

LEARNING TO LIVE WITH FIRE



What do you think of when you hear the words “wildland fire”?

If you are like most people, these words conjure up images of large tracts of charred and barren land, a scene of devastation. But did you know that fire is a natural and essential part of California’s ecosystems?

California’s Fire-Adapted Ecosystems

Fires have always been a natural component of the Earth’s ecosystems. As natural as wind and rain, fire helped create a patchwork of differing vegetation types. For millions of years in what is now North America, lightning and volcanic activity started fires, long before people came on the scene. Later, Indians regularly burned the vegetation to open up an area and to favor plants that attract game animals. These natural and human-caused fires have helped select vegetation types that tend to depend on fires for their existence. In these ecosystems, the plants and animals have many adaptations that help them survive and re-establish after fires.

Chaparral, found in central and southern California, is one plant community often impacted by fire. Typical chaparral plants include manzanita, ceanothus, chamise, and scrub oak, along with herbs and grasses. This community contains plants that are well adapted to fire, and some that even encour-

age fire! After a fire, some chaparral plants sprout, grow, and spread rapidly. Many have heat-resistant seeds that break their dormancy after long intervals between fires. Many species of *Ceanothus* for example, have leaves that are coated with flammable resins that fuel a fire. This adaptation benefits the species because ceanothus seeds require intense heat for germination. “Fire-resistant” roots also enable the plant to re-sprout quickly in recently burned areas.

Other California plant communities are also adapted to fire. Giant sequoias live where lightning strikes and lightning fires are common. Mature trees are protected from fire by a fibrous bark that is 60 to 120cm (2 to 4 feet) thick. This fire-resistant bark insulates the living tissues of the inner bark from the heat of the fire. Lightning fires can burn the thick layer of litter on the forest floor, exposing the mineral soil beneath. Fire is important to this community because the tiny seeds of the giant sequoia must fall on

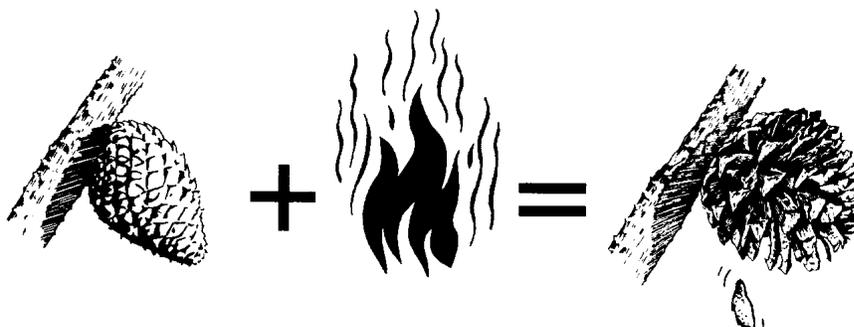
partially burned or bare mineral soil to germinate successfully.

Closed-cone coniferous trees show other adaptations to fire. These trees, including the knobcone pine, Bishop pine, and Sargent cypress, have seed cones that require the heat of a fire to open. The seeds are protected from fire behind tightly closed resin-coated scales, often so well insulated that even when the outer part of the cone is charred, the seeds inside are protected. High temperatures cause the cone to open, releasing the seeds that fall to the ground into a cool bed of ash and mineral soil.

The Role of Fire in California

Despite the apparent devastation after a wildland fire, fire is essential to the health of most ecosystems in California for several reasons. First, in chaparral and closed-cone conifer communities, the seeds need fire to germinate.

Second, fires clear the forest of underbrush, leaving ash and open-



A fire’s heat triggers a closed cone to open and release seeds.

ing the forest floor up to sunlight. The resulting grasses, herbs, and regenerated shrubs provide food for many wildlife species. Third, where the ground has a deep accumulation of fallen branches and dry litter, fires reduce this debris and supply nutrients to the soil. Periodic burns in an area help use up the fuel, which means that successive fire is less intense and less destructive than when fires are suppressed and plant debris accumulates. Last, but not of least importance, when fire removes a thick stand of shrubs, the water supply is increased. With fewer plants absorbing water, streams are fuller, benefiting other types of plants and animals.

Using Fire to Manage Wildland Fires

A controlled or “prescribed” wildland fire may have many of the same beneficial effects as a naturally caused fire. These fires can remove underbrush and help increase the herbaceous plants and insects that wildlife species need for food.

Foresters commonly use fire to reduce debris and encourage regeneration of trees after a tract of trees is logged. Other benefits include the control of competing vegetation — which often include species not native to the area — and the control of diseases and pests.

According to land managers, perhaps the most important use of a prescribed burn now and in the



Cause of Fires						
Cause	2004	2005	2006	2007	2008	5 Year Ave.
Equipment Use	1618	1487	1237	489	401	1046
Vehicle	833	677	555	84	69	444
Undetermined	837	856	986	969	908	911
Debris Burning	546	507	455	490	431	486
Misc.	679	505	627	1061	1115	797
Arson	378	304	319	227	220	290
Campfire	118	93	113	41	23	78
Lightning	223	165	237	126	332	217
Power Lines	126	141	130	27	20	89
Smoking	109	104	87	84	62	89
Playing with Fire	87	40	40	12	8	37
Railroad	20	29	19	0	4	14

Figures for California Department of Forestry and Fire Protection jurisdictions.

future is to reduce the amount of dead vegetation and other organic debris that decays very slowly in dry environments. This debris results in a hazardous situation, because it is much more likely that when a fire finally does occur, the abundant, dry fuel available will create a high intensity burn.

For many years, land managers thought that fire interfered with wildland growth and brought destruction to life and property. Their policy was to eliminate fire completely, using tough suppression measures. Today, however, land managers recognize the negative impacts of excluding fire. They are reversing this trend by increasing the use of controlled and prescribed burning, a practical and natural way to reduce the dangerous accumulation of fuels, and so to minimize the potential for severe wildfires.

When Wildfires Become Foes

While fire can be a “friend” to the natural landscape, it can also be a “foe” to people when it gets out of control. There is an important distinction between low intensity natu-

ral wildfires that are set or controlled for a particular purpose by a land manager, and wild-fires that create the destruction that make headline news. A wildfire is a fire that runs “wild,” burning out of control and made unpredictable by changes in weather. Lightning that sparks dry leaves or other organic matter causes some wildfires in California. Most often, however, people and their activities cause them. Common causes are arson, sparks from brush clearing and equipment, improperly maintained campfires, smoking, and children playing with matches.

When a wildland fire begins, fire managers ask two major questions: “Where is the fire — in a forest or grassland, or in a human-dominated landscape?” If people and property are threatened, all efforts are made to extinguish the fire. In some areas, such as in national parks and forests, when the fuel moisture and weather are within the limits of a “prescription to burn,” under surveillance, a fire may be permitted to burn naturally until it goes out by itself or must be put out.

Wildland fire managers must constantly assess the threat of both natural and human-caused fire to the wildlands, and the threat of wildland fires to humans. In prescribing a fire or controlling a wildland fire, they must carefully evaluate and plan how the fire will effect the ecosystem, impact air quality, and threaten the safety of human life and property.

Living in a Fire-Prone Ecosystem

Each year during California's "fire season," usually from May to late fall, thousands of acres of wildland and hundreds of structures are burned. Some of the qualities Californians most enjoy — our warm, dry climate and beautiful natural landscapes — create one of the most severe potential wildfire conditions in the world. Added to this is the greater number of people moving into new communities that were once wildland areas — the foothills, grasslands, and mountains of California.

Mixing fire-prone wildland areas and suburban areas makes it very difficult to maintain the natural role of fire and to protect human lives and property. The rapid population growth into these areas of the state is putting great strain on the fire-fighting forces as well as on the integrity of these fire-dependent ecosystems. Acknowledging that it is every Californian's responsibility to understand the role of fire in maintaining the health of fire-adapted ecosystems, and to help protect lives and property from fire, there are certain steps that everyone living in a fire-prone area can take. By evaluating the risks and taking steps to make their community and property "fire safe," Californians can learn to live with fire.

For more information, see the brochure "Why 100 Feet?", and "California Living: Fire Safe", a DVD

available from CAL FIRE Headquarters, P.O. Box 944246, Sacramento, CA 94244-2460, or call (916) 653-5123.

Activities:

The following three activities can give your students the opportunity to learn more about the role of fire in California and ways they can act responsibly.

Fire Triangle

Students learn how fire is a natural event in California's ecosystems by exploring the three elements necessary for a fire.

Preparation

Copy enough Fire Component Cards so that each student gets three. Be sure there are equal numbers of fuel, heat, and oxygen cards.

Doing the Activity

1. Place a small birthday candle in a jar, mounting it in a dab of modeling clay. Ask students what it needs to burn. Discuss: What are other ways that fires might be started? What would happen if I put the lid on this jar? (The flame will go out.) Why? (The oxygen in the jar has been used up.) How else could we extinguish the flame? (Cutting the wick from the candle removes the fuel. Putting water on the flame removes the heat and cuts off the oxygen.)

2. Draw a diagram of the fire triangle on the board. Discuss: "What three things are needed for a fire to burn? Under what conditions would it be easy to start a fire? When would it be hard?"

3. Mix the Fire Component Cards, and hand out 3 cards to each student. Explain that each student will try to create a fire by trading cards with other students. When a student has three cards required for a fire, he or she stops and sits down.



4. When the trading is complete ask a few volunteers to tell the class what components make up their fire.

5. Give students a copy of the Fire Facts. Ask them to write a story about their fire using the information from their cards and from the Fire Facts, including how the fire gets started, how long it lasts, how it might be put out, and its effects.

This activity was adapted from "Bo-real Forest Fire Triangle," The Role of Fire in Alaska. Anchorage: U.S. Fish and Wildlife Service, 1992.

Cause and Effect

Through a graphing activity using real data, students learn about the different causes of fires in California.

Preparation

Copy the Cause of Fires Data to give to groups of students.

Doing the Activity

1. Using the information in the Cause of Fires Data, have students develop tables, graphs, or pie charts showing the actual numbers and percentages of fires from different causes for the years studied. This information can also be used to create a computer-spread sheet or to practice creating a database.

2. Have students compare the data and determine:

- How does the number of fires for

each cause in each year compare with the five-year average for that cause?

- What percentage of the fires each year was natural? What percentage was human-caused? What percentage was intentional? What percentage was accidental?

Fire Safe Home

Students learn ways they can keep their homes and families safe from wildfires.

Preparation

Make a copy of the Fire Safe Check-list for each student.

Doing the Activity

1. Ask students what kinds of things they might be able to do to reduce the risk of fire in and around their homes.
2. Give each student a copy of the Fire Safe Checklist to use at home. You may want to send a letter home explaining the purpose of the checklist, and asking adults to work with their student on any items that may need doing.
3. Have students report on their findings, and on any action they took.

Assessment Opportunities

- Relate to students the information about fire-prone plant communities contained in this bulletin, using local examples. Ask students to design a fictitious plant or animal that has characteristics enabling it to survive a fire.
- Have students survey friends and family to find out what they think about wildland fires. The survey might include questions like: Have you ever seen a wildland fire? If so, where was the fire you saw? Do you think wildland fires are beneficial? Which of the following do you think starts more wild-fires each year: (a) lightning or (b) humans? Do you think wildland fires should be allowed to burn if human life and property are not threatened?

Resources For Teachers

Cottrell, William H., Jr. *The Book of Fire*. Mountain Press Publishing Co, 2004. Through simple illustrations and explanations, this book explores the science of fire and forest fires.

Peluso, Beth A. *The Charcoal Forest*. Mountain Press Publishing Co, 2007. Find out how birds, bugs and blooming things come back after a fire.

For Students

Fraser, Mary Ann. *Forest Fire!* Golden, CO: Fulcrum. Young readers can learn about the changes that happen after a forest fire.

London, Jonathan and Lanny Pinola. *Fire Race: A Karuk Coyote Tale About How Fire Came to the People*. San Francisco: Chronicle Books, 1993. This delightfully illustrated story is based on a myth of the Kurak people who are native to the Klamath River region in Northwest California.

Pringle, Laurence. *Fire in the Forest: A Cycle of Growth and Renewal*. New York: Atheneum, 1995. This engaging book gives readers a clear explanation of how a fire can benefit the forest ecosystem.

Simon, Seymour. *Wildfires*. HarperCollins Publishers, 1996. Present wildfires are neither good nor bad but part of an endless cycle of change in forests and grasslands.

Patent, Dorothy Hindshaw. *Fire: Friend or Foe*. New York: Clarion Books, 1998. Discusses forest fires and the effects on both people and the nature.

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Sources:

"Fire: Friend or Foe," Wild in the Woods (Virginia's Project WILD and Project Learning Tree newsletter), May 1996.

"Fire Safe—Inside and Out" Brochure, California department of Forestry and Fire Protection, Public Education Office.

California Vegetation by V.L. Holland and David J. Keil, Dubuque, IA: Kendall/Hunt.

Fire Component Cards

(Cut cards apart.)

FUEL Bunch Grass	OXYGEN 40 MPH winds	HEAT Lightning, light rain showers; air temperature is 50 °F
FUEL Tops of ponderosa pine trees	OXYGEN 20 MPH winds	HEAT Lightning, heavy rain showers; air temperature is 70°F
FUEL Low Bushes like chamise	OXYGEN 5 MPH winds	HEAT Sparks from road-repair equipment, air temperature is 90°F
FUEL Stumps and downed logs	OXYGEN 15 MPH winds	HEAT Fireworks; air temperature is 80°F
FUEL Roots and organic matter in soil	OXYGEN 10 MPH winds	HEAT Campfire left burn-ing; air temperature is 70°F, very dry
FUEL Dead standing trees and high brush	OXYGEN 30 MPH winds	HEAT Cigarette thrown in grass; air temperature is 70°F
FUEL Deep duff of pine needles and dried leaves	OXYGEN No wind	HEAT Lightning; air temperature is 90°F
FUEL Fire burned here 10 years ago, little fuel build-up	OXYGEN No wind	HEAT Debris-burning fire gets away; air temperature is 70°F



Fire Facts

Types of Fires

Crown or canopy fires burn all green and dead materials in the treetops or canopy.

Fuels: tree branches and crowns, dead standing trees (snags)

Surface fires burn all materials lying on or immediately above the ground.

Fuels: needles or leaves, duff, grass, small dead wood, fallen logs, stumps, and limbs

Soil fires burn all burnable materials lying beneath the soil surface.

Fuels: deep duff, roots, rotten buried logs, and other woody materials

Fire Intensity

Fire intensity tells you how hot a fire is. A fire can be cool, moderate, or hot.

Some things that influence fire intensity include:

Fuel: Fuels that are small and very dry (like grass) produce cooler fires.

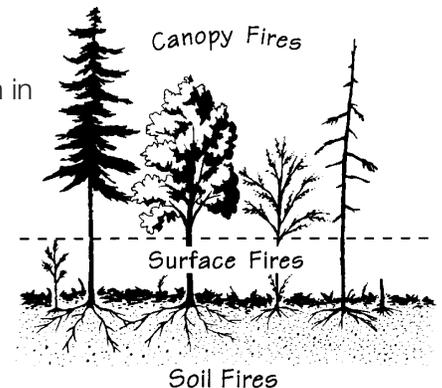
The woodier the fuel, the hotter the fire.

Moisture: The more moisture present, the cooler the fire will be. Fires that burn in spring are less intense (cooler) than fires that burn in hot dry summer months.

Rain makes a fire less intense.

Wind: Wind can fan a fire, making it more intense (hotter), and pushing and spreading it on the front.

Temperature: The higher the air temperature, the drier the fuel, and the more intense (hotter) the fire is likely to be.



Fire Safe Checklist

- Make sure there is a smoke detector on every level of your home.
- Test your smoke detectors monthly, and replace batteries twice a year.
- Make sure you have charged fire extinguishers in your kitchen and garage that are easy to find.
- Make sure each member of your family can hold and use your fire extinguishers and knows where they are located.
- Create a “defensible space” around your home by removing all dry grass, brush, and dead leaves at least 30 feet from your home — and keeping it clear.
- Stack firewood and scrap woodpiles at least 30 feet from any structure and clear away dry grass, brush, and dead leaves within 10 feet of these woodpiles.
- Make sure that your house address and street name are printed in numbers and letters at least 4 inches tall. They should be visible from each direction for at least 150 feet.
- Make sure all family members know escape routes from the house and a meeting place outside.
- Store at least a three-day supply of drinking water and food that doesn’t require refrigeration or cooking.
- Make sure all family members know how to Stop, Drop, and Roll if their clothes catch on fire, and how to call 9-1-1.

Parent or Guardian: This Checklist contains only items that are appropriate for students to do to make sure your home is “fire safe.” For a more complete list, see the “Why 100 Feet?” brochure, “Homeowner’s Checklist” booklet or “California Living: Fire Safe” DVD available from: CAL FIRE Headquarters, P.O. Box 944246, Sacramento, CA 94244-2460, (916) 653-5123.