



9. Tree Parts and Fire: The Class Models a Living Tree

Lesson Overview: In this activity, students learn to name parts of a tree, describe their functions, and explain how some trees can survive fire or reproduce well after fire.

Lesson Goal: Increase students' understanding of how trees function, how they may be affected by heat from wildland fires, and how they may be able to survive or reproduce well after fire.

Objectives:

- Students role-play various parts of a tree as they form a living model of a tree.
- Students can identify numerous parts of a tree.
- Students can describe how some morphological traits help trees survive fire or reproduce well after fire.

Subjects: Science, Writing, Speaking and Listening

Duration: One half-hour session

Group size: Whole class

Setting: Classroom or outdoors

Vocabulary: *bark, branch, cambium, cone, flower, ground fire, inner wood ("heartwood"), leaf, phloem, photosynthesis, root, seed, surface fire, xylem ("sapwood")*

Standards		1st	2nd	3rd	4th	5th
CCSS	Speaking and Listening	1, 2, 4, 6	1, 2, 4, 6	1, 2, 4, 6	1, 2, 4, 6	1, 2, 4, 6
	Language	1, 2, 4, 6	1, 2, 4, 6	1, 2, 3, 4, 6	1, 2, 3, 4, 6	1, 2, 3, 4, 6
NGSS	From Molecules to Organisms: Structures and Processes	LS1.A, LS1.B,		LS1.B	LS1.A	LS1.C
	Heredity: Inheritance and Variation of Traits	LS3.B				
	Biological Evolution: Unity and Diversity		LS4.D			
	Engineering Design		ETS1.B			ETS1.B
EEEEGL	Strand 1	A, B, C, E, F G				A, B, C, E, F G
	Strand 2.2	A, B				A, B

Teacher Background: In **Unit V**, students learn how trees can survive wildland fire and grow back or reproduce after fire. To do this, they need to know a few terms. In this activity, they work together and take on roles - complete with actions and sounds - to create a model of a

functioning tree. They also describe how some tree parts help it survive fire or reproduce after fire.

Different characteristics enable trees (and other plants) to survive specific kinds of fire:

- Thick bark can protect a tree's sensitive phloem and cambium from the heat of surface fires. However, it provides no protection from crown fires.
 - If a tree tends to shed its low branches as it grows taller, surface fires are less likely to climb into the tree crowns than if the tree's branches are continuous from ground to crown. This "self-pruning" tendency thus helps protect it from crown fire.
 - If young trees of a species grow really fast, getting their leaves and branches high above the ground, they may be able to survive surface fires even when young.
 - Roots that grow deep into mineral soil are protected from the heat of surface and ground fires. If the roots are shallow or mainly in the duff (organic) layer, they are vulnerable to heat from any fire. Deep roots, however, do not prevent damage to the cambium from surface fires or damage to the leaves and seeds from crown fires.
 - If a tree can protect its seeds from fire, new trees can become established afterwards. Tightly sealed cones or capsules protect the seeds of some trees from crown fire. Burial underground protects seeds from all kinds of fire – unless they are in duff or organic soil, which may burn.
 - If a tree can sprout from the roots, the base of the trunk, or other underground parts after its top is killed, it can survive both surface fire and crown fire. Its ability to survive ground fire depends on how well its underground parts are protected.
-

Materials and preparation:

- Obtain a few small packages of nuts or seeds. If you have students with nut allergies, select something that will be safe for them.
- You'll need a large, open space to assemble the living tree model. It's great to do this outdoors. If you're in the classroom, you need a space at least 10 feet across. The directions here are written for a class of about 25. Adjust the numbers so everyone can participate.
- Print 1 copy/student: **Handout E09-1: Tree Parts**

Procedure:

1. Explain: We'll work together to assemble a living model of a tree. This will help us learn how trees work and how they might survive fire.
2. Ask two tall students to stand back-to-back, with their arms stretched high and reaching slightly outward. Their bodies are the **inner wood ("heartwood")** of the tree trunk, which provides support for the tree but does not take an active part in the tree's life functions.

Their arms are the tree's **branches**, and their fingers are its **leaves**, which gather energy from sunlight and turn it into nutrients that all living cells in the tree can use (photosynthesis). Their branches also hold their **flowers** or **cones** and **seeds**, so give each student a package of nuts or seeds to hold. Ask them to pantomime photosynthesis by wiggling their fingers. Have them create and practice a sound that represents their functions. **With this role and those that follow, after the students have prepared, let them stay in place but pay attention as you “construct” the rest of the model tree.**

3. Ask: How can leaves and branches be protected from fire? **Leaves and branches are safe from fire only if they are high up on the tree, and if the tree is in an open stand so it is unlikely to catch fire from neighboring tree crowns. Low branches and leaves are vulnerable to surface fires, and they serve as ladder fuels that make the tree more likely to support a crown fire.**
4. Ask: How can seeds be protected from fire? **(1) Store them high in the tree to keep them safe from surface and ground fires. (2) Bury them underground to keep them safe from surface and crown fires – although this may not protect them from ground fires if the heat penetrates the soil. (3) Keep them sealed tight inside their cones in the tree crown until the fire has passed, then release them onto the burned soil.**
5. Ask 4-6 students to stand in a circle around the inner wood, with their right shoulders to the inside and their left shoulders to the outside. They are the **xylem** cells (also called “sapwood”). Xylem cells pump water and dissolved minerals from the roots up to the leaves and flowers or cones. Have the students create a motion and a sound to represent this process.
6. Ask 4-6 more students to stand shoulder-to-shoulder in a circle around the xylem, facing out. These are **cambium** cells. They can form new xylem cells (at their backs – to the interior of the tree) and also new phloem cells (at their fronts). Have the students create a motion and a sound....
7. Ask 4-6 more students to stand outside the cambium holding hands. They are the **phloem** cells. They carry nutrients throughout the tree—from leaves to roots, from roots to leaves and flowers/cones, or wherever they are needed. Have the students create a motion and a sound....
8. Review these layers of cells: **xylem, cambium, phloem**. The tree needs all 3 of these layers to live. Which is most important? **Cambium is most important, because it produces new xylem and phloem. If xylem and phloem cells are killed, they can be replaced. But if the cambium layer is killed, the tree cannot produce new xylem and phloem cells.** Ask: What does the tree need to protect its cambium from the heat of fires? **Bark! The thicker the better!**
9. Ask 5 more students to stand shoulder-to-shoulder outside the phloem, facing out and looking very strong. They represent the tree's **bark**, which contains mostly dead cells and air, and protects the inner layers from injury. Have the students create a motion and a sound....

10. Ask the remaining students to lie on the floor—feet at the base of the tree, heads and arms spread out along the ground. They are the **roots**, with their tips and tiny hairs (called “root hairs”) growing out, searching for water. Have the students create a fitting motion and sound.
11. Place some seed packages on the ground.
12. Ask: How can roots and buried seeds be protected from fire? **Soil protects them. The deeper they are, the better. Roots are only vulnerable to fire if the soil gets very hot or if they are living in soil that contains a lot of dead plant material, which can burn in a ground fire.**
13. Review the action and sound for each group of students. Then ask them to all do their work at once. They will see that a living tree is a very busy, hard-working kind of organism!
14. When you’ve had enough bedlam, **review:** Have the students disassemble the tree but stay in groups of similar tree parts. Ask each group to describe how they can be protected from fire. Supplement their ideas with these:
 - **Inner wood: Grow thick xylem and bark.**
 - **Branches, leaves, flowers/cones, and seeds in the crown: Grow tall really fast to get the leaves and seeds away from surface fires. Shed low branches so surface fires can’t climb into the tree’s crown. Pack seeds into thick, tightly sealed cones or capsules so they won’t be killed by crown fire.**
 - **Xylem: Fill up with lots of water so you can’t be easily overheated. Make sure you have thick bark.**
 - **Cambium and phloem: Get very thick bark for insulation from surface fire.**
 - **Bark: Grow thick.**
 - **Roots and fallen seeds: Grow roots deep so you can survive even if the litter and duff on the surface are burned. Be able to sprout new growth if the tree parts above ground are killed. Store seeds deep in soil, too.**

Assessment: Give each student a copy of **Handout E09-1: Tree Parts**. Go through the directions at the top of the handout, then have them complete it:

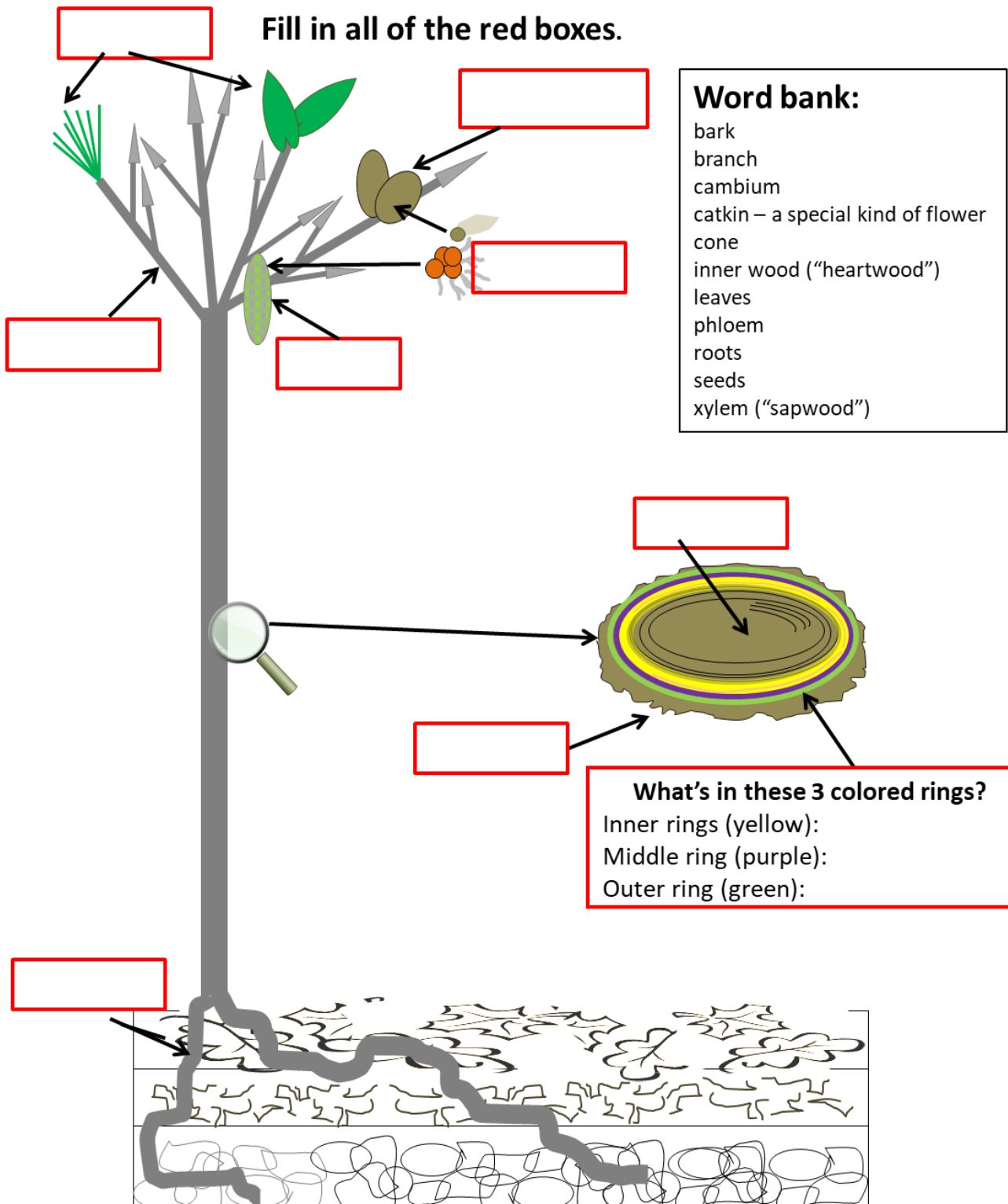
1. Use the word bank to label the parts of the tree. Note that the word bank contains “catkin,” which is a special kind of flower produced by many trees and shrubs.
2. At the bottom, list two things that help a tree survive fire or grow well after fire.

Evaluation: Refer to **Answer Key for Handout E09-1: Tree Parts** below.

	Full Credit	Partial Credit	Needs Improvement
Labeling component	9-11 correct labels	6-8 correct labels	<6 correct labels
Writing component	Correctly listed two things that help a tree survive fire or grow well after fire.	Correctly listed one thing that helps a tree survive fire or grow well after fire.	Did not list anything that helps a tree survive fire or grow well after fire.

Handout E09-1: Tree Parts

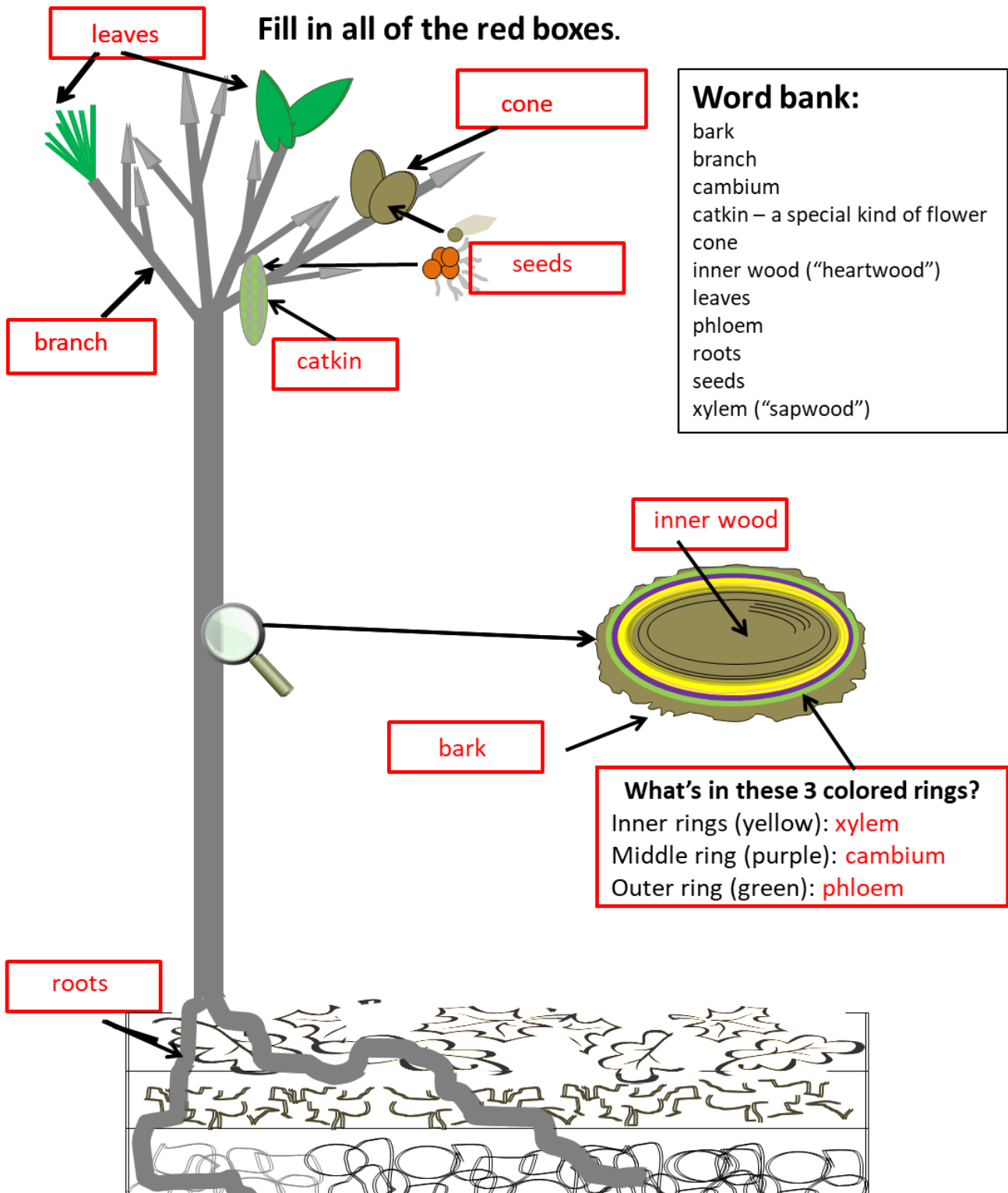
Name: _____



List 2 things that help a tree survive fire or grow well after fire:

Answer Key for Handout E09-1: Tree Parts

Fill in all of the red boxes.



List 2 things that help a tree survive fire or grow well after fire: **Has thick bark, sheds low branches, grows fast, has deep roots, buries seeds in soil, stores seeds in sealed cones, is able to sprout after top is killed...**