



Roots and Shoots

Connected Next Generation Science Standards

K-LS1-1 Use observations to describe patterns of what plants and animals need to survive.

1-LS3-1 Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

Featured Science and Engineering Practices

Analyzing and Interpreting Data

Featured Cross-Cutting Concepts

Structure and Function

Stem (Shoots) Adaptation: This lesson can also be adapted to use for teaching about plant stems (shoots), as well. One station will make observations of woody stems (trees) and another a variety of herbaceous stems (vines, flower stems, edible stems such as celery and asparagus stalks). In Making Connections, they can weed the garden and measure the stems.

Overview

In this lesson students will rotate between root observation stations to compare and contrast root characteristics in order to identify the main functions of roots. Finish the lesson with weeding and measuring of roots. This lesson is intended to be adapted easily to teach about stems as well.

Students will

- Compare two different types of roots
- Identify the shape of root structures.
- Understand how root structures benefit the growth of a plant.
- Practice measuring

Teacher Preparation

- Collect fibrous and taproot roots for students to observe in 2 stations. Fibrous roots include grasses, tomatoes, and beans. Edible taproots are plants like carrots, radishes, and beets.
- Optional: Harvest or purchase, wash, and chop enough root vegetables like radishes or carrots for students to taste test.

Guiding Question - Why do plants need roots?



Roots and Shoots

Materials

- Teacher - small whiteboard or chalkboard
- Garden journals or worksheets and clipboards
- Pencils
- A variety of taproots and fibrous roots
- Rulers
- Optional- Magnifying glasses, radishes or carrots to taste test

Setting

- School garden or green schoolyard
- Spring or early fall

Explore

- Hold up an edible root like a carrot and radish or pass out root vegetables for a taste test. If available, have students first touch the vegetable. What does it feel like? Is it wet or dry?
- Have students try the vegetable, paying close attention to the texture and sound of it. What do these root vegetables taste like? How would you describe the texture of the vegetable? The vegetables are crunchy because they are filled with water.
- Next, ask students, What plant part do you think you just ate/saw? (Roots)
- Tell students they will get to have a chance to explore 2 types of roots. Brainstorm how they can make good observations - slow down, look at small details, and ask questions.
- Pass out pencils, garden journals or worksheets, and magnifying glasses. Demonstrate how to use the magnifying glasses if needed.
- Remind them they can observe using their eyes and hands, but they must handle the roots very gently.
- Divide students into 2 groups. Pass out the fibrous roots to one group and taproots to the other.
- Give each group about 5-7 minutes to explore the various roots at their stations and to draw a scientific drawing of their observations or list adjectives that describe the roots.
- Walk between groups and probe them to make deeper observations. What do the roots remind them of? What do they notice about the texture or shape of the roots?
- Switch the roots between the groups and repeat their observation process.



Roots and Shoots

For older students, have them work in small groups on their own root Venn diagrams.

The 3 main purposes of roots:

1. To anchor the plant into the ground.
2. To suck up water and nutrients and take it to other parts of the plant (the stem).
3. To store food or energy.

Stem Lesson Adaptation:

The 3 main purposes of stems:

1. To support the leaves.
 2. To store and transport water and minerals to other parts of the plant.
 3. To store and transport sugars to other parts of the plant.
- *It is important to clarify that not all stems hold a plant upright, as many stems, like vines, do not do this.

Digging Deeper

- Bring the entire class back together with their root samples and notes.
- Ask students to turn to a neighbor and compare their root observations. What was similar about the 2 roots?
- On a white board draw a Venn diagram. Label the first circle "Root 1: Fibrous" and the second circle "Root 2: Taproot."
- Explain to students that they observed the two types of roots today: **fibrous** roots and **taproots**. Now, we will explore how they are similar and different to understand the purpose of roots.
- Popcorn around the group descriptive words for each type of root and similarities between the two types of roots.
- Ask probing questions about their descriptive words to guide students to understand the three main purposes of roots. What do you think the roots do for the plant?
- Write down the purposes of roots on the white board as they come up in discussion.
- How do you think the shapes of the 2 types of roots help them do their jobs?

Making Connections

- Remind students that roots hold plants into place. Many garden weeds are very hard to pull out of the garden. Let's figure out what makes those weeds so hard to remove.



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- Lead students to a garden bed with plenty of weeds. If there are crops growing in the garden, pass around examples of the weeds. Demonstrate the proper way of weeding - pinching the plant where it meets the soil and pulling it straight up to remove all the roots.
- Tell students you are going to see who can carefully pull up the weeds with longest root. Give students a few minutes to weed the garden bed.
- Finally, pass out rulers and demonstrate how to measure the roots. Give students a few minutes to measure their longest root. Have students record their measurements either in their journal or on a white board.
- Figure out who had the longest or shortest roots. For older students, practice charting using their measurements.
- While walking back into class, have students discuss with a partner how easy it was to pull up the weeds.