Meek and Mighty Mosses

Mosses are everywhere you look!

Four different mosses are growing on this Japanese Maple stump in the Perennial Garden; can you find the stump and identify the mosses?

Age: All
Time: 45 minutes

Today you will be a bryologist, someone who studies plants that don't have flowers and roots and don't have parts to carry water around inside the plant (non-vascular). That is a description of mosses: no flowers, no roots, no tubes to transport water and nutrients.

Here's How:

1. Take turns asking a question and discussing what you think before you read the answer.

- Find a comfortable place to sit with a friend—in the meadow or the gazebo or forest—to learn about mosses.

Question	Answer
How long do you think mosses have been on the earth? What is the oldest thing you can think of?	Mosses have been on the earth more than 400 million years. They were here long before people! Mosses are the first plants to grow in an area that is deforested or burned. They stabilize the surface and hold in water, so they are like pioneers that help prepare the ground for new plants to grow.
Where on the earth do you think mosses can live?	Mosses live everywhere on earth: in the freezing cold arctic, wet rain forests, hot dry deserts, mountain tops, and seacoasts. Whenever you travel, look all around and you will see mosses growing!
Since mosses don't have roots, then how do they stick to rocks and bark and soil?	Mosses have small hair-like structures called rhizoids that anchor them to surfaces. Since rhizoids are not roots, they do not penetrate the surface, so mosses can be easily removed from surfaces.
Since mosses don't have roots and don't have tubes inside them, then how do they get nutrients and water that they need to grow?	Did you guess that mosses are very absorbent, like sponges? They soak up moisture and minerals from rain and water directly into their very thin leaves, which are only 1 cell thick. Mosses can absorb liquids up to 20 times their weight. That means if a clump of moss weighs 1 pound, it could absorb 20 pounds of water. It is good that mosses are so absorbent—they soak up rainfall so it doesn't cause erosion or floods, they insulate the soil beneath them, and they keep conditions around them moist so other plants can thrive. Mosses prefer moisture for part of the year, but if mosses dry out, don't worry, they will rehydrate in a few seconds when they come into contact with water again. Mosses absorb whatever is in the air, including harmful chemicals: mosses will tell us if the air is polluted—they will turn brown and die.
Can mosses produce their own food like other plants?	Yes! Mosses are producers. They use the sun's energy to produce food (sugar) from carbon dioxide and water. This process is called photosynthesis, and it takes place in the cells of their green leaves.
Is moss yummy to eat like other plants?	Moss is low in calories and high in protein but does not provide many nutrients. Some mosses are toxic, so humans don't eat them. Native Americans used mosses for bandages, baby diapers, bedding, and sponges. Peat mosses are used in gardening to help the soil hold water for flower and vegetable plants.

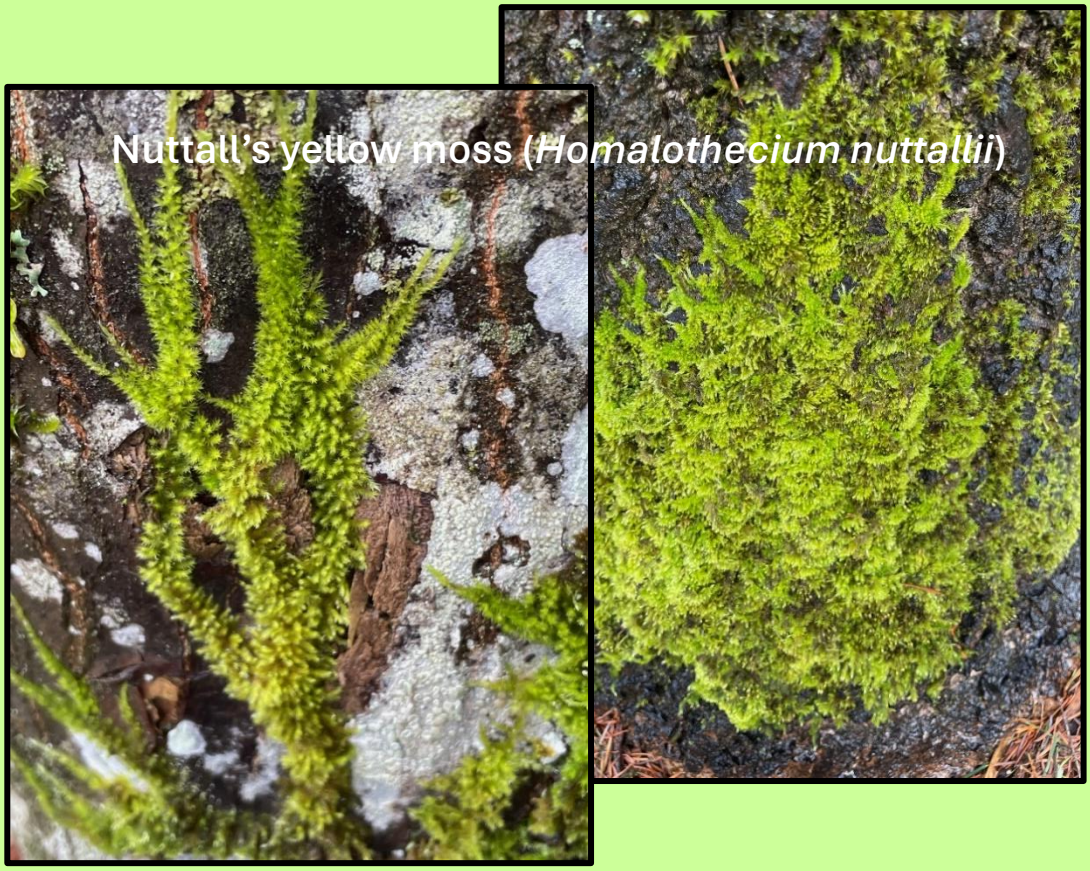
	Some animals, like land snails, eat moss. Some small animals, like turtles, live in moss because it is a safe and warm place to lay their eggs.
Can moss break?	Moss is fairly flexible and springy; touch it to see how springy it is! But too much foot traffic can harm moss. Respect all living plants, including mosses, in the arboretum and avoid walking on it.
How do mosses produce new moss plants?	Mosses can produce new moss plants and spread in a few ways. None of them involve seeds because mosses do not have seeds. Instead, they use spores to reproduce. The single-celled spores are in a capsule sitting atop the moss plant and are released when they ripen. Spores that land in moist places grow into a mop of branching green hairs, from which leaves will begin to form. Another way moss plants spread is when a plant releases shoots that extend into an area beyond the original plant. A third way that mosses spread is when a group of moss cells breaks away and forms a new moss plant. No wonder mosses have been on the earth so long—they are able to produce new moss plants in a variety of ways.
So far mosses sound amazing, but are they killing or harming the trees and grass and buildings they grow on?	Mosses do not have roots or other structures that penetrate trees and plants, and they do not take nutrients from the trees and plants, so they do not kill or harm the trees and plants they grow on. If moss growing on a tree branch has absorbed a lot of water it can be very heavy and the branch might break in windy weather, just like if the branch were covered in heavy ice and broke from the weight. Moss does not kill grass. Moss grows where other plants do not—it is not very competitive, so if moss is growing where you think grass should be it is because grass is not suited to that area. Build up the soil and use different grass seed in that area, and the moss will no longer grow there. Mosses on rooftops do not pry apart shingles. However, mosses hold water so the added moisture on the roof may cause problems with leaking.
One last question: from what you have learned why would you say that mosses are mighty?	

2. Take a walk around the Legacy Garden and Smith-Mossman Garden. Look closely at tree trunks and tree branches, rocks, and on the ground. **Use the below photos to identify some of the mosses that are common in the Lake Wilderness Arboretum**.

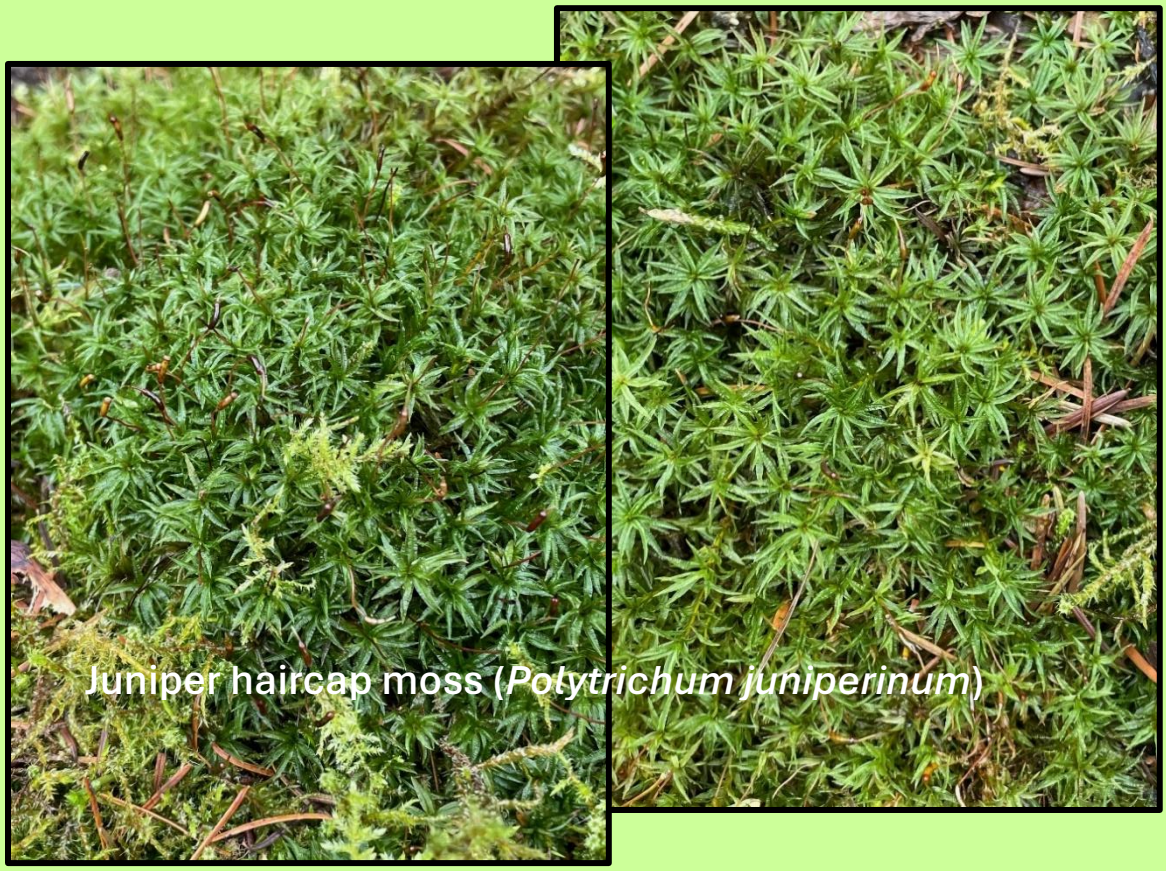
Curly thatch moss (*Dicranoweisia cirrata*)

Stair step moss (*Hylocomium splendens*)

Cat-tail moss (*Isothecium.stoloniferum*)



Nuttall's yellow moss (*Homalothecium nuttallii*)



Juniper haircap moss (*Polytrichum juniperinum*)

Menzies' neckera
(*Neckera menziesii*)

Electrified cat's-tail moss
(Rhytidiadelphus triquetrus)

The Back Story:
Look around. You will see mosses growing pretty much everywhere: on trees, rocks, walls, and soil; in cracks in sidewalks; and atop rooftops and fences! Even if you don't know the names of these amazing plants, you have seen them so often that they are a familiar sight. When you look closely you see that they look like miniature forests. Mosses are small and do not compete with other plants for space, so we could say they are meek. But they are mighty in many ways!

Don't be fooled when you see these! The organisms in the below photos are not mosses—they are lichens (fungus and algae that work together)