



Lesson of a Lichen

Grade: 3

Subject Areas:

Life Science, Language Arts

Skills: classifying, describing, drawing, identifying, observing

Duration: 1 hour

Connections:

social studies, evolution, plant science, ecology

Vocabulary

symbiosis

commensalism

epiphyte

parasitism

mutualism

lichen

fungus

algae

pioneer species

Objective:

Students will demonstrate understanding of the term symbiosis by learning about mutualism through the study of lichens.

Materials

- assorted samples of fungus, lichens and mosses (optional to bring in algae)
- reference materials/ identification sheet?
- lichen worksheet (see attached)
- magnifying glasses or loupes
- paper and pencils

Standards

Strands: Excellence in Environmental Education Guidelines Strand 1 — Questioning and Analysis: C) Collecting Information:

Learners are able to locate and collect information about the environment and environmental topics. **E) Organizing information:** Learners are able to describe data and organize information to search for relationships and patterns concerning the environment and environmental topics.

Strand 2.2 — The Living Environment: C) Systems and Connections:

Learners understand basic ways in which organisms are related to their environments and to other organisms.

California State Educational Standards:

Life Sciences (LS) 3a: Students know ecosystems can be characterized by their living and nonliving components.

LS 3b: Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.

Investigation and Experimentation 6a: Students will differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.

Background

Living Relationships

Life on Earth is at least three billion years old. Throughout evolutionary history, life has found ways of benefiting from its surroundings. One way is to profit from a close relationship with one or more organisms. A close interconnected partnership within an ecosystem is called **symbiosis**.

When we look for examples of symbiosis we find a great variety. Moss growing on a tree, the spread of pollen by animals, and the fact that some species require a host to live, are all examples. There are three main types of symbiotic relationships: commensalism, parasitism, and mutualism.

Commensalism is when one partner benefits while the other partner is seemingly unaffected. For instance, barnacles can find a home on the backs of whales and other marine animals, while the barnacles don't seem to harm the animals. Another example is epiphytes. **Epiphytes** are plants that live on another plant, usually without the need for soil. In moist old growth redwood canopies, for instance, large fern mats grow high in the branches of trees. Large branches provide a place above the forest floor for the ferns, but they do not harm the tree. These ferns produce their own soil to grow in. In these two examples, both the barnacles and ferns are more widely dispersed by this relationship and are therefore benefited.

Parasitism is a relationship where one organism benefits while the other is harmed. Most people are aware of parasites like mosquitoes, intestinal

worms, and fleas. These animals live off bodily fluids like blood and in doing so can often spread disease or weaken the host animal. Plants can suffer from parasites as well, like mistletoe and dodder. Some animals parasitize others by tricking them. The brown headed cow bird for instance, lays its eggs in another bird's nest (usually a blackbird) and has the host bird raise its chick. Having another chick to feed puts pressure on the entire host family. In addition, the foreign bird is usually a little larger and more aggressive than the host species, giving it an advantage.

Mutualism is a symbiotic relationship whereby both partners

benefit from their arrangement. This mutually beneficial relationship is widespread and certain species like corals and their arrangement. This mutually beneficial relationship is widespread and certain species like corals and lichens couldn't exist without it. Mutualism has even transformed the planet through various processes like pollination and decomposition.

There are incredible ties between birds, bats, and insects and the flowering plants they pollinate. Sometimes the relationship between plant and pollinator is so specialized that only one species can pollinate a particular plant as is the case of

Local Connection

One increasingly rare lichen growing in the forests of the Pacific Northwest is *Lobaria oregana*. Due to dispersal limitations, it is mostly restricted to old growth forests and is rarely found in young forests. *Lobaria* is commonly referred to as lettuce lichen or tree lungwort. A similar looking species is *Lobaria pulmonaria*, which is much more widespread.

Lobaria is a type of foliose lichen which grows on the limbs of large trees, especially Douglas fir. Both of these *Lobaria* species belong to a group called cyanolichens. Cyanolichens are special because they have colonies of cyanobacteria living within their leaf-like bodies or thalli. The cyanobacteria are able to convert atmospheric nitrogen into useable forms for plants via a process called nitrogen fixation. Other plants famous for fixing nitrogen belong to the pea family and are called legumes.

When *Lobaria* falls to the forest floor, it acts as a fertilizer. Studies have revealed that it can contribute substantial amounts of nitrogen to forest ecosystems. *Lobaria oregana* is becoming scarce in the King Range and is on the BLM list of sensitive botanical species. One may find it littering the forest floor after a winter storm.

orchids. The plant benefits by getting pollinated and the pollinator benefits by getting a meal.

What's in a Lichen?

The King Range National Conservation Area is largely covered by forests. In a forest ecosystem, **fungi** play a vital role in decomposition. Trees benefit by the nutrients fungi provide and fungi benefit by the vast supply of carbohydrates that the trees provide. In addition, some species of fungus, like truffles, are broadcast by various animals like squirrels. In this case, the squirrels benefit by getting a meal and the fungi benefit by the spreading of its spores.

Lichens are a unique form of mutualism. By their very nature they are a composite made of fungus, algae and/or cyanobacteria. Fungi are unique organisms that have cell walls similar to plants, but contain no chlorophyll and therefore do not use photosynthesis to gain energy. **Algae** and cyanobacteria, however, do use the sun's energy (algae is a type of primitive plant). In this relationship, the algae and cyanobacteria make sugars using photosynthesis and the fungus breaks down the sugars. The fungus gives the alga structure a place to live where it would not ordinarily be able to. The fungus usually determines the overall shape and texture of a lichen and is the part that produces reproductive structures.

There are fun little "sayings" that helps one remember the marriage between fungus and algae. One way is, "Freddy Fungus met Alice Algae and they took a lichen to one another". Repeating this phrase to kids may be a good way for them to remember which two things are living together in this unique symbiotic relationship or "marriage".

Lichens can live in harsh environments because they don't need soil to live and are one of the first species to inhabit an area. The first things that move into an area are often called **pioneer species**. As a matter of fact, lichens have the ability to break down rock and are important in the production of primitive soils. Lichens can live on rocks, wood, sand dunes and the arctic tundra. They have taken over towns and homes by living on everything from street posts to tombstones. Locally, lichens are easily found on trees and shrubs, downed logs, and rocks. Lichens are slow growing and one should avoid collecting uncommon species.

Often people mistake lichens for mosses or the other way around. Lichens come in a host of colors including white, gray, orange, yellow, red and black. Both can live in similar environments. Mosses are true plants and will usually be green in color especially when wet.

You Look Lichen...

There are three main groups of lichens categorized by shape and texture, although to truly identify lichens you need to know a lot more. Flat, splayed out lichens often forming a "crust" are referred to as crustose. Sometimes this group can appear powdery or "crusty". These lichens tend to be very thin. They are so closely attached to their substrate, one can not remove them. The best way to view these in the classroom, is to bring the rock or other substrate to which they are attached. Foliose lichens can also be thin and flat, but become soft and pliable when wet, resembling leaves or foliage. They have a distinct upper and lower

surface to them. The last group is fruticose lichens. This group can often form clumps or strands and can resemble miniature forests. Contrary to the foliose lichens, they do not have a distinct upper and lower surface.

Members of this groups are sometimes described as stalked or shrubby in nature. A local favorite belonging to this group is a kind of lichen called old-man's beard or usnea. It forms long hair-like strands that hang down from the branches of trees and shrubs. The Native Americans used usnea like pillow stuffing.

Lichens are used for a variety of things. In some cultures certain varieties are eaten. As a matter of fact, an important food for reindeer and caribou herds is lichen. Lichens have been used in natural dyes and some forms have been found to have medicinal uses. There are over 700 components found in various lichens. Lichens may be one of the first things to inhabit a new place, but it turns out that they are also one of the first to disappear when air pollution is high. Because of this they can be used as bioindicators. Lichens act as forest fertilizer when they fall out of trees because they add nitrogen to the soil. Regardless of which of the lichens you take a liken to, they are fun to learn about and to find in local habitats.

Activity: Observing Lichens

Preparation

The presenter should become familiar with the three groups of lichens. As you have the students collect samples for the classroom make they only takes those that are common. You may want to bring in a few branches and rocks that have lichen and/or moss growing on them. In addition, you may want to purchase a collection (see pg)

Procedure

1. Write three headings on the board: fungus, lichen and moss. Hold up examples of each and have the students observe some differences. Write characteristics that the students come up with under the appropriate heading. Help them along by asking questions.

2. Explain to the students about the “marriage” between fungus and algae and how it benefits both. Keep things simple by using the three concepts above and their corresponding examples.

Materials

- assorted samples of fungus, lichens and mosses (optional to bring in algae)
- reference materials/ identification sheet?
- lichen worksheet (see attached)
- magnifying glasses or loupes
- paper and pencils

- *What do you notice that is different between these samples?*
- *What do you notice that is the same between these samples?*
- *What do you know about fungus?*
- *Where can you find mushrooms?*
- *How do mushrooms get their energy?*
- *Where do lichens live?*
- *Where do mosses live?*
- *Are lichens and mosses easy to confuse?*
- *Which one do you think is a true plant? Why?*
- *What do you know about plants?*
- *How do plants get their energy?*
- *Is algae a type of plant?*
- *Where does algae usually live?*

Activity Continued...

3. Write a Venn diagram on the board by drawing two circles that intersect in the middle. Hold up a mushroom and write it in one circle along with descriptive words like “consumer” and “decomposer”. Next, hold up an example of a moss or algae and write it in the other circle. Reinforce that moss/algae is a true plant and goes through photosynthesis. Lastly, hold up a lichen. See if the students can make the connection (the intersecting circle), that lichens do both things through a partnership between fungi and algae. Use this as a way to discuss symbiosis. Write **symbiosis** on the board and below it write the three examples and a brief description. Circle **mutualism** and relate it to the “marriage” between fungi and algae. Say: “Freddy Fungus met Alice Algae and they took a lichen to one another”. Depending on the ability of the group, ask what symbiotic relationship they think moss living on a tree trunk is. Encourage them to ask questions(split into two groups).

4. Continue to show examples and explain the differences between the three groups of lichens: crustose, foliose, and fruticose. Give simple ways to remember these (refer to background information). Share some interesting information about lichens like where they can live, why they are important, and their slow growth rate.

5. Take the students outside to find samples on campus. Please don't allow them to collect samples unless it is abundant or it is on the ground. In groups of 3-4 have the students use magnification to look closely at what they find. This can be done inside or outside. Have them get comfortable and draw a favorite specimen. Encourage them to add detail to their drawings. Allow a little time to discuss what they observed. Review the lesson by having them complete the Lichen Worksheet (see attached). To expand on the world of lichens, next discuss uses of lichens by both animals and people.

• *How do you suppose scientists discovered the relationship that produces lichen? (fungus and algae mutualism) Accept all answers. The hope here is to get the students to understand that scientists need both observation and experimentation to understand the world around us. (this one is important b/c of a learning standard)*

References

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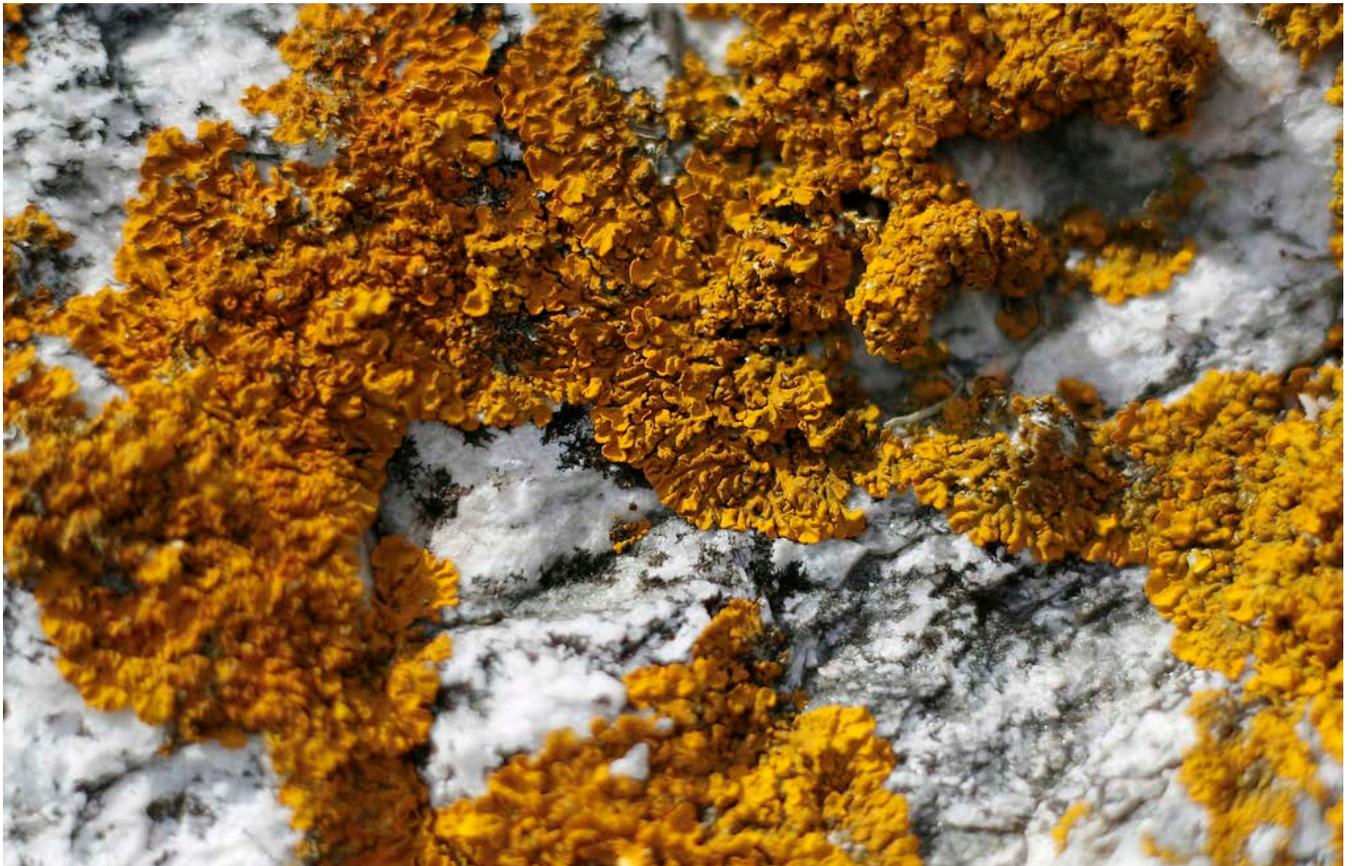
FOSS Connection

Grade 3

Life Science: Structures of Life



http://www.flickr.com/photos/jim_mcculloch/6714433811/



http://www.flickr.com/photos/op_timus/3741129188/

Name: _____

Date: _____

Lichens

1. A prefix comes _____ the other letters in a word.

2. A suffix comes _____ the other letters in a word.

3. The three groups of lichens all end with the suffix _____.

4. Match the lichen to its description below:

_____ Can form crusts, tends to live on rock

_____ Can look like flat leaves

_____ Can come in clumps and strands

A. foliose

B. fruticose

C. crustose

SYMBIOSIS:

1. What two things make up a lichen? (remember Freddy and Alice)

_____ and _____

2. What kind of symbiosis is lichen an example of? (circle one)

parasitism mutualism commensalism

Who benefits in a mutual relationship? (use a complete sentence)

