Table Rocks Curriculum

Fire and the Food Web: We are All Connected

Objective: Students will participate in a simple, hands-on activity that will demonstrate the interdependence of all the living ***organisms*** on the Table Rocks. Students will be introduced to the concept of a ***food web*** and will explore the effects of fire on the ***food web*** at the Table Rocks.

Benchmarks Targeted: 2 and 3 (Grades 4-8)
Oregon Standards:

Subject Area: Life Science

Common Curriculum Goals: Diversity/Interdependence: Understand the relationships among living things and between living things and their environments.

Benchmark 2: Describe the relationship between characteristics of specific habitats and the organisms that live there. Describe how adaptations help a species survive.

Benchmark 3: Identify and describe the factors that influence or change the balance of populations in their environment.

Subject Area: Scientific Inquiry

Common Curriculum Goals: Forming the Question/Hypothesis: Formulate and express scientific questions or hypotheses to be investigated

Benchmark 2: Make observations. Bases on those observations ask questions or form hypotheses based on those observations, which can be explored through scientific investigations.

Benchmark 3: Based on observations and scientific concepts, ask questions or form hypotheses that can be explored through scientific investigations.

Subject Area: English/Language Arts

Common Curriculum Goals: Writing: (**All Grades**) Investigate topics of interest and importance across the subject areas, selecting appropriate media sources, using effective research processes, and demonstrating ethical use of resources and materials.

Common Curriculum Goals: Writing: (**All Grades**) Demonstrate knowledge of spelling, grammar, punctuation, capitalization, and penmanship across the subject areas.

Length of Lesson: 30-60 minutes, depending on discussion and whether students make their own cards for the game.

Materials:

- ✓ Spool of yarn or string
- ✓ Scissors
- ✓ Hole punch
- ✓ Tape
- ✓ Pencils or markers
- ✓ Animal pictures (or student drawings of animals)

- ✓ Index cards
- ✓ Small playing area (classroom will work if a large open area can be created)

Key Vocabulary: *adaptation, carnivore, decomposer, ecology, ecosystem, fire-dependent, food web, herbivore, niche, omnivore, organism, producer*

Background:

See Chapter Introduction. At the end of this lesson you will also find a table listing familiar ***organisms*** in the ***food web*** on the Table Rocks, their ***ecological*** connections to other ***organisms***, and their responses to fire.

The purpose of this lesson is to encourage students to consider the impacts of fire on the ***organisms*** in the Table Rocks ***food web***. Students should come away from the lesson with a sense that fire is a natural occurrence in ***ecosystems*** and it plays a crucial role in maintaining the health of many ***ecosystems***. Students should be able to distinguish between fire's impact on an individual ***organism*** (which may perish in a fire) and its impact on a species as a whole (which may benefit from fire). Students should also distinguish between the short-term impacts of fire, which may seem catastrophic, and its long-term effects, which are regenerative.

Please refer to the Fire Ecology Chapter Introduction and the Background section of the lesson "Some Plants Love Fire" for information on how plant species on the Table Rocks respond to fire. Information on the responses to fire of selected Table Rocks animals can be found in the table at the end of this lesson.

Procedure:

Preparation:
Ask students to name some of the plants and animals found on the Table Rocks. If they need prompting, start with a familiar plant such as an oak tree or grass, and ask what animals might eat that plant. After you and your students have brainstormed ideas, refer to the table at the end of this lesson which lists common ***organisms*** found on the Table Rocks and their relationships within the ecosystem. Write students' suggestions on the board (not in list format, but instead scattered over all the available space). Make sure a wide variety of types of ***organisms*** are included: plants, fungi (e.g., mushrooms), insects, mammals, birds, reptiles, and amphibians. When students have provided a sufficient number of ***organisms*** (at least 15), begin discussing the interconnections between them. Discuss each species ***niche*** and who depends on whom for food and shelter. For example: *The black-tailed jackrabbit eats the new growth of buckbrush and uses this shrub for cover. The coyote depends on jackrabbits for food. When a coyote dies, decomposers (such as insects, bacteria, and fungus) break down the carcass and release its nutrients into the soil. Buckbrush then uses these nutrients to sprout new shoots.* Draw lines between the ***organisms*** you've written on the board to connect each one with another that it depends on for food or shelter. The diagram will very quickly begin to appear tangled and messy! This visual representation will help students appreciate the complexity of interdependences in an ***ecosystem***.

Next, have each student create a card with the name of an ***organism*** found on the Table Rocks. You may choose to have the students also decorate their cards with drawings or photographs of their chosen ***organism***. Cards should include information about the ***organism***'s relationships with

other ***organisms*** in the ***ecosystem*** and its response to fire (see the table at the end of the lesson). Examples of some plants, reptiles, amphibians, birds, and mammals that live at the Table Rocks can be found on the BLM Table Rocks website: (http://www.blm.gov/or/resources/recreation/tablerock/table-rock-wildlife.php).To find information about insects at the Table Rocks, research favorite insects eaten by the birds and reptiles that live there, or consult a field guide such as *Bugs of Washington and Oregon* by John Acorn. Another good source for insect information is the Pollinator Conservation Digital Library website (http://libraryportals.com/PCDL). This site allows you to enter the name of a plant (one that grows at the Table Rocks) and find out what insects it depends on for pollination. Another useful resource is the Mather Field Vernal Pool website at (http://www.sacsplash.org/mather/animals.htm); Although this site deals with vernal pool environments in the Sacramento area, it describes many of the same species that live at the Table Rocks. Be sure to have a variety of species represented.

Activity:
Provide each student with tape or string so they can attach their ***organism*** card to their shirt or hang it around their neck. Have the students stand in a circle. To begin the game, choose a student who represents a plant species and give that student the spool of string. Ask the students to identify all students holding a card for an animal that depends on that plant for habitat needs (food, shelter, nesting material, etc.). The student with the plant card and the spool of string holds on to the end of the string then passes the spool to a student with a card for an animal that uses the plant. Now ask the students to identify any ***ecological*** connections between the animal and the other ***organisms*** in the circle (predator-prey relationships, ***decomposers*** and nutrient recyclers, sources of shelter, etc.). Have the student with the animal card extend the string to another student with an ***ecological*** connection. Repeat this process until every student is holding onto the string. Be sure to keep tension on the string as it is passes from student to student. Your class has created a ***food web***, of which each student holds a vital strand.

Now the students will explore some of the impacts fire can have on the organisms in the ***food web***. Ask the students to consider the various instances of fire using the list below and in each case identify which ***organisms*** are affected. Have students describe how each ***organism*** will respond in both the short-and long-term. As you discuss each situation, have the species involved gently tug the string. The class will discover that when any one student disturbs the string, the others must adjust to maintain the tension in the web. This is a great time to talk about balance in nature. When a change or disturbance occurs, an ***ecosystem*** will move toward a new state of balance over time. Because the ***ecosystems*** at the Table Rocks have evolved with fire, they are well adapted to it. Fire-adapted ***organisms*** will recover from a fire quickly, while individuals may perish but the species overall will benefit after regeneration.

This activity demonstrates, in a fun and vividly tactile way, that all ***organisms*** in an ***ecosystem*** are ***ecologically*** connected and a disturbance such as fire will affect them all, either directly or indirectly. Use discussion to reinforce and further explore these themes.

Examples of Impacts from Fire:

- Small shrubs (buckbrush, manzanita) and underbrush are cleared by a low intensity fire
- A high intensity severe fire burns the mixed woodland and kills many Douglas-fir trees

- Most of the insects perish in a fire that burns through the chaparral ***ecosystem***
- An old, sick coyote is unable to run and escape the flames of a fire
- A fire burns the tree where a family of Acorn Woodpeckers stored their food
- A low intensity fire burns through the grass and flowers of the oak savannah
- A fire in the oak savannah kills numerous snakes and rodents who are not fast enough to escape, while others survive by burrowing underground.

Scientific Inquiry:
Grades 6-8: In order to provide students with background knowledge for the activity, have them complete this component beforehand. Have each student choose an ***organism*** that lives in the Table Rocks environment and research its habitat. Based on this research, each student should formulate a hypothesis concerning how that ***organism*** will respond to fire. Encourage students to think about the response not just of an individual of the species they selected, but also of the species as a whole. Below are some questions for students to consider as they formulate their hypotheses:

- Is your habitat ***fire-dependent***?
- Will you escape or perish in the fire? If you escape, where will you go? If you perish, how will your species survive?
- Will your young or seedlings survive? How will that affect the population and the ability of your species to survive?
- Will you rebuild your home or find a new one?
- Will you remain in the burned area or move? What risks are involved in moving?
- How will your food supply be affected?
- Will the ***niche*** you occupy or the role you play in the food web change?
- Does fire influence your risk of insect infestation, infection, or disease?
- Will you respond differently to a large, high intensity fire than to a small, less intense fire?
- How long will it take for you or your population to recover? Will you experience any permanent changes?
- Explain the ways in which fire is beneficial or detrimental to you and your habitat.

Some potential benefits of fire include:

- Creation of snags (standing dead trees) and downed wood, which provide habitat for many animals
- Insect and disease control
- Removal of undesirable plants (noxious weeds) or reduction in plant density (fuels)

- Return of nutrients to the soil (which may then be more conducive to seed germination)
- Better growing conditions (more space and light, less competition) for small plants and new seedlings
- Less cover for small animals means easier hunting for some predators
- Certain plants use fire to regenerate themselves; some have seeds that only germinate after a fire, while others resprout from their roots after a fire (see "Some Plants Love Fire" lesson)
- New sprouts provide more food to smaller animals and are often preferred by deer

Once students have formulated hypotheses, they can investigate the available scientific data to evaluate their hypotheses. After completing their investigations, students should prepare reports summarizing their findings and give creative presentations to the class.

Follow-up:

- **Grades 4-8:** Have students complete the "Some Plants Love Fire" lesson and think about what kinds of animals might choose to live in or near their invented plant.
- **Grades 6-8:** As students hike the Table Rocks, have them look for evidence of past fires, including fire scars on trees, tree trunks growing in ring formations, etc. Also, have them consider how long it has been since there was a fire on the Table Rocks. If a fire burned at the Table Rocks today, would it be a light fire or an extreme fire? Why? Would there be a risk to the surrounding homes if a fire did occur?

Extensions:

Take a field trip to a recently burned area. Contact the BLM Medford District Office at (541) 618-2200 for information on a safe site nearby.

Discussion Questions:

What is a *food web*? Draw and label an example of a *food web* that exists on the Table Rocks using the following terms: *herbivore, carnivore, omnivore, decomposer,* and *producer* (for additional information, see the "Food Web Freeze Tag" and the Ecology Chapter Introduction).

*See vocabulary definitions. Diagrams will depend on **organisms** chosen by students.*

Define the term "interdependence." Explore this concept by reviewing the impacts of fire on animals in the Table Rocks *food web*.

*Interdependence is the idea that everything in nature depends, directly or indirectly on everything else; what happens to one species affects all other species in the **ecosystem**. Have students discuss the **ecological** relationships they explored during the **food web** activity and have each student review the connections between their **organism** and all the other **organisms** in the web.*

Give an example of a *fire-dependent ecosystem* and explain how it is maintained by fire.

In the oak savannah, for example, frequent fires prevent the encroachment of shrubs and Douglas-fir seedlings, ensuring the native grasses and wildflowers will have access to sunlight and room to

grow. The maintenance of an open, grassy understory benefits predators like the coyote and the hawk by allowing them better access to prey animals. It also allows the oak trees, for which this ***ecosystem*** *is named, to be healthier, as they are not competing against other woody plants for resources. Shrubs and trees that do burn will return nutrients to the soil, which will aid the growth of other plants.*

References:

BLM Learning Landscapes. Michael Smith. 2002. Bureau of Land Management. 3 December 2007 <http://www.blm.gov/education/LearningLandscapes/teachers.html>.

"Mather Field Vernal Pools." Kids Splash. Sacramento Splash. 11 February 2008 <www.sacsplash.org/mather/animals.htm>.

Table Rocks Environmental Education. 2007. USDI BLM. 3 December 2007 <http://www.blm.gov/or/resources/recreation/tablerock/index.php>.

Animals

Organism	Relationships within Ecosystem	Response to Fire
Coyote	Hunts small mammals in the grass and seeks shelter beneath chaparral shrubs such as buckbrush and manzanita.	Runs away and finds new den site. Hunts mammals that return to feed on new vegetation.
Black-tailed deer	Feeds on buds and leaves of grasses and shrubs. Hunted by cougars and sometimes coyote.	Runs away and seeks shelter in a forest. Returns to feed on new growth after fire.
Black-tailed jackrabbit	Eats grasses and other plants, rests and hides in grass and shrubs. Eaten by coyotes, bobcats, cougars, eagles.	Hops away or burrows underground. Returns to feed on new growth after fire. May become more vulnerable to predators due to decreased cover.
Bobcat	Hunts rodents, rabbits, and birds. Dens in rock piles or hollow logs.	Runs away and finds new den site. Hunts mammals that return to feed on new vegetation.
Acorn Woodpecker	Nests and stores acorns in dead standing trees (a tree used by Acorn Woodpeckers for acorn storage is called a "granary tree"). Feeds on acorns and insects.	Flies away, establishes a new granary tree (By killing some trees, fire provides Acorn Woodpeckers with new potential granary trees.) Returns to burned site to eat the abundant insects that live in dead wood.
Western fence lizard	Eats insects and worms. Shelters under rocks and tree bark. Eaten by snakes and birds.	Hides under a rock or in a hole. Returns after fire to eat insects in dead wood and on new flowers.
Western rattlesnake	Eats small mammals. Sleeps under rocks or in the shade, and warms up in the sun.	Slithers away or hides underground. Returns to eat small mammals which feed on the new vegetation.
Pacific tree- frog	Eats insects. Lives near water, where it lays its eggs, and is eaten by snakes and birds.	Goes underwater until fire passes; moves to a moist, vegetated habitat after fire to feed on returning insects.
Turkey vulture	Eats dead animals.	Flies away, but returns to look for animals that were unable to escape the fire.
Western Meadowlark	Eats insects and seeds of grasses and flowers. Lives on the ground in a grass nest and is eaten by coyotes, bobcats, and raptors such as falcons.	Flies away to establish a nest in a different grassland until grass grows back after fire. Returns to feed on insects and seeds of new growth after fire.
Anna's Hummingbird	Eats nectar from flowers, as well as insects. Nests in shrubs.	Flies away to escape fire. May have to seek new nesting and feeding sites, but will return to feed on wildflowers that will thrive in the rich soil and open space after a fire.
Pocket gopher	Eats plants and lives in underground burrows. Eaten by snakes, coyotes, bobcats, and hawks.	Stays in burrow, but may establish a new burrow site immediately after fire and return when new plants grow back.

Bumblebee	Visits flowers and feeds on pollen and nectar. Spreads extra pollen to other flowers to pollinate them. Nests underground. Eaten by birds.	Flies away or stays in underground nest. Returns to collect nectar from new flowers after fire.
Butterfly/caterpillar	Caterpillars eat plants and butterflies eat nectar from flowers. Many flowers depend on them for pollination. Eaten by birds.	Butterflies fly away, caterpillars will probably die in fire. Butterflies will return after fire to feed on the new flowers and lay eggs on new foliage.
Spider	Eats insects; eaten by birds and western fence lizards.	Ground-dwelling spiders may hide under a rock or in a burrow. Web-weaving spiders will probably die in a fire. Will benefit from abundance of insects feeding on new plant growth after a fire.

Plants

Madrone	Berries eaten by birds and mammals; flowers provide nectar for insects. Provide shelter and shade for wildlife.	Most trunks will burn completely, although some older trunks may survive a light fire. Several stems can sprout from one root mass; insects and wildlife eat new shoots.
White oak	Acorns eaten by jays, woodpeckers, rodents, deer, bears, and native people. Leaves eaten by caterpillars. Home for birds and small mammals, moss, lichen, and mistletoe. Bark may be home and food for insects such as wood-boring beetles.	May burn partially or completely, depending on the intensity of the fire. Will resprout from roots or trunk after fire; acorns that survive will germinate in the nutrient-rich soil. Parasitic mistletoe may burn off. New growth is food for insects and wildlife.
Mistletoe	Obtains water and nutrients from oaks; fruits are food for birds, which spread the seeds to new trees.	Fire destroys mistletoe, benefits the oak trees it grows on.
Arrow-leaved balsam root	Leaves, roots, and seeds are eaten by insects, birds, and small mammals; pollen and nectar eaten by insects, which serve as pollinators.	Burns, but new plants will grow from an underground stem and usually do well in the nutrient-rich soil after a fire.
Buckbrush	Leaves, buds, and branches eaten by deer and caterpillars; seeds eaten by birds and small mammals; flowers provide pollen to insects. Provides cover and nesting sites for birds, deer, and small mammals.	Shrubs usually burn completely, returning nutrients to the soil. Seeds germinate only after fire; new growth is eaten by insects and wildlife (especially deer).
Manzanita	Flowers provide nectar for hummingbirds and butterflies; berries are food for birds. Provides nesting and cover for small mammals and birds.	Shrub usually burns completely, returning nutrients to the soil. Will resprout from roots or seeds buried in soil. New growth feeds returning wildlife and insects.