

LEVEL: Grades 4-8. Variation:
Grades Pre K-2

SUBJECTS: Science, Social Studies, Language Arts.

PROCESS: Through learning how fire is a natural event in forests and other ecosystems, students discover how fires help keep plants and other parts of the ecosystems healthy.

OBJECTIVES: The student will:

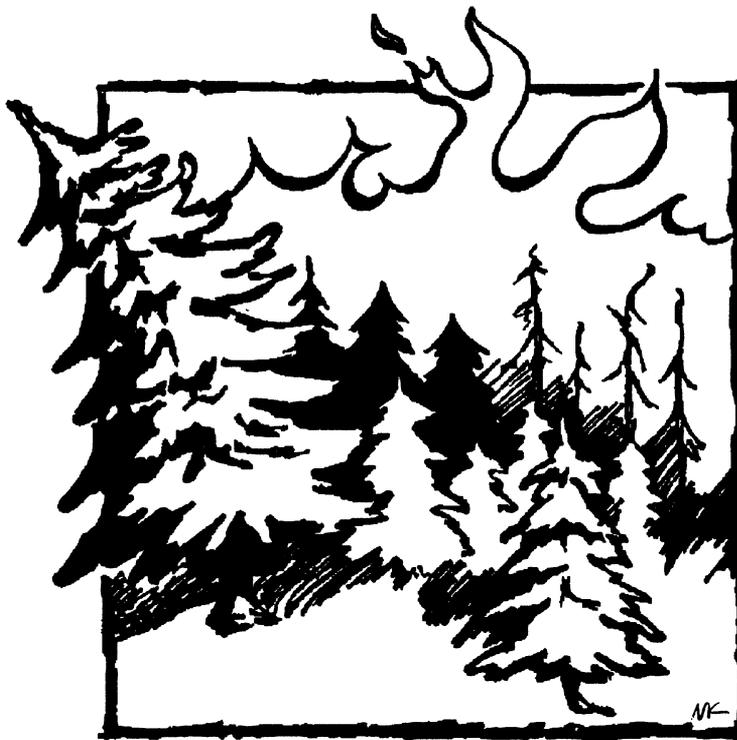
1. Observe a burning candle to learn about fire.
2. Describe a forest fire: how it starts, spreads, and burns out.
3. Explain several approaches to forest fire management.
4. Create and administer a survey about forest fires and discuss the results.

TIMEFRAME: Preparation: 50 minutes. Activity: Part A: 30 minutes; Part B: two to three 50-minute periods; Part C: two 50-minute periods. Variation: 30 minutes.

SKILLS: Analyzing, categorizing, classifying, observing, summarizing.

MATERIALS: Art materials, glass jar with metal lid, wooden kitchen matches, small birthday candles, paper match, corn or potato chip, magazine photos of forests or fires, "Fire Triangle" and "Colorado Wildfires" worksheets on Student Pages 1 and 2 (attached). Variation: 20 strands of yarn and pieces of blue poster board or construction paper to make necklaces, pieces of red and green construction paper to make head-bands. (Extension: Drawing materials, "Tree Tops Valley" Student Pages 3 and 4 (attached).)

VOCABULARY: Arson, firebreak, fuel, interface, prescribed burn.



LIVING WITH FIRE

OVERVIEW: Fire is a natural event in most forest ecosystems. Some forests depend on fire to recycle nutrients back into the soil. From an ecological standpoint, fire is neither "good" nor "bad." Fire occurs naturally through lightning strikes in the presence of dry fuel. Fires also occur when humans start them intentionally or accidentally.

Fires need heat, fuel, and oxygen to burn - these three elements are known as the "fire triangle." Remove any one of these three elements and the fire will not burn. Initially, the heat is provided by the source of ignition. Fuels include dry trees, dead trees and limbs, leaf litter, and dry grass.

Oxygen is, of course, available in the air. Weather conditions have a great influence on when fires occur and how they spread. Hot temperatures and dry winds can dry out trees and grasses in a forest, making them available as fuel for a fire to consume. The

stronger the winds, the more quickly moisture evaporates from the vegetation, and the faster the fire can spread.

Even in the largest fires, such as the Yellowstone fire in 1988, not everything burns. Patterns of burned areas across the landscape can help keep ecosystems healthy. Areas that have recently burned do not have much fuel or dry dead litter, and they are less likely to burn again soon. Having trees of mixed ages is healthy for the forest ecosystem in many ways, one of which is preventing the entire forest from burning down.

In the southeastern United States, the months of March, April, and May are called "fire season," when 75 percent of forest fires occur. Fire season in the West usually runs from June through October, during the very dry months of year. In the Northeast, it is March through May, and then again in the fall, corresponding to

the leaf drop. Wildfires do not generally occur when the fuels (trees, shrubs, and grasses) are wet and cold.

Fire was an important tool in Native American cultures and is in other cultures around the world. Some Native American people set fire to prairies knowing that new growth would attract game. Fire has traditionally been used to drive game, reduce populations of unwanted animals, enhance crop growth, and clear forests.

Fire can be an effective management tool for state and federal agencies to manage their wildlands, which include forests, grasslands, and other ecosystems. Over the years, fire management policies and techniques have changed. A controlled, or prescribed burn (one that is lighted by trained fire personnel within prescribed fuel and weather conditions) can prepare a logged area for reforestation, enhance wildlife habitat, protect a native tree species, control insect populations or disease, or reduce future fire hazards by reducing burnable fuels. They are not risk free and they can be expensive.

Fire is an essential component in the lifecycle of several tree species. Some depend on the heat of fire to open their cones and release the seeds, while others simply need fire to open the forest canopy to provide light. In general, fires return nutrients to the soil in the form of ash.

Preventing, controlling, and suppressing wildfires is becoming more vital as more urban people seek woodland settings for their homes. More and more homes, property, and lives are endangered by fire along the wildland-urban interface. Once again, we learn that it isn't easy to balance the needs of humans against the needs of forest systems.

PROCEDURE:

PRE-ACTIVITY:

1. Make photocopies of the "Fire Triangle" worksheet (student page 1) for each student. Gather materials for the demonstration. You may want to invite a local firefighter or forester who is involved with fire management to visit your class.

2. Variation: You need an outdoor area or large room for the game. Make four green headbands out of construction paper for the "rangers." Make one red headband for "wildfire." Make 20 "fire protection necklaces." These can be made by cutting squares out of blue poster board and tying string through them. (Or, simply make loops or bands of blue construction paper large enough to go over students' heads and rest on their shoulders.)

ACTIVITY:

PART A: FIRE TRIANGLE

1. Pass out the "Fire Triangle" worksheets. Have students read and work through it on their own. When everyone is finished, ask the class what three things are needed for fire to burn. Draw the fire triangle on the board. Ask them under what conditions they think it would be easy to start a fire, and when they think it would be hard.

2. Demonstrate how a candle burns in a glass (from a science lab) when each of the three different elements are limited:

- A. Place a small, lighted birthday candle in a jar (you may want to mount it in a dab of modeling clay). Then seal the jar with the lid to cut off the supply of oxygen. As the flame consumes the oxygen in the jar's air, the flame will go out. Explain that cutting off oxygen is one way of managing a fire.

- B. Open the jar, relight the candle, and put the lid back on. Only this time, when the flame starts to go out reopen the lid to let more oxygen in; the candle will reignite. Explain that this illustrates what happens when the wind picks up during a fire; the fire may reignite or burn out of control.

- C. Take the lid completely off and allow the candle to burn until all the fuel (paraffin) is consumed and the fire extinguishes itself. Give the students time to see how long it takes. Set up a wooden match and a paper match (similar size) in bases of clay. Light them both and see which burns longer. How do these two tree products - wood and paper - burn differently? Place a corn or potato chip on a piece of tin foil and light it. See how long it takes to burn. What fuel in the chip made it burn? (Vegetable

oil, found in all plants.)

Explain that the primary way fire managers prevent fires is by reducing fuels so fires will not start as easily, and won't burn as intensely or for as long.

3. Finally, extinguish the flame by adding water, which removes the heat and smothers the flame. With all of today's "high-tech" firefighting equipment, water is still the main "tool" used to fight fires.

4. Try to have a local firefighter visit your group to talk about the equipment and techniques that are used to suppress fires. Prepare students to ask questions about how fire can be prevented and how they can protect themselves should a fire occur. You can also have a forester visit your group to talk about wildfires. Prepare students to ask questions about how forest fires are managed in their region, and how they can best be prevented.

Note: For grades 6-8, the candle demonstration can be done by groups of students rather than the teacher.

PART B: SURVEY DEVELOPMENT

1. Use magazine pictures of fires and forests to initiate a discussion revolving around students' attitudes on forest fires.

2. Present your research question to your students.

Examples:

-Should controlled burns be allowed in public forests?

-Do forest fires play a negative role in ecosystem management?

-Do forest fires play a positive role in ecosystem management?

Students may be involved in the development of those questions.

3. Discuss surveying as a technique to gather information.

4. Have students develop a ten-question

survey related to perceptions associated with forest fires. Samples:

SAMPLE SURVEY

Please take a few minutes to complete our survey. Simply circle the best response for each question. Thank you!

1. I support controlled forest fires.

Strongly Agree

Agree

No opinion

Disagree

Strongly Disagree

2. I feel that forest fires started by lightning strikes should be allowed to burn until personal property is in jeopardy.

Strongly Agree

Agree

No opinion

Disagree

Strongly Disagree

3. I feel that all forest fires should be extinguished immediately.

Strongly Agree

Agree

No opinion

Disagree

Strongly Disagree

4. I feel that no intervention should occur with forest fires.

Strongly Agree

Agree

No opinion

Disagree

Strongly Disagree

5. Have students pass out surveys to parents, neighbors, teachers, other classes, etc. asking first if they would like to participate. Finished surveys are collected and participants are thanked. After each student collects five surveys, results are tallied and discussed. Be careful, however, not to place too much validity on the results. There are many variables that influence survey results, including such things as the age, education, occupation, residence, etc. of the respondent. Survey questions must be carefully worded. Results can, however, lead

into new areas of study.

PART C: CAUSE AND EFFECT

1. Have students contact their state forestry agency (usually within the state department of natural resources or department of agriculture) or a local office of the USDA Forest Service. They can ask for information concerning the causes of all large forest or range fires in the state over the past several years, including data on both prescribed burns and uncontrolled burns (see “Colorado Wildfires” student page 2 for sample data).

2. Using the Leading Cause of Fires Tables, have the students develop tables and pie charts showing the actual percentages of fires from different causes for the year 2000. (student page 2).

3. Using the Colorado Wildfires table, have students compare the data for at least three different years.

-Determine the number of fires each year, noting increases or decreases.

-Reasons why increases or decreases might have occurred.

-Make a graph for 1985-2000 | Chart number of wildfires and acres burned.

4. Have students research the effects of fire on the economy and the environment. Find out about financial costs involved in the loss of natural resources and in fire management, ecological costs involved in the loss of natural resources and in fire management, ecological costs or benefits from forest fires, and how various agencies or forest industries manage fire and handle fire prevention.

VARIATION: PRE K-2 FIRE TAG

This game simulates how trees can be destroyed by fire, how they can be protected from fire, and how they grow back.

1. Choose one student to become the Wildfire that burns the trees. She or he wears a red headband.

2. Choose four students to be Smokey Bear rangers. They wear green headbands.

Give each ranger five blue “fire protection” necklaces to hold (see Pre-activity).

3. The remaining students pretend to be trees. They scatter to different parts of the room and stand still.

4. The Smokey Bear rangers gather around the Wildfire in the middle of the room.

5. The game starts when someone yells, “Fire!” Then the Wildfire runs to grab the hand of a tree. When this happens, the tree becomes part of the Wildfire, and the two of them run to grab another tree. Thus, the fire builds and spreads.

6. At the same time, the Smokey Bear rangers run to protect the trees by putting fire protection necklaces around their necks. They can protect only trees that have not yet caught on fire.

7. When a tree receives a necklace, it joins hands with the other protected trees to make a “firebreak” (line of protection that the fire cannot penetrate). In reality, this could be a strip of wet or bare earth.

8. When the fire runs out of fuel, it burns out. Wildfire students drop their hands and stand still to show that new trees have grown in the enriched soil. Once again, there is a forest.

9. Before dismissing the group, discuss the meaning of Smokey Bear’s slogan: “Only you can prevent forest fires!”

ASSESSMENT: Have students create a picture-board story of wildfire - it’s like a comic book but without any dialogue. The picture board should have at least ten frames showing:

a. How the forest looked before the fire (the fuel-dead trees, leaf litter, etc. should be labeled).

b. How the fire was ignited (natural or human source).

c. The pattern the fire burned (burning near a cabin because there are dry trees around it).

d. How the fire was put out. Which parts of the fire triangle were removed to stop the fire?

RESOURCES:

Fire, George R. Stewart, University of Nebraska Press, 1984.

Fire Ecology: The United States and Southern Canada, Henry A. Wright and Arthur W. Bailey, New York, John Wiley and Sons, 1982.

Fire in America: A Cultural History of Wildland and Rural Fire, Stephen J. Pyne, Princeton, NJ, Princeton University Press, 1982.

Fire: The Story Behind a Force of Nature, Jack DeGolia, Las Vegas, KC Publications, 1989.

Introduction to Wildland Fire: Fire Management in the United States, Stephen J. Pyne, Princeton, NJ, Princeton University Press, 1984.

Wildlife in Transition: Man and Nature on Yellowstone's Northern Range, Don Despain, Douglas Houston, Mary Meagher, and Paul Schullery, Boulder, CO, Roberts Rinehart Publishers, 1986.

Yellowstone and the Fires of Change, George Wuerthner, Salt Lake City, Haggis House Publications, 1988.

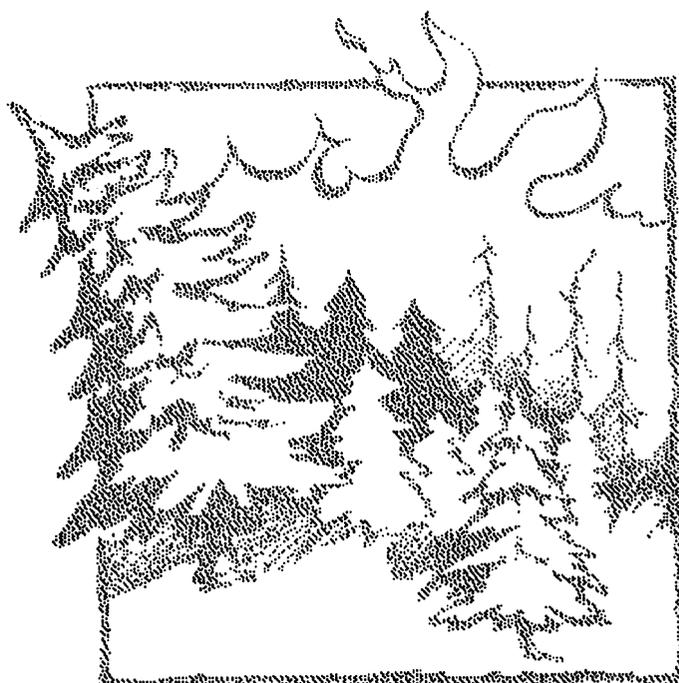
Videos:

Yellowstone Forest 1988, produced by Video Visions, P.O. Box 6721, Bozeman, MT 59715. One hour.

Yellowstone in the Summer '88, produced for Travel Montana and Wyoming Travel Commission by Sage Advertising, P.O. Box 1142, Helena, MT 59624, (406) 442-9500. 17 minutes.

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FIRE TRIANGLE

1. Fires need heat, fuel, and oxygen to burn. This is known as the "fire triangle." Draw a triangle below and label each of the three sides with the word and a picture for each of the three parts.

4. Oxygen is available in the air. Weather has a great influence on when fires occur and on how they spread. Hot temperatures and dry winds can create severe fire conditions by affecting fuel, moisture, and oxygen. What can dry winds do to fuels to make them more likely to burn?

2. Initially, the heat is provided by an ignition source, which can be human or natural. Name two natural and two human-caused sources of heat for fire ignition.

Natural:

1. _____

2. _____

Human-caused

1. _____

2. _____

5. If you cut off any one of these elements, a fire will not burn. What are some ways firefighters might cut off each of the three parts of the fire triangle?

3. Fires need fuel to burn. In a forest, what sort of fuels might you expect to find? Name three potential fuels:

1. _____

2. _____

3. _____

**COLORADO WILDFIRES
STATE AND PRIVATE LANDS**

<u>Calendar Year</u>	<u>Protected Acres</u>	<u>Number Wildfires</u>	<u>Acres Burned</u>
1985	25,958,109	985	25,343
1986	25,958,109	1,337	30,247
1987	25,958,109	1,194	24,208
1988	25,958,109	1,722	33,037
1989	25,958,109	1,767	56,732
1990	25,958,109	1,475	9,825
1991	25,958,109	1,449	6,576
1992	25,958,109	1,048	4,158
1993	25,958,109	1,267	3,526
1994	25,598,109	3,185	52,125
1995	25,598,109	2,224	32,011
1996	25,598,109	2,449	49,498
1997	25,598,109	1,605	16,703
1998	41,432,979	1,349	10,282
1999	41,432,979	1,987	33,256
2000	41,432,979	2,043	76,288

**THE LEADING CAUSES OF FIRES
Year 2000**

National Forest	
<u>Cause</u>	<u>% of Total</u>
1. Lightning	64%
2. Campfire	13%
3. Arson	8%
4. Miscellaneous	7%
5. Smoking	2%
6. Equipment	2%
7. Debris Burning	2%
8. Children	1%
9. Railroads	1%

State and Private Forestlands	
<u>Cause</u>	<u>% of Total</u>
1. Debris Burning	34%
2. Arson	24%
3. Miscellaneous	14%
4. Equipment	10%
5. Lightning	7%
6. Smoking	3%
7. Children	3%
8. Railroads	3%
9. Campfire	2%