a Nature Center of your nearest park!

Valentine's Day Special

A Lichen Love Story

- as narrated by Joe Walewski

Author of "Lichens of the North Woods "

"Freddy Fungus lived alone in a spacious home that he built himself. Freddy was a master architect, engineer and builder. Unfortunately, with all his skills, Freddy couldn't sustain a life alone. He was quickly fading away primarily because he just didn't take care of himself. He couldn't cook.

Then Alice Algae came along. She seemed a magician with food. She appeared to concoct fabulous meals from nothing more than thin air. And for Alice, making food was more than a passion; it was a way of life. It became an obsession and she routinely made more than was possible to eat by herself. For, she too lived alone.

When they first met, everyone could see they were destined to be together. True love? Maybe. All they would admit was that they immediately took a 'liken' to each other. Freddy and Alice developed a relationship in which they lived symbiotically ever after.

But symbiosis isn't always as you might think. Freddy and Alice didn't benefit equally. Freddy couldn't survive without Alice. Alice felt trapped — she couldn't be herself. As time passed, anyone could see their relationship was on the rocks."

Lemon Lichen

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