

5.LS1.1 Needs of Plants

Phenomenon-Based Instructional Task: Uprooted

Performance Expectation (PE) | 5.LS1.1

Support an argument that plants get the materials they need for growth chiefly from air and water.

Disciplinary Core Idea (DCI) | Organization for Matter and Energy Flow in Organisms

The energy released from food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

Possible Driving Phenomena



Student Observation or Initial Interaction

Students learn that NASA astronauts grow food in space. Students observe that the plants they grow are not in soil and their roots are hanging in mid-air. Students might question whether the plants are real based on the photos. *There are many other non-NASA photographs of aeroponic plant systems available online.*

Student Observation or Initial Interaction

Students interact with a plant growing in water and make observations about its structure and environment. Students might question if the plant is actually growing in the water or if it just has been placed there. *Potatoes, onions, and lucky bamboo are practical options for plants that can be grown in class.*

Phenomenon Explanation for Teachers

Astronauts can grow plants in space without any soil. The plants' roots just hang in the air and are sprayed with water periodically. This shows that water and air can provide all the materials that plants need to grow and make food for us to eat.

Phenomenon Explanation for Teachers

Plants can grow in just water without any soil. This growing method works when the plants' roots remain in water and their leaves always have access to air. This demonstrates that plants can get everything they need to grow from only air and water.

How Does the Phenomenon Connect to the DCI or PE?

Plants require water, light, carbon dioxide, some oxygen, and nutrients for growth. To perform photosynthesis, most plants use their roots to take water in, and their leaves absorb carbon dioxide and oxygen from the air. If a plant is growing in soil, the nutrients it needs become dissolved in the water as it passes through the soil. These nutrients then enter the plant through the water, not the soil itself.

In this way, if the water entering a plant's roots has nutrients in it already, then soil is unnecessary for growth. Plants can be, and often are, grown in systems that do not use any soil. As students observe their own plants grown in class with their roots in high-nutrient water (hydroponic) or NASA's system with roots hanging in the air and misted with high-nutrient water (aeroponic), they will see that these plants have access to just air and water and still grow successfully. Students can use both cases as evidence that plants require only air and water to acquire the nutrients necessary for growth.

Gathering Evidence and Using Reasoning to Construct and Refine Explanations

How can students gather evidence using Science and Engineering Processes (SEPs) and Crosscutting Concepts (CCCs) to help them construct and refine a supported explanation of the phenomenon?

Students collect observational data and use it to argue that plants' growth materials come chiefly from air and water.

1. Initial Engagement With the Phenomenon

For either phenomenon, students should make observations about the way the plants appear to be growing. Students note what resources the plants have access to, the locations of plant parts (e.g., where are the roots, stems, etc.), and the actual structures in which the plants are growing. Students create an initial claim and attempt to explain how the plants are accessing the nutrients they need to grow in these unexpected environments.

2. Continuing Exploration

Students create a list of things plants need to grow and compare these things with the resources that are available to the plants in the phenomenon. After comparing their list with their observations of the phenomenon, students revise their initial claim or create a new claim and use the evidence to explain it.

Guiding Questions

- How would you describe/define the system in which plants grow?
- What are the materials that plants need for growth?
- How do the materials move from the environment into the plant?
- Where are the nutrients coming from and where are they going?
- Why do plants need air and water?

Communicating Understanding Through Final Explanation of the Phenomenon

How might students communicate their understanding of the targeted DCI or PE in an explanation supported by evidence?

Students generate a final explanation of the phenomenon in the form of a final written revision or an alternate type of explanation. This final explanation should be done individually.

Possible Formats for Constructing Explanations of the Phenomenon

- Students create a model to demonstrate how an air or water growing system enables plants to take nutrients out of their environment and use them to grow. This model could be illustrated or constructed.
- Students write a paragraph using the Claim-Evidence-Reasoning (CER) strategy to explain why soil is not necessary for plants to access the materials they need for growth. Students use the observational data they collected during exploration of the phenomenon to justify their response.
- Students write a persuasive letter to convince someone who thinks soil is necessary for plants to grow that air and water are the only resources that plants need to obtain the materials for growth.
- Small groups perform a skit or create a video of an evidence-supported argument in which they attempt to convince a friend that plants can grow with only air and water.