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Learning on the Land

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San Juan Mountains Association - For Lands' Sake!

Welcome to our e-Newsletter!

We hope you enjoy SJMA's newsletter created solely for educators - whether you teach in the classroom or outdoors, this newsletter is for you! In each monthly issue, you will receive helpful information on natural and cultural resources found in the Four Corners area, as well as field and classroom activities to do with your students.

The San Juan Mountains Association is the educational nonprofit partner for San Juan National Forest and Bureau of Land Management. If you received this newsletter and do not wish to continue receiving it, send an "unsubscribe teacher newsletter" email to gabi@sjma.org. If a friend or colleague sees this newsletter and is interested in receiving it, please have them send an email to gabi@sjma.org.

Fungi, Lichens and Mosses, Oh My!

Fungi, lichens and mosses are three categories of living things that may sometimes have relationships with each other, may look like each other, but are in fact different 'things'. In this newsletter we'll explore these different living things, and learn about their various interesting characteristics.

Fungi

A mushroom walks into the bar and says to the bartender "Hey, could I get a beer please?"

The bartender looks at him, shakes his head and says "No, we don't serve your kind here."

The mushroom says "Why not? I'm a Fungi!"

Fungi are not plants. They are not bacteria. They, in fact, belong to their own Kingdom - Fungi. They once were considered to be plants, since they look similar and do not move, but now we know that there are many differences between plants and fungi. One of the most obvious differences between them is that fungi do not photosynthesize - they can't make their own food, while plants can. In fact, it is now thought that fungi are more closely related to animals than plants - they probably diverged from a common ancestor 0.6 billion years ago (give or take ☺).



Fungi, continued

Fungi are made up of *hyphae* - small, white threads that grow over things that are food for the fungus. A lot of hyphae together make up a *mycelium*. In order to reproduce, fungi make spores that travel through water or air. These spores can be found on the ends of hyphae, or might be found on fruiting bodies, such as a mushroom.

Fungi can be found in the frozen arctic, rainforests, oceans, lakes and rivers. They range in size from being microscopic to over a thousand acres in size. In fact, the largest living thing in the world is a fungus! Specifically it is called the honey mushroom, or *Armillaria ostoyae*, and currently it is covering 2,200 acres in eastern Oregon, killing trees along the way. It is estimated that this fungus is 2,400 years old! The fungus kills trees via its mycelium, found underground, which takes water and carbohydrates from the tree to feed itself. It also interferes with the trees ability to absorb water and nutrients.

Scientists who study fungi are called mycologists. They believe there are over a million species of fungi in the world, and that we have identified only 5% of these. Some fungi are *saprophytic* which means they get secrete enzymes to break down organic matter, and thus obtain nutrients. Others are parasitic and get their nutrients from a living host (such as trees or our feet - yuck!). Fungi are incredibly important living organisms - they break down and consume dead matter. They are some of the recyclers, or decomposers in an ecosystem.



Mosses

Mosses, unlike fungi, are plants. They are typically small - from 1 - 10 cm - although they can be larger. They don't have flowers or seeds, but they do produce spores, as fungi do. Mosses don't have roots; they absorb water and nutrients through their leaves. They also don't have veins, making them *bryophytes*. Because mosses don't have a root system, they must live in somewhat damp environments to get their water and nutrients. That said, 'damp' is relative. Some species of moss can only live where it is damp all the time, while others are adapted to living in dry, alpine climates and even sand dunes.

Some mosses can be desiccated, or dried up, for months, but then come back to life with moisture. Mosses, lichens and fungi can sometimes be confused among each other, which is why they are included in this newsletter.



Lichens

Freddy Fungus and Alice Algae took a 'lichen' to each other.

Lichens are two organisms - a fungus and an algae - living together in a symbiotic, mutualistic relationship. This means that in this relationship, they both help each other. The algae are photosynthetic - they make food, which helps the fungus. The fungus provides a substrate, or place for the algae to live. It also protects the algae and keeps it moist. Sometimes a lichen can be made up of a fungus and cyanobacteria - aka blue-green algae (in a whole different kingdom from algae).

Lichens are pioneer organisms found in spots where other organisms cannot live, including bare rocks, desert sand, rusty metal, and animal bones. They can even shut themselves down during harsh conditions, coming back to life when conditions improve. Lichens are often decomposers, fulfilling an essential role in an ecosystem of breaking down dead (and sometimes living) things. Most lichens grow extremely slowly - less than 1 millimeter per year!

There are three forms of lichen - crustose, foliose and fruticose. Crustose lichen is crusty looking, and is often found on rocks or soil. Foliose is more foliage, or plant-looking, and fruticose is more bushy.

Lichens are now used for dating surfaces up to 500 years. Lichen can help determine when events such as floods, landslides and earthquakes occurred. This is called lichenometric dating. Some lichen are sensitive to sulfur and nitrogen compounds in acid rain, and therefore can help determine air quality in an area.



Lichens are also very important to wildlife. Some squirrels will use lichen to build nests, while reindeer are dependent on lichen during the winter months for food. Lichen provides 90% of a reindeer's diet in the winter. Even invertebrates will use lichen for habitat and camouflage.

Lichens are useful to people as well. There is even a species of lichen, *Bryoria*, that has been eaten by Native Americans during times of hardship. Lichens have also been used for making dyes, from yellow, brown, green, red, purple and orange. They have even been used in deodorants, salves, and toothpaste! However, don't go out and start rubbing lichen all over your body - some people have allergic reactions to lichens.

Cryptobiotic Soil

Lichens are also an important part of a lot of cryptobiotic soil. Crypto means 'hidden', and biotic means 'living', so this is truly living soil. It is made up of different combinations of lichens, fungi, mosses, algae and bacteria. It also consists of microorganisms including worms, insects and mites. Cryptobiotic soil is incredibly important for many reasons. First, it prevents erosion from wind and water from occurring and washing away precious soil. It also provides a microhabitat for seeds to get stuck in, and then germinate. Finally, it also acts as a sponge, soaking up water and not letting it flow away. For these reasons, it is



important not to damage cryptobiotic soil when you see it. Stay on trails, especially if you are on a bike or 4-wheeler, as tires do the most damage to it.

Field & Classroom Activities

Lichen Study

Visit an area with lichens. They can often easily be found in rocky areas, and in spruce-fir forests, hanging from the trees. Use magnifying lenses to look at lichen closely. Measure and draw lichens you see, or take pictures. Make a 'guide' to the lichens in that area. This doesn't need to include proper scientific, or even common names, but can include descriptions, and even made-up names for the lichens found.

Grow Fungi

You can grow fungi by placing a piece of bread in a plastic Ziploc bag and letting it sit out for a week or so until mold starts growing on it. Have students observe it each day for changes, and keep track of this in science notebooks. What predictions do they have about when mold will start appearing, and what will it look like? Keep these observations going as long as you want. How long before the entire piece of bread is covered? What will it eventually look like? Be sure to keep the plastic bag sealed so spores don't get into the environment - this could cause respiratory distress in some people. This experiment can also be added to by comparing different types of bread (those with preservatives and those without, for example).

Forest Searches

Find different examples of fungi, lichens and mosses in a local area. Look at the differences and similarities among the three. Use field guides when possible. Take pictures if there are identification questions, then do more research back in the classroom. When finding fungi, determine where that fungus is getting nutrients from - a decaying log, the soil, etc.

Extend the Experience

- **Lichen quiz** - The British Natural History Museum has a simple, online quiz about lichens at <http://www.opalexplornature.org/LichenQuiz>
- **More info** - The Forest Service has more online information about lichens here: <http://www.fs.fed.us/wildflowers/interesting/lichens/index.shtml>
- **More mushroom info** - visit these website to find out more about Colorado mushrooms:
<http://coloradamushrooms.com/>
<http://www.cmsweb.org/>
- **Telluride Mushroom Festival, August 18 - 21, 2011.** More info at <http://www.shroomfest.com/>



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