



## 12. Tree Parts and Fire: “Working Trees” Jeopardy-style Game

**Lesson Overview:** In this activity, students learn to name the parts of a tree, describe their functions, and describe how some of these parts can help a tree survive fire, avoid the effects of severe fire, or reproduce after fire.

**Lesson Goal:** Increase students’ understanding of how trees function and how they are affected by different kinds of wildland fires.

**Objectives:** Given a list of tree parts and other terms, students can:

- Describe a tree part, a part of the tree’s environment, and/or a type of fire to the class.
- Apply the correct term to a definition of a tree part or adaptation to fire in a Jeopardy-style game.
- Describe how specific tree parts and characteristics enable some trees to avoid, survive, or thrive after surface fire, crown fire, and ground fire.

**Subjects:** Science, Reading, Speaking and Listening

**Duration:** Two half-hour sessions – but see the gray box below.

**Group size:** Whole class, working in teams (10 teams maximum)

**Setting:** Classroom

**Vocabulary:** see terms in *Handout M12-1*.

IF TIME IS LIMITED, you can do the jeopardy game in one session rather than 2. To do that, skip **Part I** and just have students study **Handout M12-1: Tree Parts and Kinds of Fire** as homework in preparation for the game.

Standards:		6th	7th	8th
CCSS	Reading Informational Text	1, 2, 4, 7, 10	1, 2, 4, 10	1, 2, 4, 10
	Speaking/Listening	1, 2, 4, 6	1, 2, 4, 6	1, 2, 4, 6
	Language	1, 2, 3, 4, 6	1, 2, 3, 4, 6	1, 2, 3, 4, 6
	Reading Standards Science/Tech	1, 2, 3, 4, 7, 10		
NGSS	From Molecules to Organisms: Structure and Processes	LS1.B		
	Ecosystems: Interactions, Energy, Dynamics	LS2.A, LS2.C		
	Heredity: Inheritance and Variation of Traits	LS1.B		
	Biological Evolution: Unity and Diversity	LS4.C		
	Earth’s Systems	ESS2.D		
	Earth and Human Activity	ESS3.A, ESS3.C		
EEEEGL	Strand 2	A, C		

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**Teacher Background:** To understand how fire affects organisms in the forest ecosystems, students need to know a few terms. This activity challenges them to master 23 terms, many of which (such as leaf and branch) they already know. The activity consists of two parts. In **Part I**, students teach their classmates the terms – some about tree morphology, some about the forest environment (litter, duff, and mineral soil), and some about types of fire (surface, crown, and ground fire). In **Part II**, they participate in a Jeopardy-style game that contains 25 definitions plus a bonus question (*M12\_Jeopardy\_FireWorks1.pptx*). **Use the directions on Slide 1 and work with the game (Slide 2) ahead of time** to become familiar with the game, the process of moving/deleting boxes, and the scoring algorithm.

Different characteristics enable trees (and other plants) to avoid specific kinds of fire, survive fire, or reproduce and thrive after fire. For example:

- 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, fires are less likely to climb from the forest floor into the tree crowns than if the tree’s branches are continuous from ground to crown.
- If young trees of a species can 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 in mineral soil are protected from the heat of surface and ground fires. However, deep roots don’t prevent damage to the cambium from surface fires or damage to the leaves and buds from crown fires.
- If a tree can protect its seeds from fire, new trees can become established afterwards. Tightly sealed cones protect the seeds of some trees from crown fire. Burial protects seeds from all kinds of fire – unless they are in duff or organic soil, which can burn if it dries out.
- If a tree can sprout from the roots after its top is killed, it can survive surface and crown fire. Its ability to survive ground fire depends on soil properties and how deeply its roots are buried.

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### Materials and preparation:

- Download the Jeopardy game (*M12\_Jeopardy\_FireWorks1.pptx*) and **make a backup copy** on your computer. BE SURE TO READ THE DIRECTIONS on Slide 1 ahead of time and practice working with the game on Slides 2-3 before you play it with the class. The answer key is on Slides 4-5 and also reproduced below. **IMPORTANT:** Minimize the left margin when you display the presentation, so students can’t read the answers!
- Download *M12\_WorkingTreeDiagram\_Blank.pptx* so you can project it on the board during the student presentations in **Part I**. Each presenter will sketch where each term

occurs on this diagram. If a particular term isn't shown in the diagram, have the student sketch it in.

- Print 1 copy/student: **Handout M12-1: Tree Parts and Kinds of Fire** and **Handout M12-2: Working Trees**.
- At least 1 day before doing this activity, give each student a copy of **Handout M12-1: Tree Parts and Kinds of Fire**. Explain that they will play a Jeopardy-style game and compete for "dollars" based on their understanding of these terms and how trees "deal with" fire - that is, how they avoid damage from fire, survive fire, or reproduce or regrow after fire. Tell them whether or not they will be allowed to use the definition sheet during the game.
- Decide on prize(s) or awards for the winning team.

**Procedure - Part I** (OPTIONAL. See grey box on first page):

1. Explain: Look up 1-2 term(s), as assigned, using **Handout M12-1: Tree Parts and Kinds of Fire** and at least 1 other source. Develop a 1-2 minute presentation to teach the class about the term(s). Your presentation must include a visual component such as a sample from a real tree, a photograph, a drawing, or another medium (short video, PowerPoint slide, etc.).
2. Assign each student 1-2 terms from **Handout M12-1**. There are 23 terms in all.
3. Have students teach their terms to the class. Have each student sketch and label his/her terms on the board/projection (**M12\_WorkingTreeDiagram\_Blank.pptx**). A few terms (snag, sprouter, and the 3 kinds of fire), are NOT on the projection; have students sketch them separately. **It is best to have branches presented before leaves, buds, cones, and catkins; cones and catkins presented before seeds; and roots presented before sprouts.** If the students "teach" errors or miss an important point, correct them gently.
4. Have students take their handouts and notes home to study for the Jeopardy game.

**Procedure - Part II:**

5. Explain: You will compete in a Jeopardy-style game to show your understanding of the information on the handout. Before beginning, are there any questions about the handout, any terms or concepts that you don't understand? **Answer questions...**
6. Set up teams.
7. Explain:
  - Explain the procedure. (**See the directions on Slide 1 of the game.**)
  - Tell students whether they are or are not allowed to use the handout during the game.

- Play the game (*M12\_Jeopardy\_FireWorks1.pptx*). Check answers with the **FireWorks Jeopardy: answer key** below.
- Present awards to the winning team.

**Assessment:** Give each student a copy of **Handout M12-2: Tree Parts and Kinds of Fire**. Go through directions as needed. Have students complete the handout.

**Evaluation:** Refer to **Teacher’s Answer Key for Handout M12-2: Working Trees** below.

	<b>Full Credit</b>	<b>Partial Credit</b>	<b>Less than Partial Credit</b>
<b>Part I. Presentation</b>	-Student presented accurate information in a clear and concise way. -The visual component was relevant and helpful.	-Student presented information that contained some misinformation ( <i>which the teacher corrected</i> ). -Visual component was present but only slightly relevant.	-Student presented incomplete or incorrect information. -Visual component was distracting or missing.
<b>Part II. Jeopardy Game</b>	-Student participated consistently by contributing to group discussion, listening, giving answer for the group, and/or giving other group members a chance to answer.	-Student participated sporadically in game by listening, occasionally contributing to group discussion, and/or presenting answer for the group.	-Student did not participate by listening to or engaging in group discussion or presenting group’s answer.
<b>Written component (Handout M12-2)</b>	-Student correctly labeled 9-10 parts on diagram. -Student correctly described 3 adaptations that can help the tree survive or grow after ground, surface, and crown fire.	-Student correctly labeled 5-8 parts on diagram. -Student correctly described 1-2 adaptations that can help the tree survive or grow after different types of fire.	-Student correctly labeled less than 5 parts on diagram. -Student did not describe any adaptations that can help the tree survive or grow after fire.

# FireWorks Jeopardy: answer key

	Growth	Transport	Support	Protection & Habitat	Helps deal with what kind of fire?
\$10	Makes food Leaf	Absorbs water from soil Root	Treetop Crown	Tree skin Bark	Resin-sealed cones Crown fire
\$20	Holds baby tree Seed	Pumps water up from roots Xylem or sapwood	Connects leaves to trunk Branch	Holds conifer seeds Cone	Thick bark Surface fire
\$30	Makes new xylem & phloem Cambium	Helps conifer seed float from tree Seed wing	Supports crown, connects roots to crown Trunk	Fallen leaves Litter	Deep roots in mineral soil Ground fire
\$40	Holds next year's leaves Bud	Delivers nutrients from leaves Phloem	Inner wood Heartwood	Dead tree with broken top Snag	Seedlings grow fast Surface fire
\$50	Can regrow its top if killed Sprouter	Helps seeds fly miles on wind Catkin	Anchors trunk in soil Root	Layers of rotting leaves Duff	Low branches drop off Crown fire

## FireWorks Final Question: answer key

Wager your winnings:

Deep duff can protect a tree from fire or make it more vulnerable. How?

Deep duff can protect a tree's cambium and roots until it dries out. After the duff dries, it burns slowly but hot. That kills the tree's shallow roots and the cambium around the tree's base.

## Handout M12-1: Tree Parts and Kinds of Fire

**Bark:** the outside covering on a tree's trunk and branches, the tree's "skin." Thick bark can protect the tree from surface fire.

**Branch:** a limb of a tree or shrub that grows out from the trunk and holds the leaves up in the light. Some trees drop their low branches as they age, which helps keep surface fires from climbing up into the crowns. This way the tree can avoid crown fire.

**Bud:** The cells that will grow next year's leaves and branches. Located at the tree's top and the tips of branches. Similar cells occur at the tips of roots.

**Cambium:** the layer of living cells under a tree's bark that produces the xylem and phloem layers of cells.

**Catkin:** a kind of flower produced by some trees and shrubs. This lightweight, fluffy package hangs down from the plant's branches. It contains many tiny flowers, which can mature into tiny seeds. The "fluff" helps the seeds float a long way on the wind, sometimes many miles.

**Cone:** the package in which a conifer stores its seeds. If cones are sealed tight with resin, the seeds inside may survive crown fire and be released soon afterward.

**Crown:** a tree's top, which holds most of its leaves and buds.

**Crown fire:** a fire that spreads through the crowns of trees and tall shrubs. Crown fires are usually ignited from surface fires. They are common in some conifer forests and chaparral-type shrublands.

**Duff:** the layer of soil that is made up of dead, rotting plant parts. Duff is below litter and above mineral soil. Sometimes it is mixed with mineral soil.

**Ground fire:** a fire that burns in the duff and other organic material in the soil. Ground fires usually burn slowly, with lots of smoldering instead of long flames. Even without flames, ground fires can burn hot enough to kill things living in the duff, including roots and other underground plant parts.

**Heartwood:** inner wood of a tree, which helps it stand strong and resist decay.

**Leaf:** the green part of a plant that uses sunlight, water, and carbon dioxide to make "food". Needles are a special kind of leaf.

**Litter:** the layer of dead leaves and other plant matter, not yet decayed, lying at the top of the forest floor.

**Mineral soil:** soil that contains no plant or animal parts, so it cannot burn.

**Phloem:** the layer of living cells under a tree's bark that moves nutrients from one place to another, especially from the leaves to other parts of the tree.

**Root:** the part of a plant that lives underground, collects water and minerals from the soil, and keeps it firmly planted in the soil. If the roots are buried deep in mineral soil, they may be able to survive a ground fire.

**Seed:** a very tiny, living plant—just waiting to grow—plus a package of nutrients and a protective covering. If seeds are sealed tight inside a cone, they may survive crown fire. If they're embedded in moist duff, they may survive surface fire. If they're buried in mineral soil, they may survive ground fire.

**Seed wing:** part of a conifer seed that helps it float away from the parent tree when it falls.

**Snag:** a dead tree, often with a broken top.

**Sprouter:** a kind of plant that can grow from underground parts if its top is killed off.

**Surface fire:** a fire that burns the litter, grasses, shrubs, and wildflowers on the forest floor but does not burn the crowns of trees or the duff.

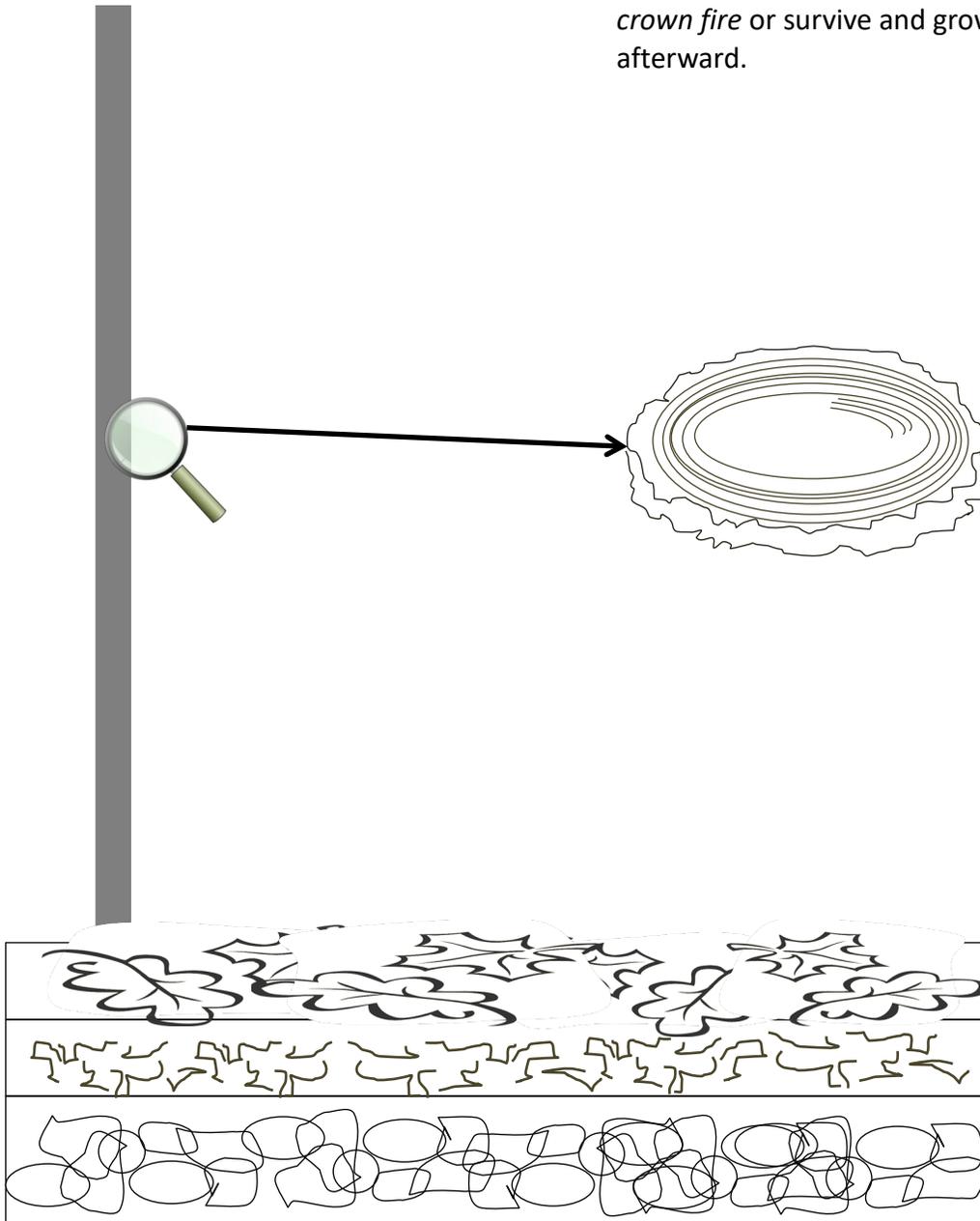
**Trunk:** the stem of a tree. The faster the trunk grows, the sooner its crown will be out of reach of surface fires.

**Xylem:** the layer of wood cells inside the cambium that pump water from roots to leaves. Also called sapwood. As a tree grows, older xylem cells become inactive and die, forming heartwood.

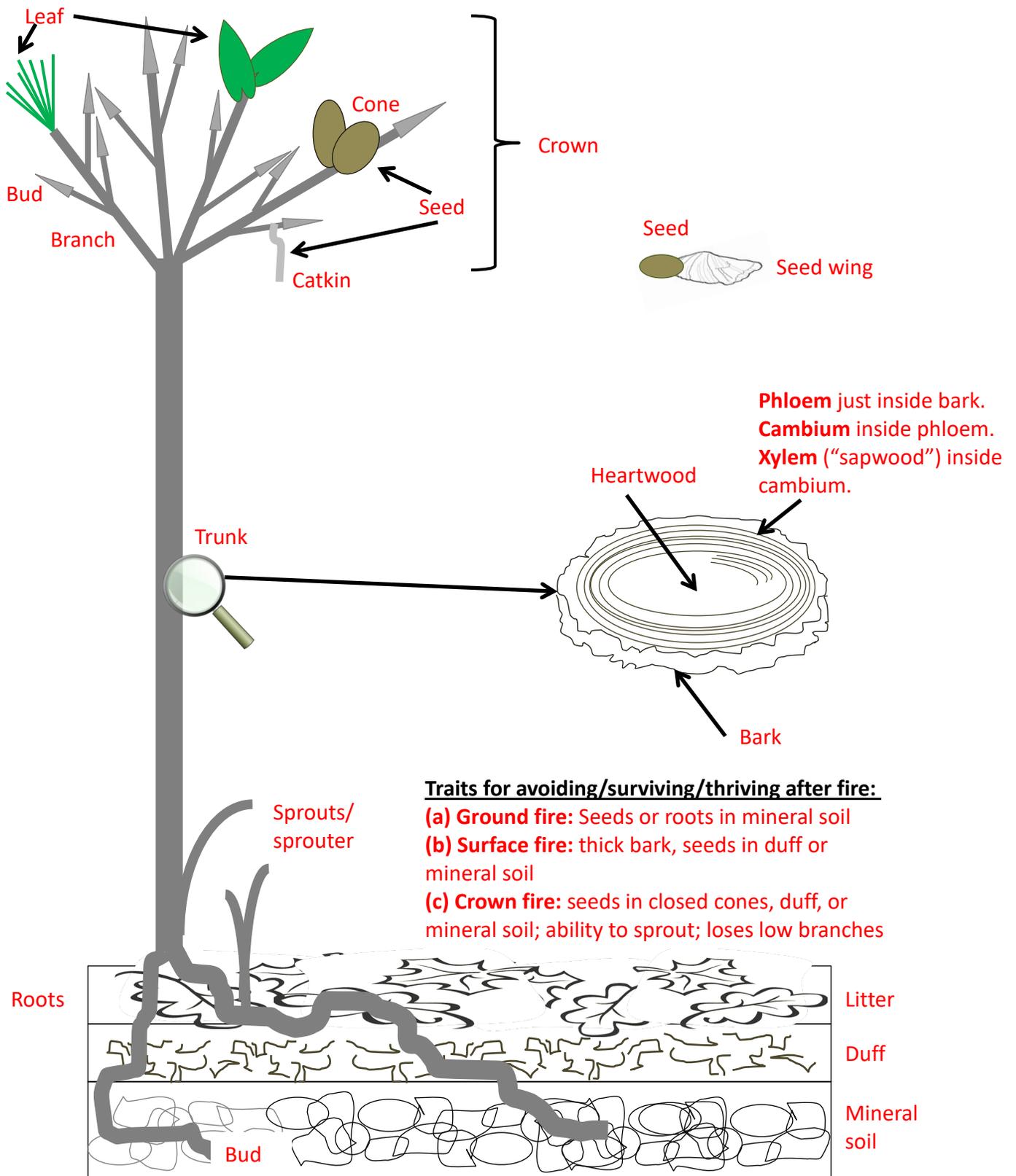
# Handout M12-2: Working Trees

Name \_\_\_\_\_

1. Sketch ten parts of this tree and/or its environment. Use terms from **Handout M12-1**. Label each part.
2. Name (a) one trait that can help the tree survive *ground fire*, (b) one trait that can help it survive *surface fire*, and (c) one trait that can help it avoid *crown fire* or survive and grow well afterward.



# Answer Key for Handout M12-2: Working Trees



**Traits for avoiding/surviving/thriving after fire:**

- (a) Ground fire:** Seeds or roots in mineral soil
- (b) Surface fire:** thick bark, seeds in duff or mineral soil
- (c) Crown fire:** seeds in closed cones, duff, or mineral soil; ability to sprout; loses low branches