

the
**GIVING
GROVE**

CLASSROOM LEARNING ACTIVITIES FOR ELEMENTARY STUDENTS

NUTRITION FROM TREES

ENVIRONMENTAL BENEFITS OF TREES

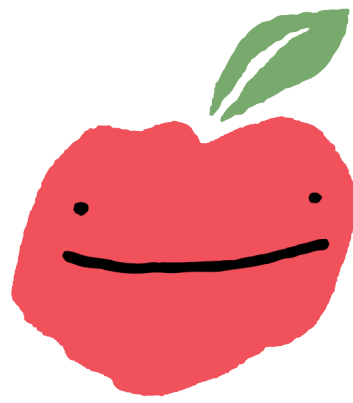
SOIL BIOLOGY FOR GROWING HEALTHY TREES

TREE BIOLOGY FOR MAINTAINING HEALTHY TREES

Curriculum provided by Kansas City Community Gardens
and sponsored by EPA Region 7

300 WEST 39TH STREET, KANSAS CITY, MISSOURI 64111

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ELEMENTARY TABLE OF CONTENTS

SECTION THREE: ENVIRONMENTAL BENEFITS

Lesson 11: Trees Conserve Energy

Lesson 12: Trees Provide Habitats and Shelter

Lesson 13: Trees Prevent Erosion

Lesson 14: I Speak for the Trees

Lesson 15: Urban & Community Forests

Lesson 16: Threats to Healthy Trees

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TREES CONSERVE ENERGY

Lesson Objective: The Learner will identify ways that trees help to conserve energy.

Key Questions: Why is the temperature cooler in the shade vs. in the sun? How do trees help us to conserve energy?

Background Information:

One-quarter of the forest canopy in the United States is found in urban counties. The trees planted within our communities are known as our “community forest” or “urban forest.” One of the more measurable benefits trees provide is energy conservation. On a community-wide scale, shade trees help reduce the “heat-island” effect caused in urban centers by buildings and pavement, which absorb light energy and reflect it as heat.

Trees conserve energy! Three trees placed strategically around a single-family home can cut summer air conditioning needs by up to 50 percent. By reducing the energy demand for cooling our houses, we reduce carbon dioxide and other pollution emissions from power plants.

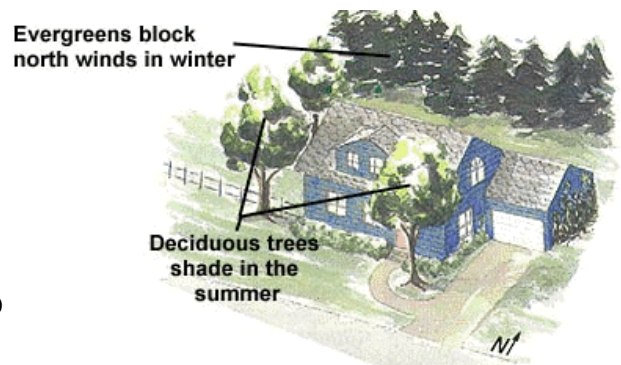
Trees save energy in several ways. Tree leaves absorb light energy, thereby reducing reflected heat. They also absorb water through their roots and release moisture through the leaf surfaces by a process called evapotranspiration, which cools the air in much the same way our skin cools us through the process of sweating. Trees can reduce the surrounding air temperature by 9 degrees F and the temperature directly under the tree as much as 25 degrees F. It only takes a hot summer day to send us looking for the shade of a tree and its cooling benefits!

Trees can be strategically planted to take advantage of their energy-saving benefits. Properly placed trees can effectively reduce the solar heat absorbed by buildings and reduce cooling costs by 30 percent. Large-growing deciduous trees are the best choice for shading and cooling. During summer, their leaves block the sun and provide shade, yet during winter months the sun passes through the leafless canopy. Placing trees on the south and west sides of your house can take advantage of the shade they provide, especially if they are planted to shade the building during the hottest part of the day or early evening. Trees with a broad canopy will provide the greatest shading benefits. A combination of large and smaller trees can be used on the west side of a building to reduce the late afternoon heat and glare when the sun is at a lower angle.

Shading other impervious surfaces such as driveways, sidewalks, streets and parking lots also can significantly improve the microclimate around your home by reducing glare and reflected heat. And if your air conditioner is not located in a shaded area, consider planting a small tree or large shrub nearby to shade the unit. Shading an air conditioning unit can increase its efficiency by 10 percent.

You can even plant shade trees for your sidewalk and driveway to keep sunlight off the hard paving and thereby lower local temperature without shading your house at all.

Trees also shield people from ultra-violet rays. Skin cancer is the most common form of cancer in the United States. Trees reduce UV-B exposure by about 50 percent, thus providing protection to children on school campuses and playgrounds - where children spend hours outdoors.



Materials:

Outdoor area with shade trees

Outdoor thermometers

Science journal

Activity Page “Made in the Shade”

Learning Activity:

- A great activity to educate your students about the cooling effect of shade is to measure the temperature difference between shaded and non-shaded areas. The general gist of this activity is to put thermometers in areas of direct sunlight and in the shade of trees and measure the temperatures in both locations.
- Select 3 or 4 locations, close to each other: one area shaded by a man-made structure, one area shaded by a tree (or 2 areas, each shaded by a different type of tree), and one area in direct sunlight.
- Place a thermometer in each location (thermometers should be of the same kind).
- Check temperatures at regular intervals. Be sure shady places stay shady during temperature measurements.
- Carefully record all observations and measurements.
- Repeat the above process on another day, under the same conditions and in the same locations, but switch the thermometers around.
- Have blindfolded volunteers spend one minute in each shady area, with at least one minute of exposure to direct sunlight in between.
- Ask students which (if any) type shade they preferred.
- Analyze the data. Interpret your findings.
- Show results visually using charts and graphs. For younger students, use the Activity Page “Made in the Shade”.
- Display any interesting photos taken throughout the course of the experiment.
- You can increase this activity’s degree of difficulty by incorporating graphing exercises. If your science department has some light sensing and data logging equipment, this could be used to compare light levels and temperature, and the relationship between these variables.



Additional Resources:

Lesson adapted from <https://www.education.com/science-fair/article/made-in-the-shade/>

<https://www.thefencepost.com/news/trees-help-consume-energy-in-several-ways/>

<https://www.plt.org/educator-tips/activities-explore-uses-trees/>

MADE IN THE SHADE

Use an outdoor thermometer to gather outdoor temperature data in various locations at different times of the day. Choose a location next to a building, under a shade tree, and in direct sunlight. Graph your findings.

TEMPERATURE DIFFERENCES

| | | | | | | | | | | | | |
|-----------------|--|-------------------------|-------|-------|--|---------------|-------|-------|--|-----------------|-------|-------|
| 100° | | | | | | | | | | | | |
| 90° | | | | | | | | | | | | |
| 80° | | | | | | | | | | | | |
| 70° | | | | | | | | | | | | |
| 60° | | | | | | | | | | | | |
| 50° | | | | | | | | | | | | |
| 40° | | | | | | | | | | | | |
| 30° | | | | | | | | | | | | |
| 20° | | | | | | | | | | | | |
| 10° | | | | | | | | | | | | |
| 0° | | | | | | | | | | | | |
| TEMPERATURE (F) | | Time: | Time: | Time: | | Time: | Time: | Time: | | Time: | Time: | Time: |
| | | LOCATION ONE: | | | | LOCATION TWO: | | | | LOCATION THREE: | | |
| | | LOCATION OF THERMOMETER | | | | | | | | | | |

Why is there a temperature difference between areas in the shade vs. the direct sunlight?

What are some conclusions that you can make from the data you collected?

TREES PROVIDE HABITATS AND SHELTER

Lesson Objective: The Learner will investigate the various ways that trees (living and dead) provide habitats and shelter for animals, organisms, and humans.

Key Questions: How do living trees provide habitats for animals/organisms? What are the similarities/differences in the ways that trees provide shelter for humans vs. animals? How do dead/decomposing trees provide habitats?

Background Information:

From their leafy branches to their tangled roots, trees provide a habitat for a host of plants and animals. Trees provide shelter for people, too!

It is only natural that wherever trees are planted, wildlife and other plants are sure to follow. Trees provide shelter and food for a variety of birds and small animals, such as squirrels and beavers. Enhancing growth diversity, trees create an environment that allows the growth of plants that otherwise would not be there.

Flowers, fruits, leaves, buds and woody parts of trees are used by many different species. Bacteria and fungi contained in tree parts cause decay which makes nesting easier for some birds and increases soil fertility and structure for furrowing by other land animals.

Trees also provide shade, reduce water and air temperatures and contribute to the overall health of aquatic ecosystems by providing habitat, shelter and food for aquatic species such as turtles, otters, beavers and fish.

While dead trees may not be the most attractive part of a forest, they are essential to its health. As dead wood is decomposed (by fungi, bacteria and other life forms) it aids new plant growth by returning important nutrients to the ecosystem.

And those seemingly dead trees are actually teeming with life! Logs (dead trees on the ground) and snags (standing dead trees) play a vital role in the lifecycles of hundreds of species of wildlife, providing a place to nest, rest, eat and grow. A few examples you may have seen:

- Some eagles, hawks and owls use snags or dead branches to get a clear view of potential prey when hunting. Similarly, certain birds that engage in flycatching (catching flying insects directly out of the air) will use these perches to launch their aerial attacks.



- Snakes use logs to sun themselves in summer to help regulate their internal temperature. Logs also provide snakes with a place to hide, find a meal or (for some) hibernate for the winter.
- Many woodpeckers nest in cavities excavated in snags (or dead parts of living trees) while using those same dead trees to drill for food.
- Some mammals—including tree squirrels, opossums and raccoons—use dead trees as nesting sites.
- Salamanders in our area use rotting logs or stumps as both shelter and a source of food.
- Many species of fungi grow only on dead wood, breaking it down and returning important nutrients to the soil. And that’s not taking into account the many living things (from microscopic bacteria to insects) that may escape your glance.

Materials:

Magnifying glasses Nature walk around playground/park Science journal
 Sections of a decomposing tree Activity page “Trees Provide Habitats and Shelter”

Learning Activity:

- Where do you live? A habitat is the place where a plant or animal can get all the things it needs to survive.
- The next time you pass by a tree, think of it as a habitat, or living space.
- While observing a tree, have children learn about the different ways plants and animals can find food, water, shelter, and living space by asking:
 - ⇒ What are some plants and animals that depend on trees?
 - ⇒ What do trees provide for these plants and animals?
 - ⇒ Can you see signs of life on the trunk, branches, roots, and leaves? (Have children look on the ground around the tree for fallen leaves, twigs, bark, seeds, fruits, or nuts.)
 - ⇒ How is a tree affected by the plants and animals that live on it? (they may benefit, harm, or be neutral to the tree)
- Even snags, or standing dead trees, provide habitat for a number of different species.
 - ⇒ Tree frogs and beetles live under a snag’s bark.
 - ⇒ Woodpeckers and other birds feed on the insects that live in snags.
 - ⇒ Chickadees nest in cavities created by woodpeckers.
 - ⇒ Squirrels and deer mice store food in them.
- In what ways do dead/decomposing trees provide habitats?
- If possible, allow children to use hand lenses or binoculars to get a closer look.
- Ask them to use their sense of hearing to locate more plants and animals.
- Finally, compare a tree to your own home, or habitat. How are they alike or different?
- Have students complete the Activity Page “Trees Provide Habitats and Shelter”.

Lesson Extension:

Tree Houses

Cast your mind back to when you were a child. Perhaps one of your more memorable pastimes was building and playing in a treehouse. Whether they build it in the backyard or a secret forest location, kids love designing and building their own treehouses. Why not turn that into a learning experience at home or at school?

Some students enjoy designing their treehouse on programs such as SketchUp or simply drawing them by hand. Others like to build a model of their treehouse, using old or recycled craft materials. Older kids may like to add dimensions to their design and create a floor plan for a real livable treehouse; especially one that incorporates sustainable and environmentally-friendly design features. Either way, exploring school grounds or a local park can help inspire your students' imaginations for their own treehouse design.



Lesson Extension:

Animal Habitat Research Projects

Of course, trees provide shelter for a wide range of different species. Have students investigate and research animal habitats. Dioramas are a great project idea because they allow students to not only research their habitat of choice, but also recreate its features.

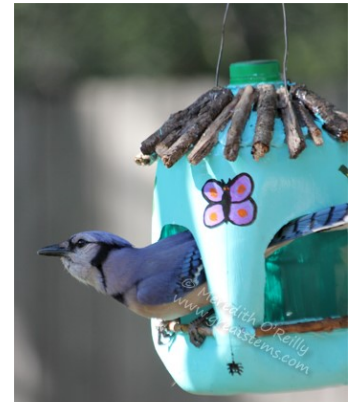


Lesson Extension:

Bird Houses

First, take your students on a walk through a local park or the school grounds. Look out for natural bird houses or potential bird house locations. Focus their attention on how trees provide the structural support and protection that birds need to build a home. Then, transition into a bird house design and building activity.

Encourage your students to give some thought to the challenges facing birds when they construct their own places to live. For example, students will need to take into consideration how birds will enter and exit the birdhouse, what materials are best to use and why, and how to hang their bird houses from the tree itself.



<http://www.greatstems.com/2013/05/wildlife-projects-for-kids-milk-juq-bird-feeders.html>

What could you do to attract bees and bats to your school orchard?

Additional Resources:

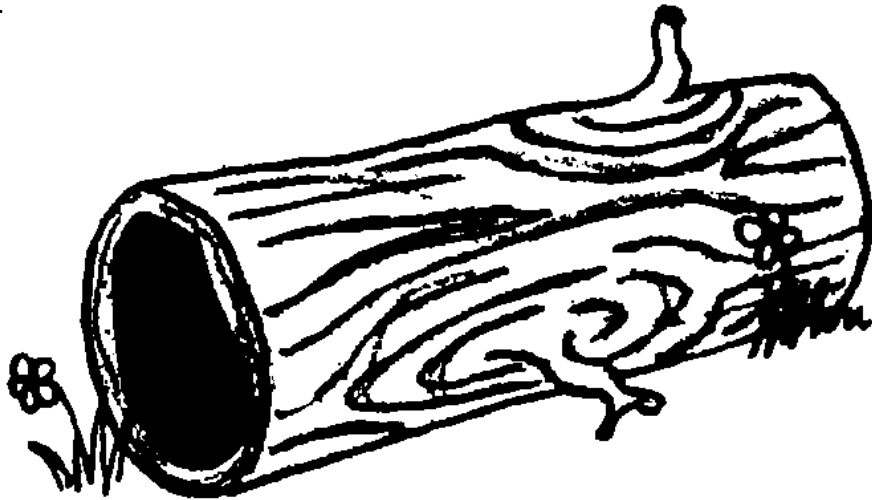
<https://www.plt.org/educator-tips/activities-explore-uses-trees/>
<http://fpdcc.com/did-you-know-dead-trees-play-an-important-role/>

TREES PROVIDE HABITATS and SHELTER

Add details that demonstrate how a living tree provides habitats and shelter for animals and organisms.



Add details that demonstrate how a dead tree provides habitats and shelter for animals and organisms.



How do trees provide shelter for people? How many different ways can you think of?

TREES PREVENT EROSION

Lesson Objective: The Learner will identify causes/effects of soil erosion, explain how trees/plants can reduce erosion/run-off, and draw conclusions about the best ways to reduce erosion.

Key Questions: What events in nature might cause dirt or soil to be moved from one place to another? Why is it important for dirt or soil to stay in its place in our natural environment? What things can be done to help keep soil in its place?

Background Information:

Trees reduce the effect of erosive forces using their root systems and foliage. Tree roots begin as thick stems that branch into fine filaments to create a network of flexible tendrils that help stabilize the soil around the tree and hold it in place. The leaves and branches of trees create a flexible screen that reduces the force of wind and rain in the surrounding area. You can increase the beneficial impact of trees on areas with eroding soils by planting them in groups.

Wind and rain are two of the main forces that erode bare soil. Droplets of rain water gain momentum as they fall which provides enough force to move particles of dirt when they reach the ground. Rain trapped on the surface of the soil can carry loose soil particles downhill under the influence of gravity. This problem is exacerbated in areas of bare soil since the soil is exposed to full force of wind and rain. Bare areas exposed to strong winds can lose significant amounts of soil if the ground is dry and there are no roots present to hold the soil in place.

The root systems of most trees consist of several large roots that branch out into many smaller roots. The root systems of many trees extend out into the surrounding soil far beyond their branches. These roots hold the soil in place and improve the drainage of the soil. The roots prevent soil compaction and help water soak into the ground instead of flowing over its surface. Tree roots tend to grow more deeply than other plants and provide a greater resistance to erosion on hillsides than grasses and other small plants.



Tree foliage intercepts falling rain water and reduces the force it exerts when it hits the ground. Rain water caught in a tree's foliage is channeled over the stems and down the trunk until it soaks into the soil. This process helps rainwater penetrate the soil instead of washing over it and reduces the force that falling rain drops exert on the soil. Although the area a single tree protects is limited, trees with broad foliage planted together can reduce the force of falling rain drops over a significant area.

Newly planted trees need to grow for several years before they will be large enough to have an impact on erosion. The best trees for preventing erosion allow grasses or cover crops to grow under their foliage while the tree is establishing itself. Trees with broad root systems that seek water aggressively help hold the soil in place, increase the amount of water that can infiltrate the soil and help prevent the soil from becoming saturated for long periods of time. The best trees for windbreaks have a rapid growth rate and dense foliage that significantly reduces the force of the wind. Trees that withstand crowding work well in windbreaks, since closely planted trees provide a more effective wind barrier.

Materials:

Pictures of various types of erosion

Science journal

Aluminum baking pans (at least 5cm deep and 40cm – 50 cm long) filled with dirt/soil

Large blocks or other means to raise one end of the pan so that it has a slope

Small blocks of wood (5cm – 20cm long, should fit easily within the pan)

Empty 2 liter bottle with cap (prepare cap by drilling small holes so that water comes out evenly)

Large plastic tubs to catch runoff

Small plants, maybe seedlings or tufts of grass with the roots attached (keep the roots moist)

Craft sticks or other sticks that can be planted in the soil

Plastic wrap or other materials that students can experiment with in controlling soil erosion

Learning Activity:

- In this lesson, students will investigate the role plants, grasses and trees have in preventing soil erosion. Soil erosion can be damaging because soil, chemicals and other particles travel into water sources. After students discover that planted material can help keep soil in place, they will extend their understanding of run-off by exploring ways that people in their community can keep chemicals and dangerous substances out of our streams, rivers, and oceans.
- Show students a small pile of loose dirt on a table in the classroom, as well as an oscillating fan and a garden hose or bucket of water. Ask students to predict what might happen if either of the items were used on this pile of dirt.
- Show students various images of erosion (building sliding off a hill, farmland erosion, geographical formations caused by erosion). Ask what might have shaped the rocks. What happened to this building? Why are the tufts of grass sticking out above the rest of the land?
- Record students' thinking on a piece of chart paper. You will want to keep these comments and come back to the images once students have studied erosion more closely.
- Ask students the following essential questions: a. What events in nature might cause dirt or soil to be moved from one place to another? b. Why is it important for dirt or soil to stay in its place in our natural environment? c. What things can be done to help keep soil in its place? You may wish to have students record their thinking in science notebooks or record their responses on chart paper.



- This hands-on investigation is usually best done outdoors. (Indoors requires a plastic tarp to handle spills. Using a tarp is usually a good technique for outside investigation as well.) There are a few different options for this exploration, depending on what resources are available to you.
- Students should sketch the soil conditions before, during and after the activity in their science notebooks and label the parts. (Optional: Use digital cameras to photograph before, during and after. Students can download the images and add text to them for labels. The images can be projected so that all students can view the data.)
- The ideal exploration would take place outdoors either on a paved slope or sidewalk. If this is not available, a sloped plot of land where you can temporarily remove the grass material would be a good alternative. If neither of these situations are possible, this exploration can be done with a large aluminum baking pan filled with dirt and propped up to create a slope.
- Divide students into groups of three or four and ask students to predict what will happen to the soil if they pour the water down the slope.
- Now guide students in using the bottles with perforated caps to pour 2 liters of water onto the sloped surface mimicking rain, and observe the results.



Lesson Extension

- Have students try out some ideas for stopping or slowing erosion. They will repeat the soil erosion test, but this time make a different environment on the soil.
- Provide them with the variety of materials to try planted grass tufts, mulch on top of soil, soil with small plants. Have them predict how the different environments will withstand erosion and then instruct them to run their tests and record their results in their science journals.
- Be sure to have them repeat their data collection. If it is possible to use a digital camera, repeat the same camera angle and location for the photos so that they can be compared side by side with the base line test from the previous lesson.
- Students can share the results from their group with the whole class. Then, the class can compare the different materials used and determine the best environment for the least amount of soil erosion.
- To explore the difference between porous and impervious materials and how they may affect soil erosion runoff, repeat the hands-on investigation using sand or sawdust.



- Walk around your school grounds and neighborhood together to look for signs of erosion. Guide students in discussing why erosion may or may not take place in certain areas. How do plants and other turf effect erosion? When you get back to your classroom, display the photographs that the students took previously and lead a brainstorming session about how these specific plants effect erosion in your region.
 - ⇒ What benefits do these plants have on the environment?
 - ⇒ How do these plants protect your local ecosystem?
 - ⇒ Consider how your region is unique when compared to other regions of the United States, in regards to plants and erosion.
- Students can identify erosion control opportunities around their school or house and present a proposal to their school principal or parents. Guide students with the following criteria:
 - ⇒ Did the student identify and describe an area where erosion was a problem?
 - ⇒ Did the student draw or take photographs of the area?
 - ⇒ Did the student identify two possible solutions to the problem area?
- Students can create a “Do and Don’t” list for a school newsletter demonstrating their ideas about drainage and soil erosion to provide suggestions for preventing erosion to people in the community. Guide students with the following criteria:
 - ⇒ Did the student create a title and explain the purpose of the list?
 - ⇒ Did the student include at least 3 do’s and 3 don’ts in the list?
 - ⇒ Did the student make suggestions of how community members can make a difference for the environment?

Lesson Extension

Chocolate Chip Cookie Erosion Experiment

Materials: Chocolate Chip Cookies Q-tips Toothpicks Cups of water
 Paper plates Legos Activity Page “Erosion: Cookie Experiment”

- Assign students to groups of four and send them to their workspace. On their workspaces, have four cheap chocolate cookies (the cheaper the better for this exploration as they fall apart better!) Students record their observations for each exploration on their observation sheets.
- Give each group, three soak-resistant paper plates, three chocolate chip cookies, four Q-tips, four toothpicks, a small cup of water, and a timer.
- **Q-Tip Erosion (represents wind erosion):** Students place the first cookie on the first plate. They try to break the cookie up with the Q-tip. Not much will happen so let them try this method for about a minute. Students record their observations on their Activity Page “Erosion: Cookie Experiment”.



- **Toothpick Erosion (represents human impact on erosion):** Students place the second cookie on the second plate. They use their toothpicks to erode the cookie. Ensure that students wear goggles for this activity as pieces of cookie start to fly around. The toothpicks don't make much of a dent in the cookie, but things do begin to fly off when toothpicks are used. Students record their observations on their Activity Page "Erosion: Cookie Experiment".
- **Water Erosion:** On the third plate, students place the third cookie. Someone in the group is the timer. Students pour water onto the plate and time it for a minute. They lift the cookie gently to see if anything has changed. Students record their observations on their recording sheet. Students continue to time the cookie in the water for five minutes and record their observations on their Activity Page "Erosion: Cookie Experiment".
- Students record their conclusions about which form of erosion was quickest.
- Call students to the gathering area and tell them to stay in their exploration groups. Give each a 6 by 6 by 6 cube of legos. Each cube must be the same size, but could have different size pieces making it up. I tell them that this is their group's rock.
- I tell students that they will demonstrate erosion in a relay race. Students must break off one piece of lego, place it on his/her chest and crab walk it across the room to a specified location without dropping it. Students quickly realize that some groups have fewer pieces and may be making more progress than others that have small lego blocks in their rock.
- Once the game is played, call students back to the gathering area and discuss how the water eroded the cookie. Students observed that water broke down the cookie much faster and more efficiently than the Q-tip or toothpick. We discuss that water is a powerful force in the erosion process. Wind is more like the Q-tip, and human activity is like the toothpick.
- Once students have completed discussing the cookie erosion exploration, turn their attention back to the lego rock relay. Students may become heated again as they begin to discuss how fair or unfair the race was. Talk about the fact that not all erosion happens in a uniform manner. Softer rocks may break into bigger pieces while harder rocks may take longer or break off in smaller amounts during the erosion process. Students realize that this was the point of the erosion relay. They understand that not all erosion happens in the same way or at the same rate.
- What are ways that we can stop or slow down erosion? How do trees and plants help stop erosion?

Additional Resources:

Lesson adapted from

<https://www.hunker.com/12620837/how-can-trees-help-prevent-soil-erosion>

<https://betterlesson.com/lesson/644812/chocolate-cookie-erosion>

EROSION: COOKIE EXPERIMENT



When I used the Q-tip to erode the cookie, I observed:

When I used the toothpick to erode the cookie, I observed:

When I used the water for 1 minute to erode the cookie, I observed:

When I used the water for 5 minutes to erode the cookie, I observed:

My Conclusion:

I SPEAK FOR THE TREES

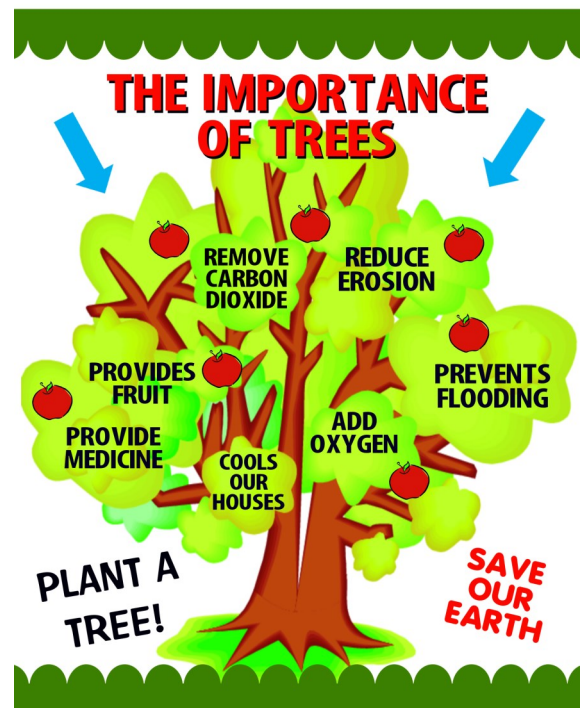
Lesson Objective: The Learner will identify the various environmental benefits of trees and describe his/her personal responsibility to care for trees.

Key Questions: How do trees benefit the environment? What would be the impact on your neighborhood/city if there were no trees? Am I responsible to care for trees?

Background Information:

Identify the great value trees bring to people by having the students identify the benefits that trees provide. List these benefits on a board or chart. Examples can include:

- Trees release oxygen into the air.
- Trees absorb harmful carbon dioxide from the air. (An acre of trees absorbs the amount of carbon produced by driving a car for 26,000 miles.)
- Trees give us shade from the sun and a cool place when it's hot. (Just three strategically placed trees can decrease utility bills by 50 percent.)
- Trees provide a home for wildlife and humans.
- Trees produce fruit and nuts for animals and humans to eat.
- Tree roots prevent soil runoff and eliminate it from washing away.
- Trees provide hundreds of products, which we use everyday (paper, benches, baseball bats, etc.)
- Trees break strong winds.
- Trees are used for medicinal purposes.
- Trees provide dyes and pigments.
- Trees increase humidity in dry climates through evaporation of water from their leaves into the atmosphere.
- Trees give us beautiful areas for camping, hiking, and playing.
- Trees clean the air by taking in carbon dioxide and releasing oxygen.
- Dead leaves and branches decompose to create enriching mulch and soil.



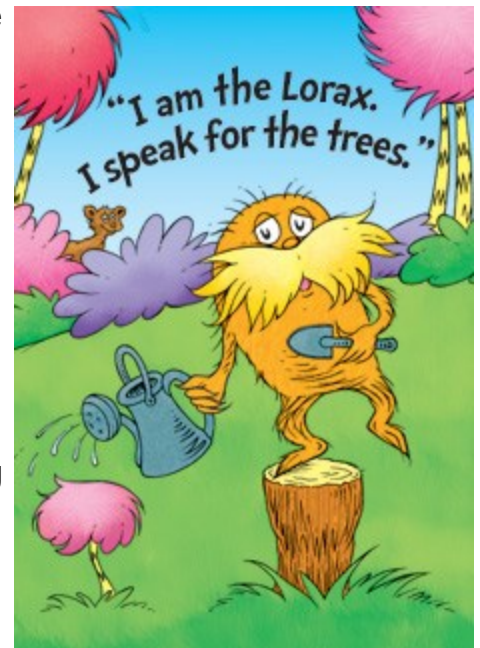
WHAT ARE SOME OTHER BENEFITS OF TREES?

Materials:

List of environmental benefits of trees Chart Paper Materials for students to create skits
Seeds from various trees Sticky Notes Activity Page "I Speak for the Trees"
The Lorax by Dr. Seuss It Could Still Be a Tree by Allan Flower

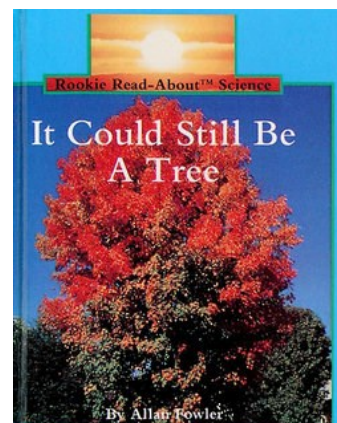
Learning Activity:

- Identify the great value trees bring to people by having the students identify the benefits that trees provide. List these benefits on a board or chart.
- Show the students a seed (such as a maple seed or acorn) and tell them to imagine that this is the only tree seed left in the world because all of the trees have been cut down to build important houses, stores and roads. Ask them to "think, pair, and share" their ideas about what they should do with this seed. (Guide them to think about the importance of trees to the world and how to ensure that this seed survives and grows more trees to replace the lost trees.) List their ideas on chart paper.
- Read aloud The Lorax by Dr. Seuss to the class. After reading, discuss the significance of the word "unless" in the story. Ask the students what their responsibility is to the trees of the world (the real world). Refer back to the list they made before reading and encourage them to add to their list of things they should do with the seed.
- Break the students into groups. Have them act out The Lorax, or have them create an original skit which highlights one of the many benefits that trees provide for us.
- The message of The Lorax will also provide an opportunity to discuss character traits such as selfishness. Ask students to name ways they think the characters were selfish. Ask students to describe some ways the characters could have been selfless for the common good.
- Ask students why it is important that citizens take responsibility for the common good. What would happen in their home, school, neighborhood if no one took responsibility for the common good?
- Use the Activity Page "I Speak for the Trees" to document students' learning.
- ENRICHMENT: Have students conduct further research on one of the benefits of trees. Have students create a presentation to share their research with classmates. Presentations can incorporate a variety of learning styles: Tri-fold board, PowerPoint, Slideshow, Skit, Commercial, Poster, Music/Song. Presentations are only limited by the student's imagination!



Lesson Extension:

- Take the students outside to an area with trees (or at least one tree). Tell them to collect fallen leaves, seeds, fruits, or flowers from the ground around the tree (to bring inside). Ask them to think of different uses/jobs of trees (climbing, shade, home for bugs, food for birds, material for chairs, etc.). Encourage creativity and wide thinking. Write their ideas on sticky notes (one idea per note). Pass the notes out to the students so they each have some notes to work with back in the classroom.
- Back in the classroom, have one student draw a rough outline of a tree on chart paper. The students should glue in an attractive manner the leaves, seeds, etc. onto the tree outline.
- Tell the students to read the ideas on the sticky notes and discuss how they could group the ideas in meaningful ways. When the class agrees on some basic categories (i.e. recreation, products, habitat), write those categories on the chart paper in and around the tree. The students place the sticky notes by the appropriate headings.
- Read aloud the book It Could Still Be a Tree by Allan Fowler or another book about the benefits of trees.
- Give students the opportunity to add more uses of trees to the chart from what they have learned from the book (use sticky notes).
- Tell the students that a community can be divided into four sectors that work together to provide goods and services for the citizens. Draw and label four quadrants on chart paper: FAMILY, BUSINESS, GOVERNMENT and NOT-FOR-PROFIT. Define each word/sector.
- Choose one sticky note from the tree chart and ask students to decide which sector would use/benefit from the tree for that purpose (e.g. climbing trees is probably done by FAMILY). Move the sticky note from the first chart to the new chart. Ask for volunteers to choose other sticky notes from the chart and put them on the new chart. Sometimes the group may decide that a sticky note/tree use fits in more than one category. Work out with the students how to solve that problem (e.g. write a duplicate sticky note or make a Venn diagram).
- Discuss how the new categories look quite different from the original chart. Discuss why you would organize the tree uses in this manner. Discuss in which sector trees are important. Guide students to recognize that trees are an important resource in many ways to many people and organizations (as illustrated in the book The Lorax) and that it is important for the sectors to work together to protect the trees for the common good.
- Invite a guest speaker who will speak to the class about trees. The speaker should present information about different types of trees, their benefits, their needs, and how students can be good stewards for the trees. After the speaker leaves, reflect with the students on the guest speakers' presentation and how they can apply what they learned to help trees.



Additional Resources:

<https://www.learningtogive.org/units/growing-our-future/speaking-trees#lesson-overview>

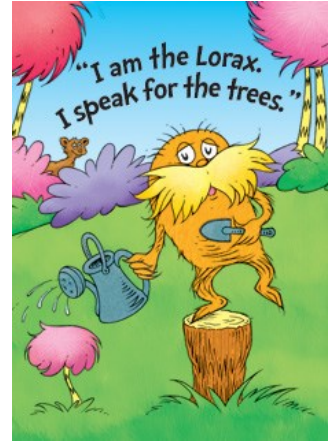
<https://www.arborday.org/trees/treefacts/>

<https://www.plt.org/educator-tips/activities-explore-uses-trees/>

I SPEAK FOR THE TREES

What are 3 ways that trees benefit the world?

1. _____
2. _____
3. _____



Draw a picture that shows how you can "speak for the trees".

How would my neighborhood/city be affected if there were no trees?

URBAN & COMMUNITY FORESTS

Lesson Objective: The Learner will describe the benefits of urban/community forests and explore various careers related to the study of trees.

Key Questions: What is an urban or community forest? Why are urban and community forests important? What are the career opportunities related to the study of trees?

Background Information:

What is an urban or community forest? An urban or community forest is comprised of trees and other vegetation in and around our communities, including the trees in our yards and along residential streets, in parking lots and along commercial thoroughfares, on school grounds, and in parks and open spaces.

Why are urban and community forests important? Healthy urban and community forests are integral to the ecological, economic, and social well-being of our communities. From cleaning our air and water to saving energy through cooling shade, from raising property values to rekindling neighborhood pride, from providing places for children to play to providing homes and food for wildlife, our communities' trees have a lot to offer. When selected, planted, and cared for properly, trees can improve the quality of our lives for decades to come.



Unlike the wildland forest that stretches uninterrupted by human activity for miles on end, the urban forest thrives around crowded highways, business complexes and conven-

ience stores from a single tree planted in the corner of a parking lot to the thick woods of a city park. The emerging trend toward the growth and care of urban forests is opening new doors of opportunity to fulfilling careers for city dwellers who love nature and want to play a role in preserving the delicate environment.



As more and more people are drawn into the urban environment, the need to reconnect with nature is becoming more acute and activities surrounding the urban forest are likely to expand. Positions within urban forestry encompass a broad spectrum offering opportunities for people of all interests, backgrounds, education and experience levels.

No matter if trees exist in the wildland forest or in urban and community forests, TREES PROVIDE JOBS! Some of the careers related to the study of trees include:

- ⇒ Arborist- Provides tree services to homeowners, commercial property owners, and cities and towns. A professional who studies trees. He/She helps people take proper care of their trees.
- ⇒ Forester- Cares for the land and sustains the long-term health of forests.
- ⇒ Park Planner- Plans all aspects of public park use.
- ⇒ Nursery Manager- Propagates, purchases, cares for, and sells potted trees, either wholesale or retail.
- ⇒ Tree Grower- Raises high-quality trees for wholesale and retail.
- ⇒ Urban & Community Forester- Cares for urban and community forest ecosystems within metropolitan and surrounding areas for the benefit of the residents. Helps to take care of the urban and community forests in a city/urban area.
- ⇒ Tree Trimmer- Provides tree care services to homes and businesses that promote optimal growth and correct problems with minimal damage.
- ⇒ Urban Planner- Coordinates and balances the complex relationships of a city. Develops a plan for cities (urban areas) to help find the best way to use their land to create a healthy community.
- ⇒ Lumber Harvester- Turns logs into lumber.
- ⇒ GIS Technician- Uses Geographic Information Systems (GIS) to manage resources and plan land-use.
- ⇒ Research Scientist- Expert in research related to trees. Seeks ways to optimize the performance of trees by studying the effects of variable conditions on trees.
- ⇒ Community Project Manager- Works with communities to implement urban and community forestry grant programs. Works with communities to find money to create urban and community forests.
- ⇒ Landscape Architect- Plans and designs private, public, and commercial green spaces.
- ⇒ Utility Arborist- Manages trees near utility lines.
- ⇒ Wildland Fire Manager- Prevents, suppresses, contains, and controls damage and injuries from fires.



WHAT OTHER CAREERS RELATED TO TREES CAN YOU THINK OF?

Materials:

Activity Page “Communities Need Trees” and “Trees Provide Jobs”

Learning Activity:

- Have students think about all the trees they see on an every day basis. Thinking back on how they use trees, have the students try to imagine their world without trees.
- Discuss the differences between wildland forests and urban/community forests. How do trees grow differently in populated vs. nonpopulated areas? Why is it important to have trees in urban areas? Can you think of place in your urban community/city where there are forest areas or green spaces?
- Each student will have the opportunity to act as a urban and community forester. He/she will be given eight trees to plant in a community where no trees exist. Using the Activity Page “Communities Need Trees”, students will plant (draw) their eight trees where they feel the trees would be most beneficial.
- Have the students number their trees as they draw them and then describe their rationale below the map.
- Whether trees exist in the wildland areas, or in the urban areas, there are many career opportunities related to trees. What jobs/careers can you think of that involve trees? Brainstorm a list together.
- Have students complete the Activity Page “Trees Provide Jobs”. For a more interactive approach, cut apart the boxes with the name of the job and the job description. Pass out a card to each student and have them find their “match”.
- Students can complete a more in-depth research project by choosing a career field related to trees and interviewing someone who holds that job.
- Ask students, “If you were to choose a job working with trees, which one would you pick? Why? What are things about your personality that would fit well with that job? What do you think would be the challenges of this job?”

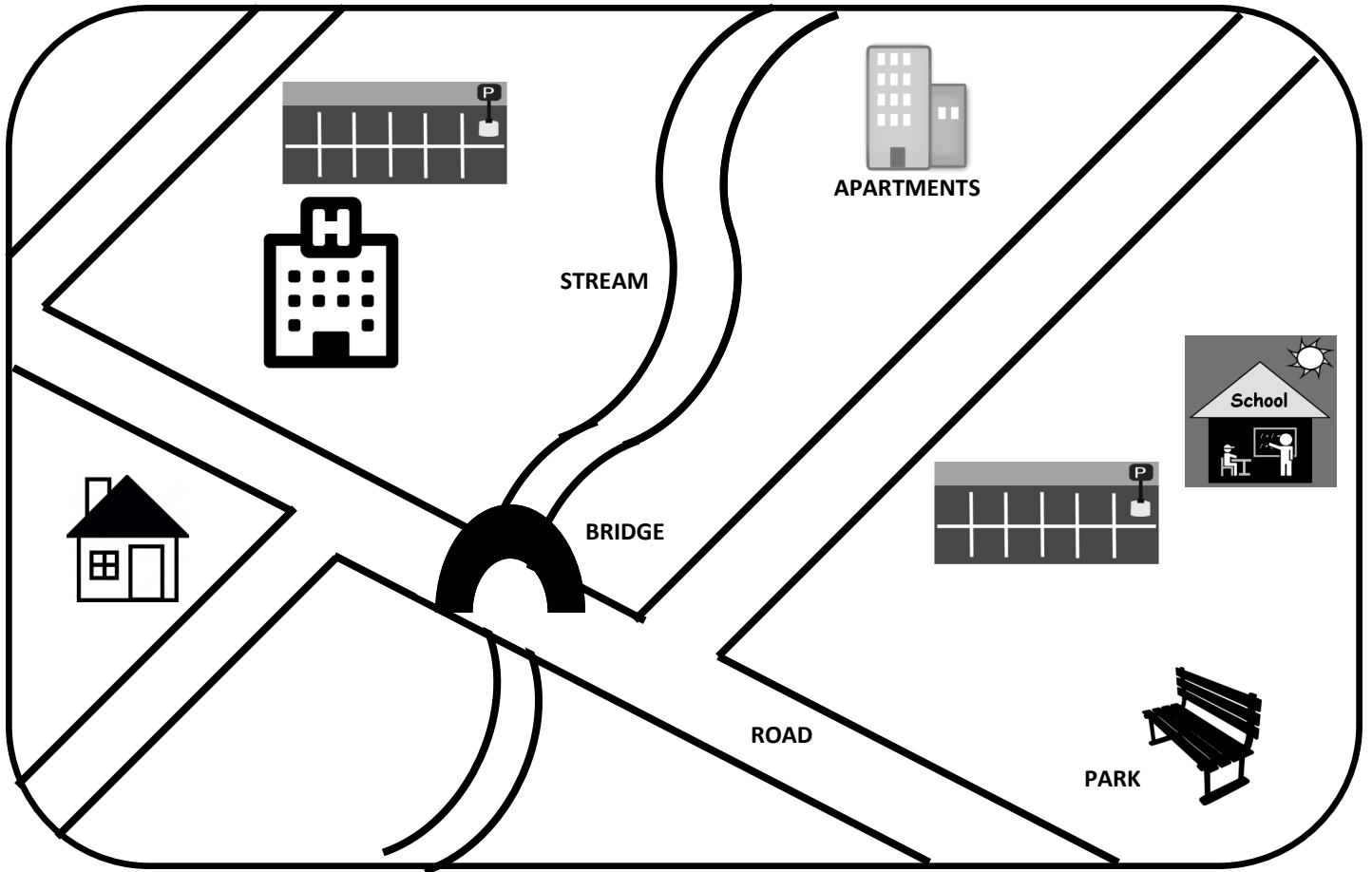
Additional Resources:

<https://californiareleaf.org/wp-content/uploads/2010/12/2011-Arbor-Week-Poster-Contest.pdf>

<http://www.urbanforest.org/index.cfm/fuseaction/Pages.Page/id/430>

<https://friendsoftrees.org/blog/the-value-of-city-trees-to-wildlife-and-people/>

COMMUNITIES NEED TREES



Your job as an urban and community forester is to plant (draw) 8 trees in this urban community. Think about where the best location may be for each tree.

Number the trees you place on the community map and describe why you planted the tree in that particular location.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

TREES PROVIDE JOBS

Can you match the job title to the job description? Which tree career would you choose?

ARBORIST

Raises and sells high-quality trees.

FORESTER

Plans and designs outdoor green spaces, like parks and playgrounds.

**WILDLAND FIRE
MANAGER**

Helps to take care of the urban and community forests in a city/urban area.

TREE GROWER

A professional who studies trees. He/She helps people take proper care of their trees.

TREE TRIMMER

Works with communities to find money to create urban and community forests.

URBAN PLANNER

Turns logs into lumber.

LUMBER HARVESTER

Provides tree care services to homes and businesses so trees will grow healthy and look attractive.

**RESEARCH
SCIENTIST**

Cares for the land and keeps the forests healthy.

**COMMUNITY PROJECT
MANAGER**

Prevents the spread of forest fires and helps keep people/animals

**URBAN & COMMUNITY
FORESTER**

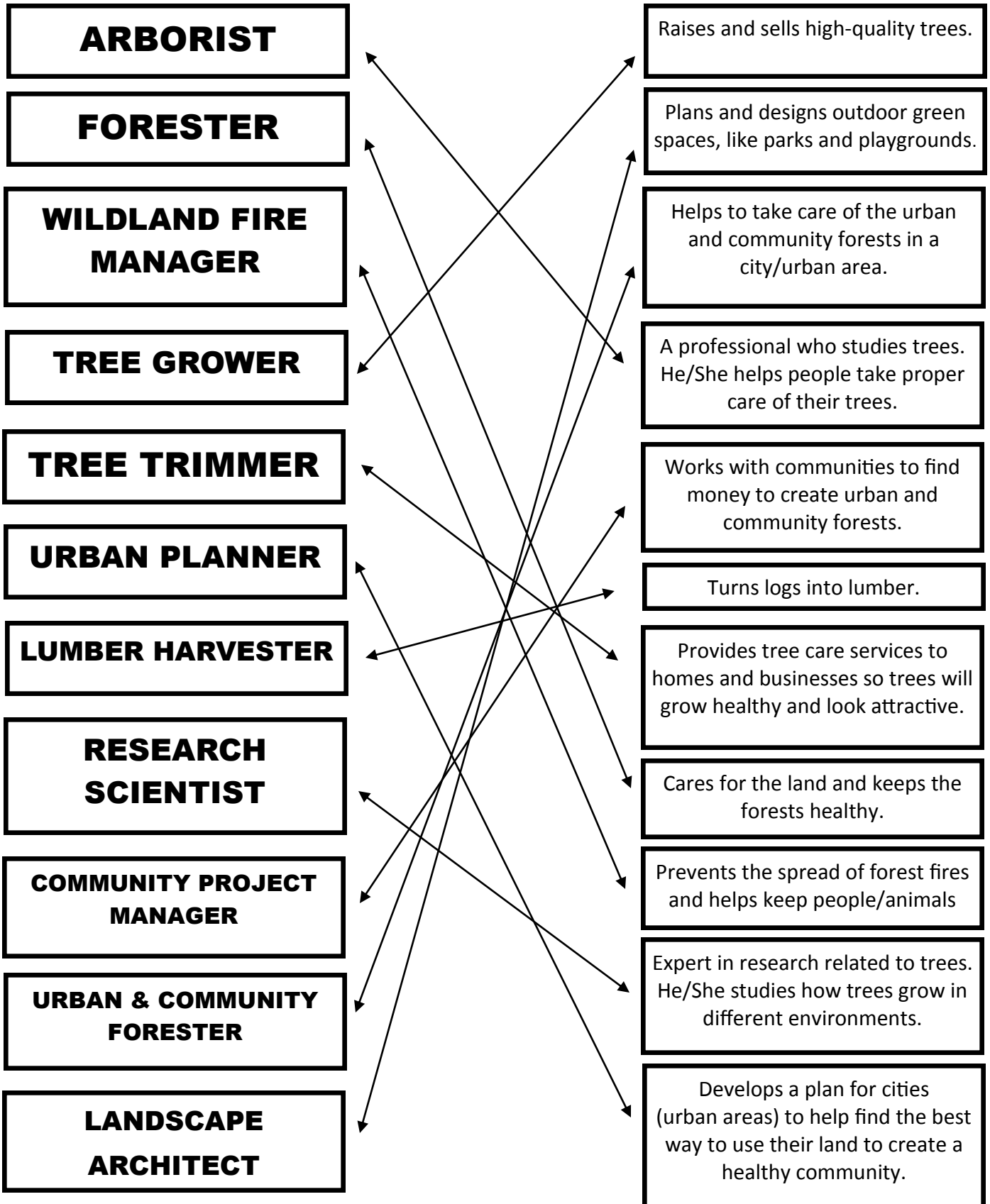
Expert in research related to trees. He/She studies how trees grow in different environments.

**LANDSCAPE
ARCHITECT**

Develops a plan for cities (urban areas) to help find the best way to use their land to create a healthy community.

TREES PROVIDE JOBS

Can you match the job title to the job description? Which tree career would you choose?



THREATS TO HEALTHY TREES

Lesson Objective: The Learner will describe the various symptoms of trees that are not healthy.

Key Questions: What makes a tree sick? How can you tell if a tree is healthy or sick?

Background Information:

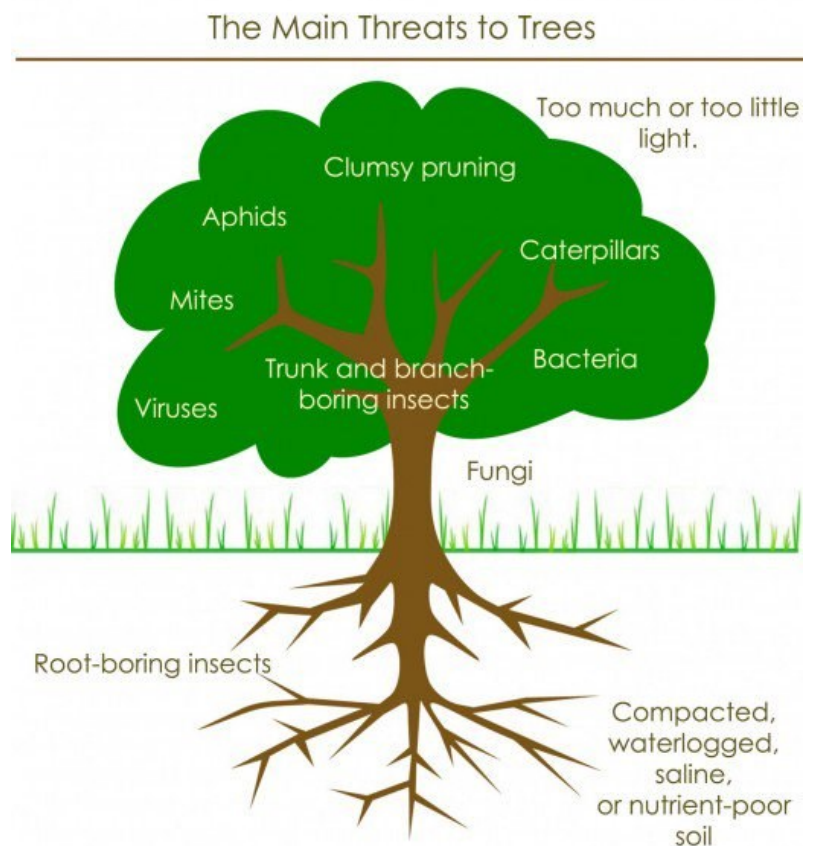
Trees can live for a very long time. A Great Basin bristlecone pine that recently died in California was 4,845 years old. Clearly, though, no tree is immortal, and some die a long time before they are fully grown.

If a tree that you care about is obviously struggling to survive, here is a little help in understanding the issues from a biological perspective. Good gardeners, and anyone interested in tree welfare, can benefit from a little science!

Did you know that most tree problems result from a combination of factors? Insects and diseases often get the blame for killing trees, but factors like drought or construction damage are most likely the primary cause of a tree's death. These primary factors weaken a tree's defenses, making it more susceptible to attack by secondary invaders like insect borers and wood-decaying fungi.

What are the main enemies of trees?

- environmental stress (water shortage, poor soil, excessive wind, too much or not enough light, for example)
- insect pests that eat or damage tissues
- mites, especially spider mites
- those fungi that can attack living trees
- bacteria
- viruses
- invasive species and exotic diseases
- some large mammals, like bears, deer, and rabbits
- human beings
- lightning



Countless insects live on, in, and around trees - many are harmless, while others can cause fatal damage. Below is a general description of the three main types of insects that affect trees.

Chewing Insects

Defoliating insects migrate to the foliage of a tree and feed on the leaves. Other chewing insects attack the fruit. Caterpillars and beetles make up the largest proportion of chewing insects.

Generally, trees can bounce back from an attack of these defoliators, though repeat infestation will weaken a tree and can eventually kill it by starving it of energy.

Examples include: Spring and Fall Cankerworm, Tent Caterpillar, Gypsy Moth, Leafminers, Bagworm, Japanese Beetle, Apple Maggot, Cherry Fruit Worm



Healthier trees are less likely to become infested, so maintaining the strength and vitality of your tree is an important prevention step. Once chewing insects are present, controlling movement up and down the stem with physical barriers can interrupt the lifecycles of many caterpillars.

Boring Insects

Boring insects are often the most harmful to trees and if left untreated can cause death. Boring, or tunneling, insects cause damage by boring into the stem, roots, or twigs of a tree. Some lay eggs which then hatch and the larvae burrow more deeply into the wood blocking off the water-conducting tissues of the tree. Boring insects generally feed on the vascular tissues of the tree. If the infestation is serious, the upper leaves are starved of nutrients and moisture and the tree can die. Signs of borer infestation include entry/exit holes in the bark, small mounds of sawdust at the base, and sections of the crown wilting and dying. It is important to regularly monitor a tree's trunk for signs of boring insects to enable early identification and quick treatment.



Examples include: Asian Longhorned Beetle, Bronze Birch Borer, Dogwood Borer, Elm Bark Beetle, Emerald Ash Borer, Giant Palm Weevil, Greater Peach Tree Borer

The key is to prevent infestation by keeping the tree as healthy as possible. This includes proper pruning, watering, mulching and fertilization. Pruning should be done in late winter to avoid attracting insects to open wounds. Dead or fallen wood should be removed immediately. Once borers are present, control becomes extremely difficult, but steps should be taken to prevent further damage and to stop the spread to surrounding trees.

Sucking Insects

These insects do their damage by sucking out the liquid from leaves and twigs. Many sucking insects (e.g. scale insects) are relatively immobile, living on the outside of a branch and forming a hard protective outer coating while they feed on the plant juices in the twig. Quite often they will excrete a sweet, sticky substance known as honeydew which contains unprocessed plant material. Honeydew can cause sooty mold to form on leaves and can become a nuisance for homeowners. Signs of infestation include scaly formations on branches, dieback of leaves, and honeydew production.



Examples include: Scale Insects, Aphids, Leafhoppers, Spider Mites, Thrips

As with other insect infestations, prevention is the best approach. This means maintaining a strong and healthy tree. Once they mature on the tree, sucking insects generally must be killed on contact to prevent reproduction and achieve effective control.

These are symptoms of common tree diseases in Missouri:



Leaf Spots

- Spots appear on leaves on all parts of the tree
- More spots appear later on in the season
- Spots spread to other trees

Probably the most common disease found on trees in Missouri is leaf spots. This is a simple fungal infection that doesn't actually do much damage to your tree. This is because there is still plenty of leaf real estate for carrying out the basic functions of a tree, including photosynthesis.

The only time you really need to worry about leaf spots is when there is a severe defoliation. Leaf spots can return the next year on the same tree.

Root Rot

- Deterioration of the roots seen outside of the soil
- Random parts of the tree starting to die
- Yellow, curling leaves or mushrooms appear toward the base



Root Rot is a tricky disease to catch because so much of it occurs under the ground. Many different fungal diseases cause root rot. By the time we see physical symptoms of the disease, it is often too late to save it. Even worse, the tree can die extremely quickly without enough time for you to find it. That is why it is so important to contact a tree care professional – the roots and stump will stay poisonous and infect other trees. The best way to prevent root rot is to keep your trees as healthy as possible. A healthy tree with enough nutrients and water getting to the tree will help to prevent root rot from taking over.

Fire Blight

- Blossoms die extremely quickly
- Amber colored liquid appears on the bark
- Stems, bark, and leaves look like they are burnt.



Fire Blight can be one of the grossest diseases your tree will get, if you don't catch it quickly enough. In the early spring months, Fire Blight will make your trees start to turn yellow and cause blooms to die after only a few days. After a few weeks, your branches and leaves will look like they've been burnt. Then the disgusting part happens. Your tree will start to ooze a liquid as it tries to repair itself. The liquid is actually bacteria that is somewhat sticky and resembles sap, but that isn't what it is. Once your tree starts to ooze that liquid, it is extremely contagious and can infect other trees in your neighborhood.

Apple Scab

- Tree produces fewer fruit than in previous years
- Tree doesn't flower at all
- Apples have blemishes or don't grow very large

If you have apple trees in your yard, you are probably used to seeing "scabs" or blemishes on your apples. However, there comes a time when they start to become a hindrance rather than just something annoying. If your apples seem strange from what you are used to, either they have more blemishes than usual, they are too small, or you don't get as many flowers, you might have a severe case of Apple Scab.



Materials:

Science journal Activity Page “Tree Detective” Samples of “sick” trees/leaves

Learning Activity:

- Become “tree-tectives” (tree detectives) by first examining neighborhood trees for signs of poor health and then investigating actions to help trees in trouble.
- When a person is ill, we look for symptoms to help identify what is wrong. Help children brainstorm causes, symptoms, and cures for their past ailments, or perhaps those of a family member.
- Together, explore:
 - ⇒ What caused the illness and what were its symptoms?
 - ⇒ How did the person get better? What was the cure?
 - ⇒ Could this illness be prevented in the future? If so, how?
- Now, work with children to compare elements that keep humans healthy with those that keep trees healthy. For example, trees require some of the same things people need to grow and thrive. They need plenty of water, nutrients, room to grow, and a stress-free environment. When a tree is stressed, it exhibits symptoms that can help determine the problem.
- Plan a walk down a tree-lined city sidewalk, in a park, or in the woods, paying particular attention to trees and their symptoms along the way. They should take notes and make sketches of their findings to try and identify what caused the damage.

Lesson Extension:

- Investigate the similarities and differences between an unhealthy tree and healthy trees nearby
- Research one of the common tree diseases or tree insects in your area
- Adopt an unhealthy tree as a community project
- Revisit an unhealthy tree over time to document any change or decay
- Invite a tree expert from a garden center or forestry department to help

Additional Resources

<https://www.plt.org/family-activity/trees-in-trouble/>

<https://owlcation.com/stem/Why-do-trees-die>

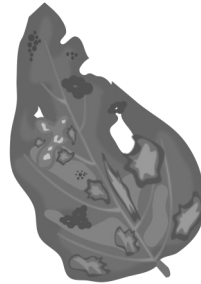
<https://www.treehelp.com/about-tree-insects/>

<https://www.gogreentree.com/5-common-tree-diseases-missouri/>

TREE DETECTIVE

Trees can get sick just like people. These trees are not healthy. Can you describe the signs you see that tell you when a tree is sick? What do you think caused these trees to become ill?













What can you do to keep trees healthy?