

Fire: Benefits, Problems, and the Role It Plays in Ecosystems

Lesson Plan

Grade Level: 6-8

Curriculum Focus: Conservation of Natural Resources

Lesson Duration: Two class periods

Student Objectives

- The benefits and problems associated with fire.
- The role that fire plays in maintaining healthy ecosystems.

Materials

- Discovery School video on *unitedstreaming: Understanding: Fire*
Search for this video by using the video title (or a portion of it) as the keyword.

Selected clips that support this lesson plan:

- Part One: Understanding Fire
 - Thoughts to Consider as a Class
 - Understanding Fire
 - Activities and Topics for Discussion
- Part Two: Understanding Fire
 - Thoughts to Consider as a Class
 - Understanding Fire
 - Activities and Topics for Discussion
- Video on *unitedstreaming: Enviro-Tacklebox: Module 4: Forces in the Environment: Rebirth in Fire*
Search for this video by using the video title (or a portion of it) as the keyword.

Selected clips that support this lesson plan:

- Misconceptions about Fire: The Difference Between Wildfires and Prescribed Burns
- Successful Prescribed Burns: A Revival of Plant and Animal Life
- Benefits of Prescribed Burns
- Serotinous Plants: Thriving With the Help of Fire
- The Mississippi Sandhill Crane National Wildlife Refuge: A Fire-Dependent Ecosystem

- Materials to make posters or brochures
- Books, Web sites, and videos regarding national parks, fire, and environmental science (see Procedures for suggestions)
- Computers with Internet access

Procedures

1. Discuss the positive and negative power of fire. On the board or a piece of paper, create a *Fire Power* chart with two columns: "Harmful" and "Helpful." During the discussion, write the students' responses on your chart. Have students brainstorm ways that fire can be harmful, such as damaging homes, communities, and ecosystems and harming people. Then ask students to think about ways that fire can be beneficial. Students may suggest its value as an energy source for cooking, heating, and powering machines, its symbolic use in religious and political ceremonies, and so on. Explain that fire is necessary to the health of some ecosystems.
2. Introduce the concept of *surface fire* as a valuable and necessary part of forest or grassland ecosystems. Include the following facts:
 - A surface fire is one that primarily burns undergrowth and leaf litter.
 - Surface fires can prevent larger, more serious "crown fires" from occurring.
 - By burning forest litter, these fires release nutrients present in forest litter that would otherwise decompose very slowly.
 - Surface fires can also spur the germination of plants, especially conifers such as the giant sequoia, the lodgepole pine, and the jack pine. These trees' pinecones need to be exposed to extreme heat before they can be released from the cone itself and germinate.
 - Surface fires help reduce the number of pathogens and insects.
 - Surface fires create or help to maintain habitat for animals such as deer, moose, elk, muskrat, woodcock, and quail by burning back or thinning sections of the forest.
 - Ecosystems such as prairies, savannas, chaparral, and jack pine forests are dependent on periodic fire to maintain themselves. Otherwise, these ecosystems would be taken over by trees.
 - Periodic fires can open up sections of the forest canopy, creating an opening for smaller plants that need lots of sunlight to grow; this stimulates diversity in the forest ecosystem.
3. Explain that surface fires often occur naturally when lightning strikes a forest and starts a fire in a forest or grassland. Recently, foresters and park officials have begun setting fires called "prescribed burns" to mimic these natural fires. Prescribed burns are done to counteract years of fire prevention policy, which called for all fires to be suppressed as quickly as possible. The policy of blanket fire suppression has not only disrupted plant succession patterns in the forest and limited the variety of habitat available to animals but also resulted in a tremendous buildup

of forest underbrush and litter. Therefore, when these forests do catch on fire accidentally through human error, the fire is very destructive. Ironically, prescribed burns are a type of fire prevention. In addition, since 1972, park officials have adopted a policy of letting most lightning-caused fires burn themselves out, within reason. Fires that threaten human lives, buildings, private property, or wildlife are extinguished.

4. Next, ask students to hypothesize what three things must be present for fire to burn. Their answers should be as follows: a fuel (wood, coal, gas, or other fossil fuel; dry trees; dead trees; leaf litter; and dry grass), oxygen, and a heat or ignition source, such as a match or lightning. These three “elements” are often referred to as the “fire triangle.”
5. Using what they’ve learned about the fire triangle, have students brainstorm ways of stopping a fire. (To extinguish a fire, you must remove or restrict one of the elements of the fire triangle. For example, remove the fuel source for the fire or remove the oxygen.)
6. Next, divide the class into two groups. Within one of those groups, have students work in smaller groups of two or three and create a public service poster, brochure, or television spot on the dangers of accidental forest fires. Encourage them to answer the following questions: What are the dangers posed by these unintentional fires? How many are set in a year? In what ways do such fires affect the ecosystem? What precautions should be taken to prevent these fires?
7. Within the second group, have students work in groups of two or three to create a poster, brochure, or television spot on the benefits of prescribed burns. Have them answer the following questions: How do prescribed burns alleviate future fire damage to forests? How often are prescribed fires set? How do foresters choose the areas where they plan to set fires? What time of year are they carried out? What safety precautions are taken? How do they keep the fire contained? How long does it take for new growth to appear?
8. Provide students with an array of resources regarding national parks, fire, and environmental science. Suggested resources include the following:

Books

- *Project Learning Tree* published by the American Forest Foundation
- *Environmental Science: Working with the Earth* by G. Tyler Miller
- *Fire: The Story behind a Force of Nature* by Jack De Golia
- *Introduction to Wildland Fire: Fire Management in the United States* by Stephen J. Pyne
- *Fire* by George R. Stewart
- *Yellowstone and the Fires of Change* by George Wuerthner

Web Sites

- The USDA Forest Service
<http://www.fs.fed.us/>

- The National Park Service
<http://www.nps.gov/>
- Links to State Fish and Wildlife Agencies
<http://wdfw.wa.gov/otherf&w.htm>

Videos

- *Yellowstone Forest 1988*, produced by Video Visions
 - *Yellowstone in the Summer '88*, produced for Travel Montana and Wyoming Travel Commission
9. Once students have completed their research, give them additional time to create their posters, brochures, or television spot.
 10. Have each group present its work to the class.

Discussion Questions

1. Compare and contrast the differences between a forest fire caused by human accident and a prescribed burn.
2. Suppose you were a park official who wanted to carry out a prescribed burn in a forest. You need to inform the residents of a nearby town of your plans. How would you defend your choice of action? What safety issues would you need to inform the citizens about?
3. Not everyone agrees with the National Park Service's policy of letting all "naturally occurring" fires – such as those started by lightning – burn. What do you think? Debate the pros and cons of this policy.
4. Some people are concerned about the National Park Service's policy of trying to put out fires within the park, arguing that the amount of damage done to the ecosystems from heavy machinery and cutting trees down to create fire barriers creates more damage than the fire itself. They argue that the cost of fighting these fires often exceeds the cost of replacing the park buildings that might burn. What do you think? Should the Park Service actively fight such fires?
5. One of the major environmental issues facing us today is the strong possibility that our climate is warming due to the excess carbon dioxide that is being released into the atmosphere by the burning of fossil fuels and forests. This is commonly called the greenhouse effect. Does this environmental concern influence your opinion about prescribed burning or allowing lightning-caused fires to burn? Why or why not?
6. Another environmental issue related to forest fires is air pollution. For example, burning fossil fuels and wood products releases particulate matter into the atmosphere. This can impair the human respiratory system – especially for those with preexisting conditions such as asthma. Should this influence the policy of prescribed burning? Why or why not?
7. Discuss how weather conditions might affect the strength of a forest fire. How might weather conditions affect those fighting the fire?

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points: Students show a strong understanding of the benefits and dangers of fire, as well as the role of surface fires; answer all the questions in their research; work cooperatively in their group to create a thorough, engaging poster, brochure, or television spot.
- 2 points: Students show a satisfactory understanding of the benefits and dangers of fire, as well as the role of surface fires; answer most of the questions in their research; work cooperatively in their group to create a complete poster, brochure, or television spot.
- 1 point: Students shows a weak understanding of the benefits and dangers of fire, as well as the role of surface fires; answer all the questions in their research; do not work well in their group; create an incomplete or vague poster, brochure, or television spot.

Vocabulary

abiotic

Definition: Nonliving features, such as light and temperature.

Context: Abiotic measurements of water quality were taken once a year.

biotic

Definition: Of or having to do with living organisms.

Context: Students were surveying the biotic features of their nearby stream.

combustion

Definition: An act or instance of burning.

Context: The combustion of the spilt fuel created a nightmare for nearby residents.

fossil fuels

Definition: A fuel (as coal, oil, or natural gas) that is formed in the earth from plant or animal remains.

Context: The burning of fossil fuels is the major cause of rising carbon dioxide levels in our atmosphere.

oxidation

Definition: The combination of a substance with oxygen.

Context: The oxidation of iron produces rust.

prescribed burn

Definition: The act of intentionally setting fire to an area in order to prevent more damaging fires.

Context: The park was closed because officials were conducting a prescribed burn.

Academic Standards

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/compendium/browse.asp>.

This lesson plan addresses the following national standards:

- Science – Life Science: Understands relationships among organisms and their physical environment.
- Science – Physical Science: Understands the sources and properties of energy.

National Academy of Sciences

The National Academy of Sciences provides guidelines for teaching science in grades K-12 to promote scientific literacy. To view the standards, visit this Web site: <http://books.nap.edu/html/nses/html/overview.html#content>.

This lesson plan addresses the following national standards:

- Physical Science: Transfer of energy
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>