Trees and Ecology

GRADES: 3–5

Key Words and Definitions

ECOLOGY : branch of biology that deals with the relations of organisms to one another and to their physical surroundings.

CONSUMER : organism that eats another to gain energy.

PRODUCER : organism that uses sunlight to produce its own energy.

APEX PREDATOR : consumer at the top of a given food chain.

DECOMPOSER : organism, especially bacteria, fungus or invertebrate that breaks down organic material.

ROOTS : part of a plant that attaches it to the ground or to a support, typically underground, conveying water and nourishment to the rest of the plant via numerous branches and fibers.

TRUNK : main, woody stem of a tree.

LEAF : flattened structure of a tree, typically green and bladelike, that is attached to a stem directly or via a stalk. Main organ of photosynthesis.

BRANCH : part of a tree that grows out from the trunk.

MANDALA : symbolic representation of the universe with an inner and outer world, often composed of concentric circles. Comes from the Sanskrit word meaning circle.

GROWTH RING : concentric layer of wood developed during an annual/other regular period of growth.

TIMELINE : graphic representation of the passage of time.

ECOLOGICAL DISTURBANCE : temporary change in the environment that causes a significant change in the ecosystem.

*Look for keywords—***BOLDED***—throughout this lesson extension!*

Activity 1: Energy Transfer Game

One, approximately 30-minute session; pre-visit

LEARNING OBJECTIVE

In the movement activity, students embody the flow of energy through a forest ecosystem.

MATERIALS

Temperate forest food web

PROCEDURE

Share that today you will explore how energy travels through an ecosystem or community once "energy-anchors," such as trees, make it usable—by converting sunlight and water to sugar/food.

Show the class the temperate-forest food web. Ask them to interpret what is happening here. Guide them towards the conclusion that the arrows represent energy, and that energy travels in many directions. In doing so, energy creates multiple connections between organisms. Take a moment to point out **PRODUCERS**, **CONSUMERS** and **DECOMPOSERS**. Distinguish their roles and energy needs from one another as follows: Producers create food from the sun's energy. Consumers can be herbivores, carnivores or omnivores, but must eat another living thing to survive. Decomposers break down organic materials and return nutrients to the soil.

Add that a food web is a collection of food chains. In order to understand how energy moves, the class is going to play a game of rock, paper, scissors that represents energy flow through a single chain in the web. Each student is energy. The object of the game is to move from the energy within a producer all the way through the ecosystem (consumers, apex predators and decomposers) and back to being producer energy again. Before playing, you should model each phase for students. Remind them that they represent the energy *within* the organism and not the organism itself.

In an open area, organize students in a circle. All students will start in a sitting position, as the energy within grass—a producer. Students will find a partner and play rock, paper, scissors. (Best 2 out of 3, if time allows.) The winner transforms into grasshopper energy (hopping around) while the loser will remain grass energy (sitting). The grasshopper energy must find another grasshopper energy to play against while the grass energy must find other grass energy. Winning grasshopper energies flow into the form of toad energy (walking around with tongue sticking out), while the losing grasshopper energies continue to hop about in search of other grasshopper energies. The winner between two toad energies flows into hawk energy (flapping wings), while the losing toad energy searches for other toad energies. When two hawk energies play rock, paper, scissors, the winner will become decomposer energy while the other student will remain hawk energy. Any decomposer dramatically calls "I'm decomposing!" while holding their hands over their heads like a mushroom and slowly sinking to the ground. Then they can begin again as grass energy—having won the game! It is important to remind students that none of these organisms turns into one another, but that energy travels through each one to the next.

End the session by reminding students that this entire cycle would not be possible without energy-anchors like trees and grass. Take a moment to celebrate producers!

SOURCE

Amsel, Sheri. "Forest Food Webs" Exploring Nature Educational Resource ©2005-2019. February 5, 2019, http://www.exploringnature.org/db/view/Forest-Food-Webs.

Activity 2: Street Tree Census and Tree Adoption

One, approximately 40-minute session; post-visit

LEARNING OBJECTIVE

Students identify local trees and become wildlife stewards as they "adopt," and tend to, street trees in their neighborhood.

MATERIALS

Tree-census worksheet

Tree bed care article

NYC tree map

i-Tree

Pencils

Paper

PROCEDURE

Before class, in preparation for this activity, cut and paste images of the street tree species in your area into the tree-census worksheet provided. You can use i-Tree to confirm the identity of each tree.

Then, walk around the neighborhood and complete the tree census as a class. Consider which trees are most abundant and make note of their identifying features.

When you return to the classroom, ask students why it is important to count the trees in your school's neighborhood. Discuss the parallels between the role of trees in a forest ecosystem and the role of trees in an urban ecosystem. These may include (but are not limited to): oxygen production, shelter for local wildlife, environmental cooling, water purification and protection from erosion. Get students excited about keeping trees safe.

Give small groups time to select and research a nearby street tree. Prompt them to consider its energy needs, lifespan and ecological relationships. Use the NYC tree map for a deeper understanding of individual trees. Ask students to sketch their trees and

record their features. When they are finished, allow time for willing students to share out about their trees.

Tell students that for the remainder of the school year, they will be visiting their street tree once or twice a month to provide it with some love and care. In this way, students can assist in producing clean air and energy for their community.

SOURCES

"New York City Street Tree Map." Map. New York City: NYC Parks, 2015. https://tree-map.nycgovparks.org/.

"What is i-Tree?" *i-Tree*, US Forest Service, www.itreetools.org/.

Brooklyn Botanic Garden Staff. "Street Tree Bed Care: Give Trees a Chance." *Brooklyn Botanic Garden*, 28 June 2012, www.bbg.org/gardening/article/street_tree_bed_care.

Activity 3: Tree Ring Mandalas

Two, approximately 40-minute sessions; pre- or post-visit

MATERIALS

Tree-Ring Timeline Worksheet

Yarn

Crayons, markers and/or colored pencils

Cardstock or cardboard

Glue

Circle-shaped found objects (or pre-cut circle cardstock in various sizes)

Various materials for students to self-select, such as glitter glue, natural materials, recycled materials and fabric scraps

PROCEDURE

Trees are ecological storytellers that have community history built into their bodies. **GROWTH RINGS** tell us how old a tree is, what the weather was like during each year of the tree's life, and about other possible **DISTURBANCES**. The color and width of each ring gives information not only about the age of the tree, but also the storms, droughts and climate conditions the tree has weathered. A scar on a tree may tell you about a forest fire the tree endured. A knot may tell you about its normal imperfect growth or about excessive pruning a tree has undergone. Each tree is wonderfully different based on how that tree experiences its environment.

Celebrate these ecological storytellers, and encourage your students to think about how they might relate to a tree. Students will explore how their environments have shaped them, and imagine that if they had growth rings, what those rings might say about how their own environments have uniquely shaped them.

Personal Timelines

Begin by letting the class know that today they will be shapeshifting into trees and imagining how they might show all of their experiences as growth rings.

First, students should begin the Tree-Ring Timeline Worksheet. These **TIMELINES** will help students create personal **MANDALAS** by guiding them to think about each year of their lives and the events that occurred in their lived environments during moments of growth. Model this activity by creating a timeline of events that may have happened locally, nationally or globally that you think may have influenced your class. *Example:* January 2017: National Women's March. Alternatively, lead a class discussion to generate this list so as to include the perspective of your students.

Mandala Making

When the timeline worksheet is complete, students should gather to discuss. Afterwards, explain that they will translate these timelines into mandalas. Explain that in Sanskrit mandala means circle, but that the word mandala holds significance in various cultures. Show examples of mandalas from China, Tibet, Japan and/or India. Observe the different parts of a mandala, paying close attention to symbols, organization around a central point and the different mediums used to create mandalas. With your students, explore the purpose of creating a mandala, and how different mandalas serve different purposes. As you look at each, encourage your students to see the mandala as a blueprint or tool that reveals important information. Make educated guesses as to what information each mandala might convey.

Working from their timelines and using cardstock or cardboard as the base, students will then begin creating their own tree ring mandalas. Rings can be uniform or constructed from different mediums. You can modify the activity based on what you are covering in other subjects. For example, one ring could include a poem in the shape of a circle, or it could be created from all recycled and repurposed materials.

Remind students that each ring should capture one year of their lives, and encourage students to consider the distance between each ring. To guide them. students should use their personal timelines, as well as the supplementary worksheet. This worksheet instructs students to consider the development of each ring, events in environments that trees document, and a tree's reactions to the weather and its environment. In looking at the stories that trees tell, students can imagine how their rings speak to their own pace of growth and what events in their community have affected them.

Once students have created their mandalas, break them up into small groups to share as much or as little about their mandala rings as they would like. Students should look at similarities as well as differences between theirs and other students' mandalas.

SOURCES

Himalayan Art Resources Inc. *Mandala: Main Page*, www.himalayanart.org/search/set.cfm?setID=91.

BACKGROUND INFORMATION

The Value of Trees

"The Importance of Trees—Learn Value and Benefit of Trees." *SavATree*, SavATree, www.savatree.com/whytrees.html.

When creating your timeline, be a tree and consider these facts about tree rings:

Tree rings are either light or dark. The light and dark rings always alternate. Wood formed in spring grows quickly; these rings are lights. Wood formed in summer grows slower; these rings are darker.

When in your life can you see that you have grown? As you go through each year, think about your proudest moments of doing hard things, when you felt supported by your family and friends, or times in your life when you took on more responsibility.

On your tree-ring mandala, you will mark these times of growth by distance from the rings. If there was little growth, the tree rings will be close. If there was a lot of growth, the tree rings will be further away.

When something disturbs a tree, you can see it in its rings. An ecological disturbance is an event that causes change in the environment, which causes a change in the ecosystem. Some examples of disturbances that might affect a tree include a forest fire, flooding, storms, insect outbreaks, earthquakes, volcanic eruptions or a fallen tree leaning on another tree. Some disturbances caused by humans include cutting down trees, carving a name in a tree and climate change.

When in your life have you felt challenged?
How did this challenge change how you did things?

When did a hard time you faced felt like a hot fire roaring?

Have you ever felt that something at home, in school, or in your community was so hard to deal with it felt Like a storm of rain? Did sad or angry feelings come flooding in?

What bugs you? Have you ever felt overwhelmed with how much you needed to do, or what was expected of you?

Did you ever have something in your life pruned out like branches being cut from a tree? When have you lost, or had to give up, someone or something special?

When in your life did you support others? Has it ever felt like a friend or something you care about needed your support?

Mark these on your personal timeline!

On your tree-ring mandala, you'll mark disturbances with knots, scars and other little markings of your choice to document your own interpretations of disturbances that happened in your environment or community.

Remember the years in your life where there was joy, love and a feeling of home and belonging. When did you feel like you had everything you needed to grow? What did this look like at home? At school? In in the communities you belong to?

On your tree-ring mandala, you'll mark these times in your life with evenly spaced rings.

Now, as you finish off your timeline, take time to celebrate the special and unique things about you. How has this shaped who you are? You may want to add this on your personal timeline in a symbol that appears in every year, in a certain color scheme, or as a border to your whole timeline.

In your tree-ring mandala, this unique thing about you will show up in how the tree ring is shaped. Not every tree's growth ring is a perfect circle, and sometimes tree rings all slant to one side.

LOCAL TREE CENSUS

Date	
Description of the environment (season, weather, time of day, etc.)	

Type of Tree	# of	Locations	Observations
Example: Sugar Maple Tree		Wave Hill shade border West 252nd Street & Sycamore Ave	