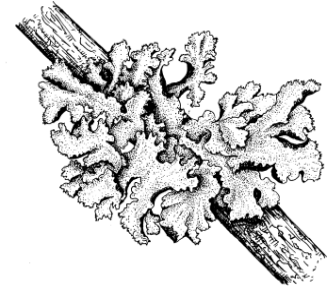

Likeable Lichens



Purpose:

The purpose of this lesson is to provide an opportunity for students to learn about an organism that grows just about anywhere, lichen. Students will explore lichen types, habitats, and its environmental benefits.

Objectives:

Students will describe lichens as part of a mutualistic relationship: fungi and algae.

Students will identify three main types of lichen: leafy, crusty, shrubby and their habitats.

Students will collect, record, and assess data of lichen types and patterns in the field.

Time Required: 1.5 hours

Appropriate grades: 9-12

NGSS and Common Core Standards:

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems at different scales.

Materials:

- Lichen type cards (20)
- Lichen specimens (8)



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Activity:

Introduction 10 minutes	<ol style="list-style-type: none">1. Set out lichen specimens for students to look at.2. Ask students to pair up. Give each pair a lichen ID card to help identify the different types of lichen.3. Have students write down two observations and one question about the lichen specimens.4. Ask students what they think they might be and compile a list of ideas on the board.
Body 1+ hour	Part 1: What is lichen? <ol style="list-style-type: none">1. Explain that students are looking at lichens- a composite organism created by a fungus and a photosynthetic partner-green algae or cyanobacteria (sometimes both!).2. Explain that the relationship between the fungus, algae and/or cyanobacteria is an example of symbiosis (a long-term, close relationship between two different organisms). Guide students to come up with other examples of symbiotic relationships, specifically mutualistic relationships where both organisms benefit (pollinators/flowers, anemone/clown fish).<ol style="list-style-type: none">a. Use the example: "<i>Alana the Algae (or Caterina the Cyanobacteria) and Frank the Fungus took a lichen to each other</i>".5. Discuss the role of each symbiotic partner-generally the fungus provides a home for itself and the algae or cyanobacteria, who in turn provides the food through photosynthesis.6. Tell the students that the mutualistic relationship allows both organisms to survive in habitats they otherwise might not have before. This is an <i>obligate</i> relationship, meaning "by necessity" because many times either organisms would not be able to survive on its own in such a habitat.<ol style="list-style-type: none">a. The opposite relationship would be <i>facultative</i>, meaning the relationship occurs only optionally, and the organisms can survive without the relationship.7. Explain that lichens are all around us and come in many different growth forms crustose (crusty), fruticose (shrubby), and foliose (leafy) (growth form definitions are listed below). Have students try to identify which



lichens might be which growth type as you go through photos or pass around lichen specimens.

8. As a lead into the Field Survey, ask students where they might find lichens. Where do you think we would find lichens? What do you think they grow on? Do different lichens grow on different things (substrates)?

Part 2 - Lichen Growth Types Survey:

Students survey a site for lichens to identify lichen growth types and determine type abundance.

Location: School yard or nearby park

Materials: Lichen type cards, pencils, and colored pencils

Procedure:

1. **Survey Teams:** Split students into survey teams of 2-3. Give each group an ID lichen card to help with identifying lichens. Each team will survey a different area of the site.
2. **Forming a Hypothesis:** Before students begin to look for lichens, students will guess what types of lichens and their habitats they think they might find in their study site and record their hypothesis (guess) on their datasheet (ex. I think I will find many crustose lichens). Have students come up with measurable ways to determine what variables affect lichen distribution.
3. **Collecting and Recording Data:** Students will need to create datasheets to record lichen types, abundance, and habitats. Once created, students will locate lichens and record data on datasheets. Students should record the substrate the lichen grows on (tree bark, rock, pavement), and try to identify the lichen growth type based on the lichen type cards. Students can also discuss how to collect and record data (make observations, write clear, legible notes etc).
4. **Scientific Sketches:** Once students have finished gathering data, students will re-find a favorite lichen they found during the survey. Students will individually create a scientific sketch of their favorite lichen including interesting characteristics such as color, size, presence of other organisms on the lichen, wet or dryness etc. If time allows, have students share the lichen they chose within their teams or with a partner.



	<p>5. Graphing Data: When students return to the classroom ask them to use their data to create a bar graph explaining what they found (see Figure 1). Discuss how to read a graph and what kind of information you might be able to determine by looking at one.</p> <p>6. Discussion: Were certain lichen types more abundant than others? Did your study site have more of one kind of substrate (all rock, all trees etc)? Did certain lichen growth types grow on certain kinds of substrates? How does your data relate to your original guess/hypothesis?</p> <p>7. Explore: Encourage students to keep an eye out for lichens around their neighborhoods. Once you start observing lichens, they're everywhere!</p> <div data-bbox="630 646 1286 1054" data-label="Figure"> <table border="1"> <caption>Lichen Types at Our School</caption> <thead> <tr> <th>Lichen Type</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Foliose</td> <td>1</td> </tr> <tr> <td>Crustose</td> <td>6</td> </tr> <tr> <td>Fructiose</td> <td>17</td> </tr> </tbody> </table> </div> <p>Figure 1: Example of lichen types graph for a class.</p>	Lichen Type	Count	Foliose	1	Crustose	6	Fructiose	17
Lichen Type	Count								
Foliose	1								
Crustose	6								
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<p>Closure 5-10 minutes</p>	<ol style="list-style-type: none"> 1. Come back to the classroom. 2. Ask students to tell their neighbor one surprising thing they found surprising when exploring lichen habitats. Did they live where you thought they would? 3. Ask group questions such as; do lichens benefit us? (They do!) How can we help protect lichens? 								



Modifications:

- **Elementary:** Instead of doing the entire field survey, have students do a field drawing of their favorite lichen and label it with the type after exploring lichen types in the field.
- **Middle School:** Have students explore at the schoolyard or local park using the field cards to identify the types of lichen they found and where. They can collect and record their data in groups to compare with other groups later in class. They should begin to hypothesize why they found the lichen where they did.

Optional investigation extension: Explain to students that foliose and crustose lichens mean clean air, because they cannot survive poor air quality unlike crusty lichens which can. When leafy and shrubby lichens do not survive, this is an indication of poor air quality. Assessing lichen abundance will help to see if biodiversity is declining and more pollution tolerant species are replacing less tolerant species. Ask students if there's anything they can find out about the area's air quality based on this knowledge. Using online resources, students can research air quality in the local region. Help students create a testable question and develop a method for investigating it.

Growth forms:

- 1. Crustose:** Growing like a crust or a stain, attached so closely to its substrate (i.e. the surface on which it grows) that to remove it would destroy the lichen.
- 2. Foliose:** Leaf-like or widely strap-shaped growth form. Foliose lichens have a distinct upper and lower surface, distinguishable by color, texture, or presence of 4 unique structures.
- 3. Fruticose:** Distinctly three dimensional in shape, like a shrub, dangling network of threads or a pedestal.



Lichen Type Card

Decide if your lichen most closely resembles one of these three kinds:

Fruticose (crusty)



Flat edges, stuck to rock or wood like paint

Foliose (leafy)



Leafy shaped, usually attached to rock or wood in one small place

Crustose (shrubby)



Often like a beard, hangs down, looks like a small bush

