

## Super Soil

Total Time: 75 minutes

### Overview:

This station will introduce middle school students to three different soil textures that can be found within H.J. Andrews, connecting students to some of the research being done on the site and teaching them a hands on method in which they identify the different textures. Students will use ceramics and physical activity to express as well as understand their observations.

### Rationale:

Soil texture is one of the most important properties of soil that affects its fertility and productivity. The growth of all the forest, from the tiniest plants to the largest trees, depend upon the composition of the soil that they take root in. This lesson will teach students the important role soil plays within a forest ecosystem. Using soil charts and creating ceramic structures both provide an interactive and hands-on exploration of soil textures.

**MS-LS2- 2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems**

### Learning Outcomes:

By the end of this station, students will be able to:

1. Identify sand and clay soil textures and name two differences between the soils.
2. Explain how soil filtration rate affects both species type and vegetation density.
3. Construct an explanation that predicts where they might expect to find different soil types, and how that will impact vegetation found in each of those areas.
4. Describe the role of fungi in decomposition and nutrient cycling in a forest.
  - a. Role of decomposition in a forest
  - b. Role of mycorrhizae and lichen in nutrient cycling

## **Identifying Soil Textures:** 15 minutes

*Framing: This activity is important because texture identification can help scientists understand how the soil is supporting the life of the forest. Today we will go through the same texture identification process that the soil scientists go through.*

Step One: Split students into two groups, one group per soil bucket. Give each group two soil texture field charts. Tell them that they are going to be getting their hands dirty like real soil scientists during this activity and the following one, and then at the end of these they will be able to wash and dry their hands.

Step Two: Give each student a small sample of soil from one of the buckets and ask them to work together with their group to identify the soil type using the soil texture field chart.

Step Three: Walk around assisting the students and helping to guide them through the process. Students will make notes in their field guides about what each soil texture is like.

Step Four: Once each group has come to a decision about their soil sample, have the groups switch buckets.

Step Five: Each group will work through the chart again with their new sample.

Step Six: Once everyone has made notes of what they think each soil texture is, have the groups share their soil texture identifications.

Bucket #1: Clay

Bucket #2: Sand

Step Seven: Discuss the process as a group.

- Does everyone understand which soil is which or have any questions?
- Was it a fun process? Does it make you want to become a soil scientist?
- What did you notice about the different soils?
- Did this remind you of anything?
- Give an example of what you noticed about the process.

## **Soil Ceramics:** 15 minutes

*Framing: This activity is important because not only is soil used for scientific research, but it can be used by artists to create artistic media. Many nature artists such as Andy Goldsworthy use the materials where they are to create or inspire their work to show natural processes in the environment such as decomposition or weathering. Through making a soil ceramic, we will be able to reflect components of the forest while further exploring the different textures of the soils.*

Step One: Prep the activity.

- Share with the students that they are going to be making a piece of art out of soil.
  - This piece of art will resemble something they have observed in the forest or what they think lives there.
- Ask the students to identify species they've learned about in the forest that they can make into a ceramic. If they are struggling offer a few ideas:
  - Mushroom, leaf, worm, butterfly, flower, woody debris, etc.

Step Two: Create the art.

- Have the students grab a handful of soil.
  - Preferably the clay soil as this will hold together the best.
- Prompt them to start making the art. They can make it in their hands or on the ground.
  - Inform them that they are allowed to use debris found on the ground, just as long as it is not rooted in the ground.
  - They can also add some water to their art to make it hold better.

Step Three: Art Gallery.

- Have the students share their pieces of art with the group and discuss what inspired it.
  - What inspired you to make that ceramic?
  - Did you see that earlier in the field trip?
  - Does that remind you of anything?

**Discard ALL remaining soil in original buckets and wash hands off with water and rag. Show them how to spoon up water into their hands and scrub outside of bucket to try to keep bucket as clean as possible.**

**Water Filtration:** 5 minutes

*Framing: This activity is important because we have just discovered and felt a variety of soil textures. Those different soil textures are found in varying places in the forest and water moves through those soils at different rates. This activity will demonstrate how water flows through the soil samples and how that can impact vegetation.*

- How do you think each soil texture will impact water filtration? Do you think water will move more quickly through sand or clay? Why?
  - Clay=slow filtration
  - Sandy=quick filtration

- Brainstorm with the students about the ways that water filtration can affect vegetation and summer droughts.
  - Loose soil (sandy) does not hold much water = does not support much life.
  - Tight soils (clay) hold water well = gives vegetation water sources when water is scarce.

Step One: Set up water and sediment game.

- Have students line up shoulder to shoulder and explain that they are going to be representing different types of soil.
- Ask one of the students to volunteer. Have this student step out of the line and explain that they are going to be representing water, and the other students in the line represent the sediment particles of soil.
- The object of the game is for the water to try and weave its way through the soil sediments.
- Emphasize safety precautions.
  - Reiterate ROSE.
  - No tripping, pushing, or grabbing of anyone or anything.

Step Two: Run the game.

- First have the group of soil sediments represent sand.
  - Have the students spread apart so that their fingers are just touching.
- On your signal, the student that is water will try to weave through the soil sediments.
- Next have the group of soil sediments represent clay.
  - Students should now stand with little space in between them.
  - Be sure no students are trying to push their legs out to keep water out.
- On your signal, the water will again try to weave through the soil sediments.
- Ask the students to figure out what type of soil they are representing. Then discuss.

Step Three: Discuss observations.

- Ask, “how difficult was it for the water to move through the sand? The clay?”
- “What about the soil sediments made it harder or easier?”
  - Water moves quicker through sandy soils because they have larger particles.
  - Water moves slower through clayey soils because they have smaller particles so there is less space for the water to move through.
- “Why might this be important information for scientists dealing with forest management and ecosystem health?”

- Water holding capacity during times of drought and times of flooding.
- Different water filtration rates lead to different types of plant growth.
- Soils that can't hold much water will support plants that can survive with little water.

### **Decomposition and Life out of Loss:** 30 minutes

*Framing: This activity is important because it will demonstrate the ways that trees and fungus work together to create a flow of nutrients to one another, benefitting the forests health overall.*

Step One: Discuss tree and fungus relationships.

- Referring to background talk about these key points:
  - There is a type of fungi called mycorrhizae that are usually found on the roots of plants
  - Mycorrhizae are very miniscule, made up of microscopic threads called **hyphae** which interconnect to form a net-like web called **mycelium**.
  - Mycorrhizae help plants be acting as an extension of their roots, growing into every little bit of soil and absorbing nutrients the plant needs to grow. The fungus also helps protect against diseases as well as provides a sort of network through its webs that allow plants to “talk” to one another.
  - Plants help the mycorrhizae by providing them with sugars.
  - This relationship between the plant and the mycorrhizal fungus is a **symbiotic relationship**. This means that both organisms involved benefit from the relationship.
- Use this as an introduction to tree and fungus game.

Step Two: Play the tree and fungus game.

- Partner students and create a circle, keeping partners together. Make sure you are part of the circle as well. Have the chaperone participate if one of the students does not have a partner.
- Have everyone in the group take one large step backwards.
- Have one partner stand where they are and the other partner crouch down in front of their partner's feet.
- Say, “all of us standing are now trees!” and stick out your arms to show that you have branches and then continue, “and all of those on the ground are fungus...but wait a second, I don't have any lichen.”
- “I don't have any lichen so I want to try and take lichen from you other trees. I am going to try and make eye contact with a lichen and when I do so that lichen is going to try and escape from their partner and come be my lichen. Now remember trees, you are rooted to the ground and

cannot move your feet, but you can move your branches. If you tag your lichen partner before they can escape from you, then they have to stay.”

- Play 3 or 4 rounds.
- Switch who is a tree and who is a fungus.
- Play 3 or 4 more rounds.

Step Three: Fungus and decomposition discussion.

- Explain, “Fungi do more than just support the trees they’re attached to, they support the whole life of the forest because they play a major role in decomposition.”
- Ask, “Does anyone here know what decomposition is?”
  - Decomposition is the process of rotting or decay.
- Fungi are the engines of decomposition. Such as a fungi called conch. They releases enzymes that break down the decaying material into nutrients that can then be absorbed.
- When leaves fall, branches break off, or storms bring trees down, they break down and provide essential nutrients to the soil that fuels growth within the forest. Ask the kids, “can anyone see any signs of decomposition happening around us here?”
  - If your group is interested, try to get them to examine things they point out more closely. For example if they point out a log you could ask:
    - “Is it decaying? How can you tell?”
    - “What part of O.W.L.S would this be?”
    - “Is there anything growing on it?”
    - “How long do you think it will take to completely break down?”

**Closing:** 10 minutes

- Allow 10 minutes of transition time to walk along trail to next activity.
- While walking along trail, take time to have students gather around plants to introduce them to the plant and make observations.