Plant Detectives

CIK 2017

OVERVIEW:
Students will explore the fascinating world of plants and trees while learning about photosynthesis in a whole new way. The forest offers many opportunities to learn about the diversity and significance of plants and trees. Students will understand how important producers are to the earth and that, through various connections, we are all dependent on plants to live.

OBJECTIVES:
Students will be able to:
- Summarize biotic and abiotic factors producers need in order to survive.
- Identify a diversity of local producers and their adaptations.
- Describe the interdependence producers have within their ecosystem.
- Summarize the interrelationship between producers and our communities

VOCABULARY:

Abiotic Factor	Biotic Factor	Carbon Cycle	Chlorophyll
Chloroplast	Conifer	Deciduous	Evergreen
Food Chain	Food Web	FWARPS	Habitat
Niche	Photosynthesis	Pollination	Producer
Root	Seed Dispersal	Transpiration	

NEXT GENERATION SCIENCE STANDARDS:
- Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2.A)
- The food of almost any kind of animal can be traced back to plants. (5-LS2.A)
- Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1)
- Science explanations describe the mechanisms for natural events. (5-LS2-1)
- Human activities in agriculture, industry, and everyday life have had major effects on the land [and] vegetation…but individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)
- Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. (5PS3-1)
- Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (MS-LS1-4)

MATERIALS:
scratch paper
pens/pencils
poker chips (at least 2 colors)
whiteboard/marker
one copy of The Grandpa Tree
at least 2 Ziploc Bags
water

PROCEDURES:
1. Introductory Activity: Adopt a Plant/Tree (found in activity glossary/activity video)
   A. *While facilitating Adopt a Plant, consider when you want to have students place Ziploc bags on plants for Transpiration activity [bags will need at least 15 minutes to accumulate water droplets]. Have your students hypothesize what they think will happen with the bags.*
   B. Debrief: Have a few students share their work. Ask them: What are some similarities of all the students' plants? What are some differences with the plants? Why is it healthy to have so many different plants in the forest? Use student examples to introduce layers of the forest.
2. Characteristics of a Plant Discussion
   A. Inform students that the plant/tree they adopted is called a **producer**. They produce the oxygen and food that animals need; some producers even produce their own food! Producers are at the bottom or base of the **food chain/web**.

B. Use students' producers from "Adopt a Plant/Tree" to describe the layers of the forest as a structure, asking questions while you explain to help students understand its function. The tallest trees form the canopy, they receive the most sunlight and protect the other layers of the forest from harsher winds and rain. Smaller trees, bushes, and shrubs form the understory, which provides habitat for many animals. What's left is the forest floor: decomposing leaves, animal scat, grasses, mushrooms, and tree seedlings. The floor is important for recycling the nutrients of these materials back into the soil.
C. Use the plants in the forest to come up with similar characteristics. All plants have branches, **roots**, stems, leaves (needles). Point out some **evergreen** plants (Pines/Firs, Manzanita,) and contrast them with some **deciduous** plants (Oaks, mesquite). Inform students that these trees are also similar. They have branches, roots… but what do you notice is different? Leaves/needles. Explain that they serve the same purpose, but leaves fall from the deciduous plants in the colder months (this will come up again later).
D. If plants are inherently similar, ask students what all plants need to survive. Begin discussion on **FWARPS** and connect it back to previous classes. Review **abiotic** and **biotic** factors. Use discussion of what plants need and how they get it to discuss impacts on resources for plants.
E. Activity: Transpiration
    i. *Wait at least 15 minutes before returning to check the bags.*
    ii. Sunlight moves water carrying dissolved minerals through plants by sweating water out of the leaves through **transpiration**, where it evaporates into the atmosphere. As water leaves the plant, it encourages new water absorbed by the roots to flow up the stem (or trunk) of the plant to replace water lost, just like a straw. During the day, the sun constantly sucks water out of the plant. A fully-grown tree can lose hundreds of gallons of water each day through this process. The clouds above rainforests are typically a result of transpiration.
    iii. Debrief: What are in the bags now? Water droplets. Where did they come from? Leaves. Why can't we see this happening all around us? Water vapor is small. Have students compare and contrast the amount of water droplets in each bag and hypothesize why those similarities and/or differences exist. What adaptation might plants have to help them conserve water?

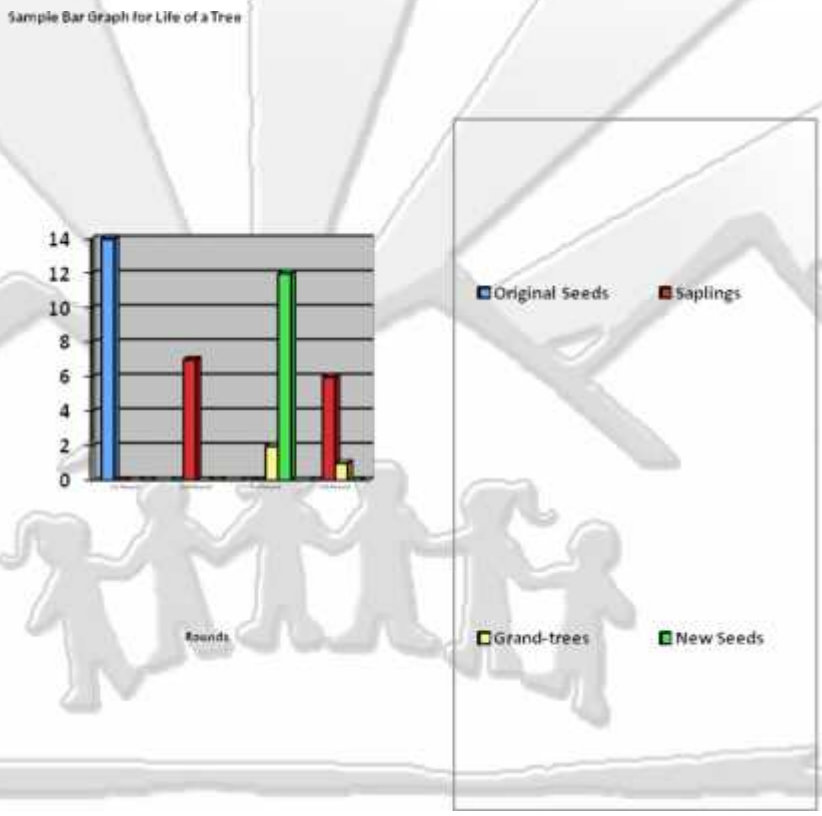
3. Role of a Plant Discussion
    A. Explain that a plant's **niche** depends on its **habitat**. The role of a tree in the desert may be different than a tree in the forest. Direct students to a pine tree. Ask them to brainstorm possible roles for that tree. Tie in the California state tree, the Redwood. The Redwood is the tallest tree in the world and can live to be over 3000 years old. It serves a niche of providing a home to many animals as well as being a host to bacteria in the soil. The Redwood is dependent on a very specific, moisture rich habitat, on the Northern coast of California.
    B. Ask students if they know how plants make food (many already know). Tell them that green plants need water, sunlight, carbon dioxide, and **chlorophyll** to produce their own food in a process called **photosynthesis**. Water, as well as minerals dissolved in the water, combines with captured sunlight and carbon dioxide in **chloroplasts** of the leaves, where BAM! glucose (sugar) forms. A by-product of photosynthesis is oxygen. Plants release oxygen into the atmosphere, and we use it to survive.
    C. Introduce the system of the **carbon cycle**.
        i. Demonstration: Carbon Cycle (found in activity glossary)
        ii. Debrief: What cycle is illustrated by this demonstration? Is this the only way carbon gets used in the environment? (No, burning fuel releases CO2, the ocean can absorb it before it gets taken in by plants, etc.) Have students hypothesize and discuss why the carbon cycle is important for photosynthesis?

4. Plant Relationships Discussion
    A. When do plants rely on other organisms for reproduction? **Pollination**. How? A bee, butterfly or other insect may go to a flower for food. Pollen sticks to the insect. As it flies from flower to flower, the insect unknowingly helps the plant reproduce. The plants cannot move; they don't have legs. Therefore, the insects are needed to make new flowers.
    B. Another way plants use other organisms to reproduce is **seed dispersal**. For example, when a **conifer** drops a pinecone, critters eat the seeds. Then what happens to the seeds? Animals poop them out as they travel through the forest. When an oak tree drops an acorn, a squirrel might pick it up. If that squirrel isn't hungry, it will bury the acorn. What happens if the squirrel forgets about it? It grows into a tree.

i. Activity: Grandpa Tree (found in the activity glossary)
ii. Read your group: Early in the day active students? Act it out. Late in the day tired group? Lay back, close eyes, and visualize.
iii. Debrief: Why was the grandpa tree so important to the forest? What would happen if trees never died? What happened to at the end of the story? Why did the end of the story sound like the beginning?

5. *Experiment: Your Life As A Tree*
   A. Conduct experiment.
   B. Debrief: Ask the students how the population changed over time. Show them a graph to illustrate the cyclic relationship between the plant/tree growth and abiotic resources. Have students hypothesize what would happen to the development of forest plants if there were enough resources for all trees to grow then what would happen to that forest in a drought or wildfire. What does this experiment teach us about carrying capacity? What does it teach us about the life cycles of forested areas? What can we surmise about the causes/effects and management of wildfires?
6. Wrap Up
   A. [*What?*] Concisely review the major points of the lesson, all the way back from the introductory activity.
   B. [*So what?*] What was important for you to discover from the lesson? Why was it important for all of us to take this class?
   C. [*Now what?*] What can you now do with this information? What changes can you make in your life? What can you teach to others? Who will you tell? What will you say?
   D. Pass out beads after all students have contributed.

THINGS TO THINK ABOUT:
Special Needs: Children are curious. Watch what types of plants they may be touching.
Weather: You can read the story indoors if inclement weather exists.



The Grandpa Tree

Mike Donahue

One day a bird was flying through the sky with a seed in its mouth, when a moth flew by. The bird dropped the seed and caught the moth.

The seed fell to the ground, rains came, and the seed soon began to grow. Tiny green branches stretched towards the sun. The sun was good to the new tree. His tiny branches became bigger and stronger and stretched even further towards the sun.

Soon summer was over and fall came. Fall was a fun time for the tree. All day long a breeze would toss dry leaves onto the tree's branches. The little tree would shake until the leaves would once again fall into the wind. Play ended as snows came. Snow fell and fell, and got deeper and deeper until the little tree was completely covered.

Seasons came and went. Years went by, and the little tree grew into a big tree. Squirrels played in his branches, birds built their nests, and baby birds sang their first songs. Pine cones grew and fell from the big tree. Soon around him new baby trees were stretching their tiny green branches towards the sun.

The big tree grew until he was the biggest tree in all of the forest. His strong branches wrestled with the fierce winter winds, slowing them down to make them play gently with the baby trees below. Armloads of snow piled high on his boughs, while little handfuls rested gently on the small young branches.

During the hot summer suns, the big tree's long branches reached out with shade for the tender young trees.
As the big tree grew old, the bay trees grew up. Squirrels played in their branches, birds built their nests, and baby birds sang their first songs. Pine cones grew and fell from the new trees. Soon, their baby trees were stretching their tiny green branches towards the sun.

The branches of the old grandpa tree were no longer needed by the younger trees. What they needed now was room to grow. One at a time, the old grandpa tree dropped his great branches to the ground, making room for the younger trees. The younger trees grew until they were the greatest trees in all of the forest.

One winter day the old, old grandpa tree began to rock and creak in the wind. He called to all of the younger trees and he said: "Once I was the greatest tree in all of the forest, just as you are now. My branches were big and strong. They could wrestle with the fiercest of winter winds, hold up under the heaviest snow, and block the hottest sun. You were baby trees then, and I watched you grow. As your branches grew strong and needed more room, mine dropped to the ground."

"Now I am needed on the ground, to be a home for rabbits and food for the flowers. So, my children, remember the youth. As they also need room to grow, leave them a world where their branches can spread as freely and gently as yours do now."

At that moment a great wind swept through the forest. CRASH- the grandpa tree fell to the ground.

Soon a mother rabbit was building a home under the grandpa tree, and baby rabbits were playing on his trunk. Ants were building their home also, biting little bits of sawdust, and dropping them from their doorstep.

The sawdust mixed with dirt, and became food for flowers. Soon the old tree was surrounded by beautiful colors. More rabbits played on his trunk and more ants dropped sawdust from their doorsteps. The grandpa tree became just a brown streak on the ground.

One day a bird flew through the sky with a seed in its mouth. A moth flew by and the bird dropped the seed and caught the moth. The seed landed right beside the old grandpa tree. Rains came. And soon little green branches were stretching towards the sun.