



16. Buried Treasures: Identifying Plants by their Underground Parts

Lesson Overview: Students examine specimens of nine plant species – grasses, wildflowers, and shrubs – and use a dichotomous key to identify them based on their “buried treasures” – underground parts that can sprout after fire and grow new plants.

Lesson Goal: To increase student understanding that plants have many ways to survive wildland fire and/or reproduce successfully after fire, including underground structures.

Objectives:

- Students can recognize different kinds of underground plant parts that can sprout new plants (bulb, rhizome, root crown, lignotuber) after fire.
- Students can use a dichotomous key to determine the species of each one.

Subjects: Science, Mathematics (logic), Reading

Duration: One to two half-hour sessions

Group size: Whole class, possibly working in teams

Setting: Classroom



New FireWorks vocabulary: *bulb, dichotomous key, fire dependent, lignotuber, rhizome, root crown, top-kill*

ABOUT STUDENT PRESENTATIONS: If you did **Activity M11. Who Lives Here? Adopting a Plant, Animal, or Fungus**, this would be a great time for student presentations on all of the herb and shrub species – and possibly also on quaking aspen. That way they can connect the concept of “buried treasures” to the underground parts of particular species that they’ve been studying.

Standards		Sixth	Seventh	Eighth
CCSS	Speaking and Listening	1,2,6	1,2,6	1,2,6
NGSS	Structure, Function and Information Processing	LS1.A		
	Growth, Development and Reproduction of Organisms	LS1.B		
	Engineering Design	ETS1.B,C		
	Natural Selection and Adaptations	LS4.B, LS4.C		
EEEGL	Strand 1	A, C, E, G		

Teacher Background: People are generally familiar with the above-ground appearance of plants, and they know that most plants have roots underground, but they don’t think much about plants’ other underground parts – unless it is in terms of food! Yet plants have many kinds of “buried treasures” that enable them to survive fire and thrive afterward. This activity covers only a few kinds of plants and buried treasures, which we selected because they are very important members of montane Sierra Nevada plant communities. They all regenerate from

underground parts after fire, and some of the require fire to regenerate. We call these *fire dependent* species.

Seeds are one kind of buried treasure. If they have a very hard covering and are located deep enough in the soil that they do not burn, they are able to grow new plants after fire. In fact, the seeds of the deer brush, sticky whiteleaf manzanita, and mountain whitethorn included in the trunk (plants 3, 4, and 9) can only germinate with heat. Sticky whiteleaf manzanita is a good example of a fire dependent species.

Other kinds of buried treasure enable plants to sprout new growth after their above-ground parts are removed. Buried roots, leaves, stems, and rhizomes account for the ability of perennial plants to survive cold winters, grazing, fire, and other forces that kill off their aboveground parts. (This is called *top-kill*.) All of these buried treasures work because they contain tiny buds with undifferentiated cells (“meristem tissue,” which is like stem cells in animals). Meristem cells have the ability to sprout and develop a new stem and leaves, but they are suppressed by hormones produced in the plant’s above-ground parts. When the above-ground parts are removed, the buds are no longer suppressed, so they begin to grow, develop, and form a new stem.

Buried treasures are plant adaptations to fire. Other plant adaptations to fire in the Sierra Nevada include the thick bark of mature ponderosa pines, Jeffrey pines, sugar pines, and firs (explored more fully in **Activity M15: Bark and Soil: Nature’s Insulators**) and the serotinous cones produced by Baker cypresses and knobcone pines. Students may have learned about serotiny from the student presentation on Baker cypress in **Activity M11: Who Lives Here? Adopting a Plant, Animal, or Fungus**. If you would like to explore the topic in more detail, you may use this activity from the Elementary curriculum: **Activity E11: Recipe for a Baker Cypress grove: Cone Serotiny**.

In this activity, students learn the names of several kinds of buried treasures: *bulbs*, *root crowns*, *lignotubers*, and *rhizomes*. Other buried treasures not covered in this activity include *combs*, *caudices*, and *taproots*. Students use a dichotomous key to identify eight plant species that thrive after fire in the wildlands of the Sierra Nevada. Most keys rely on plants’ above-ground characteristics as criteria for identification, but this key is based mainly on plants’ underground parts.

Materials and preparation:

- Download for projection: **M16_BuriedTreasure.pptx**.
- Print 1/student: **Handout M16-1: Underground Plant Parts** and **Handout M16-2: Dichotomous Key**.
- Find the 8 plant specimens in the trunk. Each species’ buried treasure is noted in parentheses here:
 1. quaking aspen (spreading roots)
 2. Sierran gooseberry (root crown)

3. deer brush (root crown)
 4. mountain whitethorn (lignotuber)
 5. Ross's sedge (root crown/sometimes short rhizomes)
 6. mariposa lily (bulb)
 7. wavyleaf soap plant (bulb)
 8. bracken fern (rhizomes)
 9. sticky whiteleaf manzanita (seeds only)
- Keep #9, (sticky whiteleaf manzanita) out to show the class a species with seeds that require fire (some also sprout).
 - Set up the other eight specimens at stations around the room so students can circulate to identify them.

Procedure:

1. Give students five minutes to draw a plant that they have seen near their house, school, or outside of their town. After students are finished, have a few of them show their sketches. Did anyone sketch underground parts? **If they did, give them kudos!**
2. Write "*Buried Treasures*" on the board. Ask: What parts of plants are found underground? List them on the board. **Students will name roots and perhaps seeds. Encourage them to recall underground "vegetable" parts, such as onions, radishes, and potatoes. We think of them as foods, but for the plant they are ways to store energy and regenerate. Although students may not know the technical names for these plant parts, they may be surprised at how familiar they are with plants' buried treasures.**
3. Explain: Most kinds of plants reproduce from seed, and some have seeds that require heat to begin developing. Show them the specimen of Plant 9, sticky white leaf manzanita. Its seeds have very hard coats, which will not open – and cannot begin to grow - until they are cracked open by heat. If a plant or animal *needs* fire, we call it a *fire dependent* species.
4. Explain: Some plants can also sprout new growth from their roots. Quaking aspen is an example. (They already identified aspens if they did **Activity M13: Tree Identification: Figure out the "Mystery Trees."**)
5. Explain: In today's class we'll look at several kinds of "buried treasures" – plant parts that can generate new growth and new plants after their above-ground parts have been removed or killed – that is, *top-killed* – by fire, grazing, winter's cold, and other disturbances. You'll need to know about these plant parts to identify the plant specimens that are set up at stations around the room.
6. Give each student a copy of **Handout M16-1: Underground Plant Parts**.
7. Project **M16_BuriedTreasure.pptx**, which shows 4 kinds of buried treasures (see the slides below). Stop at each slide and have students write the term on the handout, sketch what it looks like, and define it.

Slides from *M16_BuriedTreasure.pptx*

Slide 1



<https://commons.wikimedia.org/wiki/File%3AOnionBulbRoots.jpg>

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Slide 2



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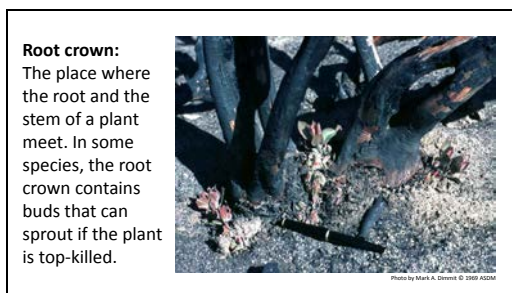
Slide 3



https://commons.wikimedia.org/wiki/File%3AChamerion_angustifolium_rhizomes%2C_wilg_enroosje_wortelstokken.jpg

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Slide 4



<http://www.desertmuseumdigitallibrary.org/public/detail.php?id=ASDM09616&sp=Chaparral%20-%20Californian>

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8. Review/Explain: Fires top-kill many plants, yet many of them can grow back from buried treasures – and they often grow larger and produce more seeds than before the fire. Furthermore, they may produce completely new plants from the same underground parts.

9. Now we will use a *dichotomous key* to identify some of the shrubs, wildflowers, and other plants that grow in the Sierra Nevada. We'll identify them based on the buried treasures that enable them survive and even thrive after fire.

Assessment:

- Give a copy of **Handout M16-2: Dichotomous Key** to each student.
- Explain: All of these wildland plants are champions at surviving and sprouting from their buried treasures after fire. You will use their buried treasures to identify the species of each sample.
- Explain these concepts for how to use the key:
 - For every plant specimen, start at the beginning (left side) of the key. If you start in the middle, you can't be certain that you got the identification correct.
 - When you think you have identified the specimen, write its number in the appropriate box in pencil.
 - Finalize your numbers only after you have identified all of the specimens.
 - Identify each species, write the correct number in the box with that plant's name, and move on to the next specimen. You may re-examine any specimen and change your mind until we finish the activity.

Have a few students start at each station.

Evaluation:	Excellent	Good	Fair	Poor
	Student identified 7-8 species correctly	Student identified 5-6 species correctly	Student identified 3-4 species correctly	Student identified 3 or fewer species correctly

Handout M16-1: Underground Plant Parts

Name: _____

Term	Draw	Define

Handout M16-2: Dichotomous Key

Name _____

Please note: This is a place holder! I did not have the specimens to create the key. We will complete the key once we have the specimens.

