FIRE ECOLOGY

Resource Management Education Unit

TEACHER BACKGROUND INFORMATION

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INTRODUCTION

Fire is an event controlled by fuels, weather and topography. Regardless of significant variations, fire occurs nearly everywhere that fuel in a flammable condition is present in sufficient quantities and when an ignition source is available. Prior to the appearance of humans in North America, the ingredients for fire were largely controlled by climate. Since human presence, ignition sources and fuels have been modified; people have changed their environment. As a result, the current distribution and composition of vegetation zones and land-based ecosystems have adapted to **wildland fires**, defined as all fires that burn in natural environments. The natural role of wildland fire, an important ecological force, cannot be ignored because fire greatly influences ecosystems. Fire's influential role as an ecological force, similar to that of other natural phenomena such as floods, earthquakes and hurricanes, will be discussed in this section.

CULTURAL INTERPRETATIONS OF FIRE

Fire has been a benevolent, mystical and religious symbol of great significance for cultures throughout the world. The mythology of ancient Egypt included a large, magnificently colored bird named the Phoenix. According to the myth, the Phoenix lived for up to 600 years. At the end of its life, the great creature built a funeral pyre (fire) and immolated itself. From the funeral fire's ashes a new Phoenix emerged with the freshness of youth to live out yet another cycle of life, death and rebirth.

Other mythical stories from the hills of ancient Italy tell of the guardian priest, the King of the Wood, who was regarded as the spirit of vegetation and believed to be endowed with a magical power to make trees bear fruit. While his life was held precious by his worshipers, the very value attached to it ensured his death. The ritual killing of the incarnate Tree-Spirit was believed to be the only way of preserving the spirit from inevitable decay. Each King of the Wood had to be killed by fire so that the divine Tree-Spirit within him would be transferred in its entirety to a younger and more robust successor.

An analogy can be made between these recurring stories from classical antiquity and wildland fire management today. In a sense, naturally recurring wildland fires are analogous with a contemporary killing of the Tree-Spirit or the rebirth of the Phoenix. Wildland fire, where properly **prescribed** and managed, fosters new plant growth and expands wildlife populations.

Fires remove dead trees and litter from the forest floor. Shrubs and trees invading grasslands also are killed by fires. In each example, new healthy regrowth occurs. Fire does not imply death, but rather change. As fire was associated with rebirth and renewal in mythology, so fire is now recognized as an instrument of change and a catalyst for promoting **biological diversity** and healthy **ecosystems**.

Wildfires, defined as unwanted fires in the natural environment, whether they burn a forest, whole towns or one home, are considered devastating. People often mistakenly consider all fires to be negative, destructive forces. However, properly managed fire, referred to as a prescribed fire, can be an effective natural resource management tool. Prescribed fires, wildfires and natural fires are discussed in more detail in the following section.

Fire and Ecosystems

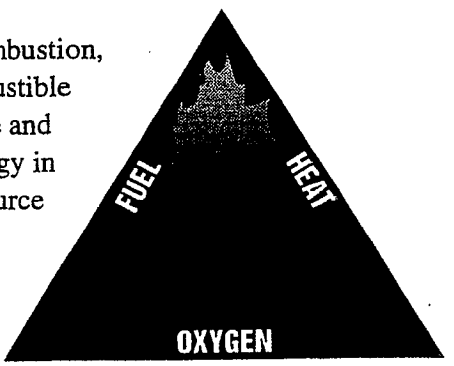
Wildland fire is one of nature's oldest phenomena, probably developing simultaneously with terrestrial vegetation and the evolution of the atmosphere. Evidence of free-burning fire has been found in petrified wood and coal deposits formed as early as the Paleozoic Era, approximately 350 million years ago.

Likewise, fire is a cultural phenomenon. It probably was the first product of nature that humans learned to control. Early societies used fire to kill and collect insects and small game for food; as a tool to clear land for agricultural activities; as a communication device to create smoke for signaling; and as a weapon against enemies. More recently, beginning with the Industrial Revolution, humans harnessed fire in engines to power machinery.

Initially, lightning was the match that ignited fires. Later, once humans learned to initiate fire, its occurrence became much more widespread. Today, approximately 10 percent of all wildland fires in the United States are started by lightning strikes, and the remainder are caused by humans.

Unquestionably, fire greatly impacts the Earth's natural environment and ultimately results in significant evolutionary change. However, such change cannot be fully understood until the process of fire itself is understood.

The Fire Triangle



Fire is a chemical reaction, called combustion, that involves the rapid oxidation of combustible materials — any substance that will ignite and burn — accompanied by a release of energy in the form of heat and light. An external source of heat generally is needed to start a fire.

The three-sided **fire triangle** shows that oxygen, heat and fuel in the proper proportions are necessary to create a fire. If any one of these three elements is removed, a fire cannot exist. Air supporting a fire must be at least 16 percent oxygen. The air that surrounds us contains about 21 percent

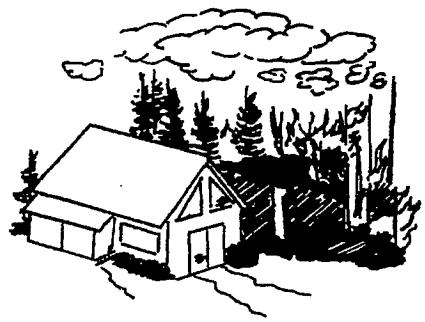
oxygen. Heat and temperature are closely related. **Heat** is a type of energy in disorder, whereas temperature is a measure of the degree of that disorder.

The final component of the fire triangle is **fuel**. Fuel is considered any material capable of burning. This would include living vegetation, branches, needles, standing dead snags, leaves, human-built wooden structures, etc.

Fire Behavior

The manner in which fuels ignite, flames develop and fire spreads, collectively referred to as **fire behavior**, is determined by three factors: 1) quantity and type of fuel present; 2) existing weather conditions; and 3) the topography of the region in which the fire burns.

A fuel's composition, including moisture level, chemical makeup and density, determines its degree of flammability. Moisture level is the most important consideration. Live trees usually contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of these fuels define how quickly a fire can spread and how intense or hot a fire may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture. In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs and trees contain oils or resins that promote combustion, causing them to burn more easily, quickly or intensely than those without such oils. Finally, density of a fuel influences its flammability. If fuel particles are close together, they will ignite each other, causing the fuel to burn readily. But, if fuel particles are so close that air cannot circulate easily, the fuel will not burn freely.



Weather conditions such as wind, temperature and humidity also contribute to fire behavior. Wind is one of the most important factors because it can bring a fresh supply of oxygen to the fire as well as push the fire toward a new fuel source.

Temperature of fuels is determined by the ambient temperature since fuels attain their heat by absorbing surrounding solar radiation. The temperature of a fuel influences its susceptibility to ignition. In general, fuels will ignite more readily at high temperatures than at low temperatures.

Humidity — the amount of water vapor in the air — affects the moisture level of a fuel. At low humidity levels, fuels become dry and, therefore, catch fire more easily and burn more quickly than when humidity levels are high.

Soil types must also be considered because fire affects the environment above and below the surface. Soil moisture content, the amount of organic matter present and the duration of the fire determine to what extent soil will be affected by fire.

The time of year influences the effects of fire. For example, wildland fire season in the western U.S. is June through October, while March through May

is the fire season in the southeastern U.S. Most fires occur in the New England states in late fall. During some seasons, more moisture is present than in other seasons, thus reducing fire threat; this varies by geographic region.

Fire Classifications

Fires customarily are classified as either natural or human-induced. A **natural fire** is not human-induced and usually is started by lightning. Natural fires may burn as prescribed fires, which are monitored and controlled, or as **wildfires**, those that humans seek to extinguish. Wildfire behavior may be more difficult to regulate than prescribed fire behavior because conditions under which the fire is ignited are not predetermined.

A prescribed fire is initiated by humans under predetermined conditions or is a lightning-started fire that is permitted to burn in the prescribed manner. **Management-ignited prescribed fires** are used to manage certain types of landscapes. These uses include reducing fuel buildup around campground areas or manipulating vegetative **succession** to increase forage for game species such as wild turkey, deer or elk. Such fires are ignited using a **prescription** that defines the actions to be taken within a specific set of environmental conditions. The prescription indicates the acceptable fuel and weather conditions under which a fire should be set so that the blaze can be controlled. When land managers prescribe fire as a management technique, they must consider the behavior of fire to assure a desirable outcome.

For example, if relative humidity is low, temperature is high, and if the wind can be described as gusty, there is a strong possibility that this is a risky time to carry out a prescribed fire. The likelihood of a management-ignited prescribed fire becoming unmanageable under those conditions is very strong. Careful planning, therefore, is required before scheduling a prescribed fire.

Prescribed fires are often carried out during the cooler, moist seasons so that they may be controlled more easily. Daily weather variations also are taken into consideration when planning a prescribed fire. Natural resource managers must consider smoke management and dispersal patterns of smoke to ensure that transportation, agriculture and human health are not adversely impacted. Morning hours when dew is still present are most conducive for controlling prescribed fires. Of course, these factors are more readily planned for when the fire is a management-ignited prescribed fire as compared to a fire started by a lightning strike.

Fire Spread

Three general patterns of fire spread are recognized: (1) **ground fires,** which burn organic matter in the soil beneath surface litter and are sustained by glowing combustion; (2) **surface fires,** which spread with a flaming front and burn leaf litter, fallen branches and other fuels located at ground level; and (3) **crown fires,** which burn through the top layer of foliage on a tree, known as the canopy or crown. Crown fires, the most intense type of fire and often the most difficult to control, need strong winds, steep slopes and a heavy fuel load to continue burning.

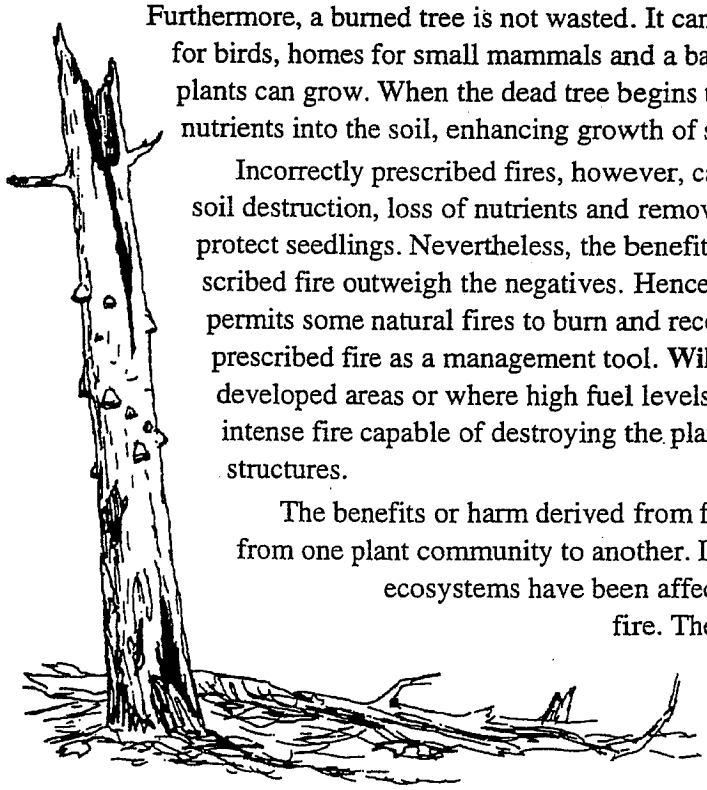
Even though fire is a fairly common occurrence, very few fires become extremely large. In the United States, 2 to 3 percent of all fires account for more than 95 percent of the total area burned annually. The blackened plots left behind by these types of large fires contribute to the image of fire as a destroyer of the natural environment. In reality, the opposite is true. A carefully planned prescribed burning program can provide many benefits that enhance the health of an ecosystem.

For example, regular prescribed fires can reduce the amount of ground fuels, thereby lowering the likelihood of potentially large and uncontrollable wildfires. If future wildland fires should occur, the fires would be less intense and easier to control. Fuel reduction can help prevent the possibility of crown fires, which burn at high intensity and are capable of causing unacceptable change. However, in five to eight years enough litter can accumulate in a forest to return ground fuel quantity to the pre-fire level. Therefore, it is important that a regular, planned burning program is followed rather than a single fire event.

Among the other benefits of prescribed burning are:

- insect pest control;
- removal of undesirable plants that compete with wanted species for nutrients;
- addition of nutrients for trees and other vegetation provided by ashes that remain after a fire;
- removal of undergrowth, thereby allowing sunlight to reach the forest floor to encourage growth of desirable species; and
- clearing of congested forest areas to facilitate planting.

Furthermore, a burned tree is not wasted. It can provide nesting sites for birds, homes for small mammals and a base from which new plants can grow. When the dead tree begins to decay, it releases nutrients into the soil, enhancing growth of surrounding flora.



Incorrectly prescribed fires, however, can cause damage such as soil destruction, loss of nutrients and removal of debris needed to protect seedlings. Nevertheless, the benefits of a properly prescribed fire outweigh the negatives. Hence, modern fire policy permits some natural fires to burn and recognizes the use of prescribed fire as a management tool. **Wildfires** are suppressed in developed areas or where high fuel levels create a potential for intense fire capable of destroying the plant community or built structures.

The benefits or harm derived from fire can vary greatly from one plant community to another. In the United States, all ecosystems have been affected to some degree by fire. The following section provides insight into the relationship between fire and some specific vegetative communities.

Tallgrass Prairie: Midwest U.S.

Historically, tallgrass prairies covered parts of Nebraska, Illinois, Iowa and Kansas and extended into the more eastern states in the Midwest. Tallgrass prairie is made up of grasses, forbs, shrubs and trees and is further characterized by relatively moist soils. Prairies depend on fire to maintain the ecosystem stability and diversity.

One benefit of fire in this community is the elimination of invasive plants, thereby helping to shape and maintain the prairie. In most managed prairies, prescribed fire is introduced on a two- to three-year cycle. Grassland fires can cover large areas in a short period of time. However, because grass provides a low quantity of fuel, grassland fires usually are easily controlled and suppressed if necessary.

The time of year during which these fires are ignited is of critical importance. Plant recovery following a prairie fire is fastest in the spring and fall when soil moisture is high and plants are not producing seeds. Growth of native species such as big bluestem, little bluestem and Indian grass increases significantly following a fire. Introduced species that initiate growth earlier in the spring and continue growing later in the fall than native species can be placed at a disadvantage by properly timed spring and fall fires (meaning the introduced species do not grow as quickly).

If fire were excluded, the tallgrass prairie would vanish, and shrubs, trees and exotic grasses would dominate the ecosystem. Before European settlement of the grassland, naturally occurring fire helped to maintain the grasslands. Today many of the prairies that remain are managed by prescribed burns.

Chaparral: California and Southwestern U.S.

Chaparral is a general term that applies to various types of brushland found in southern California and the southwestern U.S. Plants such as manzanita, ceanothus, chamise and scrub oak, along with other grasses and forbs, are examples of typical chaparral flora. This community contains the most flammable type of vegetation found in the United States. It is no surprise, then, that many of these species are well-adapted to fire and some actually possess traits that encourage fire.

One chaparral plant, *Ceanothus*, has leaves that are coated with flammable resins. *Ceanothus* seeds require intense heat for germination, and its roots are specially adapted to enable the plant to grow in areas that were recently burned. Other chaparral shrubs also contain flammable oils and resins in their leaves. The leaves and branches of these plants are small, adding to their flammability.

Chaparral plants sprout quickly, and grow and spread rapidly. This rapid growth, along with the plants' ability to produce heat-resistant seeds that remain dormant yet viable in ground litter for long periods of time, contributes

to the ability of chaparral flora to recover quickly following fire. Furthermore, many nutrients are locked in the foliage of chaparral plants. Through burning, these nutrients are recycled back into the soil.

With age, chaparral plants become less productive but are not overtaken by invading species. Fire in this type of community serves to replace older plants with younger, more productive ones of the same species rather than to eliminate exotic species and replace them with native ones, as is the case in tallgrass prairies.

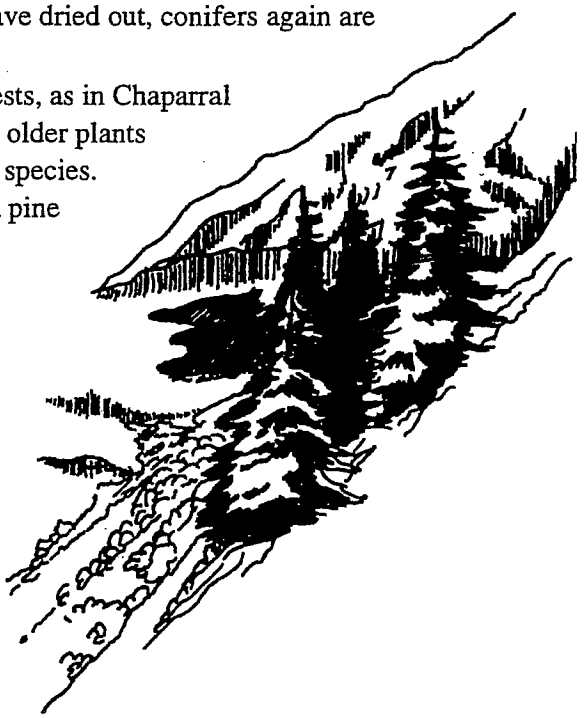
Ponderosa Pine: Pacific Northwest

Ponderosa pine can exist as one component of a mixed forest, particularly in combination with Douglas-fir, or as a pure forest type. The typical surface cover in a ponderosa pine forest is a mixture of grass, forbs and shrubs. This forest community generally exists in areas with annual rainfall of 25 inches or less. Extensive pure stands of this forest type are found in the southwestern U.S., central Washington and Oregon, southern Idaho and the Black Hills of South Dakota.

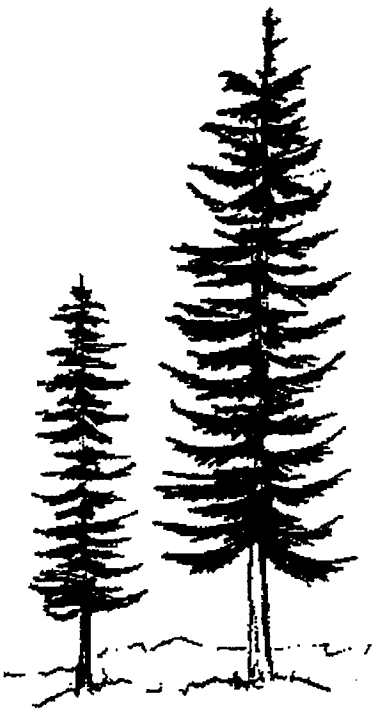
For approximately the first five years of their life cycle, ponderosa pine seedlings must compete strenuously with grass cover for survival and are very susceptible to fire. But, beginning with the fifth year or sixth year of its life, the tree begins to develop thick bark, deep roots and to shed its lower limbs. These factors increase its ability to withstand fire and decrease the possibility of a fire climbing to the crown. Furthermore, a thick bed of needles is deposited on the ground, suppressing grasses in the vicinity, thereby controlling the type of fuel available for burning and the type of fire that the tree may need to endure in the future.

Conifers, including ponderosa pine, are most flammable in the spring when their old needles are dry and new needles have not yet grown. In the fall, when the needles have dried out, conifers again are susceptible to fire.

Fire in ponderosa pine forests, as in Chaparral communities, serves to replace older plants with younger ones of the same species. Historically, fires in ponderosa pine communities burned naturally on a cycle of one every 5 to 25 years. Prescribed burning is applied with slightly greater frequency and regularity, keeping in mind that a fire that is ignited too early will not have sufficient fuel to be effective. Similarly, a fire ignited too late in the cycle may develop into an intense, damaging fire.



Douglas-fir: Pacific Northwest



Douglas-fir is widely distributed throughout the northwest U.S., including Oregon and Washington, as well as southern British Columbia, Canada. This forest type favors moist climates where rainfall often exceeds 50 inches annually and is generally found among other tree species rather than as a single-species forest type. The principle trees associated with Douglas-fir are western hemlock, silver, noble and grand firs, and western redcedar.

Douglas-fir is able to survive without fire. Additionally, the tree species possesses characteristics that enable it to withstand fire when it does occur. For example, this species is more resistant to fire than other conifers. Additionally, the Douglas-fir's abundantly produced seeds are lightweight and winged, allowing the wind to carry them to new locations where seedlings can be established.

Douglas-fir regenerates readily on sites that are prepared by fire. In fact, nearly all the natural stands of Douglas-fir in the United States originated following fire. One of the main benefits of fire in these forest communities is the removal of fuel and consequent reduction of the chance of severe crown fires. Because Douglas-fir exists in the presence of other types of trees, the timing of a prescribed fire in this type of forest community must consider the life cycles of many species.

Loblolly and Shortleaf Pine: The South

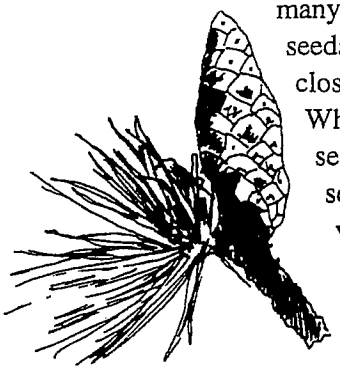
The loblolly pine and shortleaf pine are the largest tree species association in the eastern U.S. and extend from Maryland to Texas. Most forest communities of this type have developed from abandoned farm land.

After several years of initial growth, loblolly and shortleaf pine are able to withstand surface fires. However, they are not as highly resistant to fire as many other tree species. The major benefits of fire in this ecosystem include the creation of a favorable environment for seedlings and hindrance of an invasion by competing species.

Jack Pine: Great Lake States

In the forests of the Great Lake States, a mixture of pine and other tree species is found. Red, white and jack pine grow among paper birch, aspen and hazel. Grass, forbs and shrubs such as big bluestem, little bluestem, raspberry, blueberry and huckleberry also inhabit the community. The forests of the Great Lake States, like those of the Northwest, have suffered many distur-

bances throughout recent history, making it difficult to determine the "natural" state of the ecosystem.



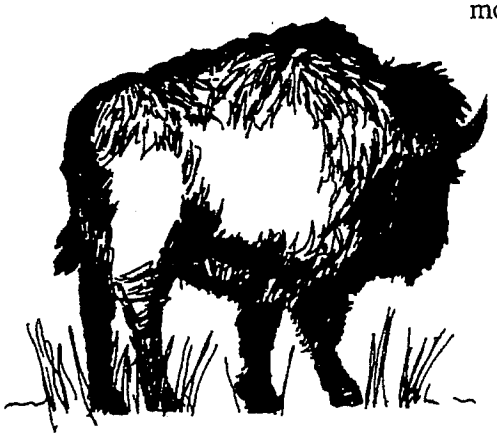
Jack pine has a unique relationship with fire. Unlike many other tree species, jack pine does not drop all of its seeds as they ripen. The majority of the seeds remain in closed cones that stay on the branches for many years. When a fire occurs, the thick cone protects the jack pine seed from the intense heat. That heat, though, opens the scales of the cone and releases the seed onto the ground where the fire has removed much of the existing vegetation, preparing the site for the new seedlings. Fire, then, serves to prepare a seedbed, reduce competition from other plants and release the jack pine seed.

Prescribed fire also is used to reduce fuel levels and prepare sites for seeding. The timing of the burning is tied to the life cycle of the pines; fall is the season of choice for burning.

Fire, as we can see, plays a significant role in ecosystems across the country. Fire, in a natural or prescribed form, performs functions crucial to the maintenance and health of forest and grassland communities.

Human Use of Fire

Native Americans have great respect for the fire phenomenon — some named it "Grandfather Fire." Historically, many Native Americans used fire as a tool to shape their environment and to improve hunting. A century before European settlers arrived at North American shores on the *Mayflower,* the bison (or American buffalo), traditionally a western North America species, moved to the eastern portion of the continent following fires, many of which were probably set by Native Americans. The fires burned the brush and trees and are believed to have helped in the creation of more open areas conducive to growth of grasslands, the lands upon which bison depend for food.



Fire was used by Native Americans for hunting many different animals. Desert tribes removed ground cover with fire to facilitate lizard hunts. The Apaches used smoke to attract deer that were tormented by mosquitoes and flies. The deer would enter smoky areas to escape the bothersome insects and thus become easy targets for the hunters. European settlers observed Native Americans using fire to herd deer onto peninsulas. Once in these small areas, deer could be hunted more easily from canoes.

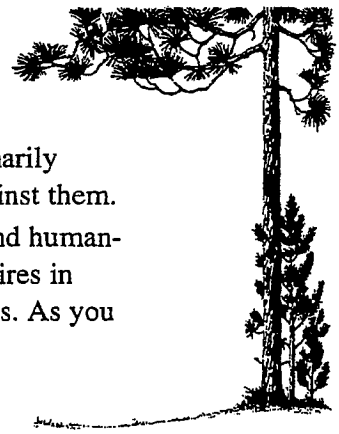
Fire was used for more than improving hunting though; fire was used as an instrument of war. Nomadic peoples burned the areas surrounding their lodges to thwart their enemies' attempts to burn them out. When hunting parties entered another tribe's territory, some of the parties would deliberately

set fires. This often would deprive the home tribe of forage but would make for better hunting in the following year when the interloping tribe returned.

In California's Yosemite Valley, Native Americans used fire as a tool to shape the lands for at least 4,000 years. The cumulative effects of the thousand years of burning by Native Americans had profound impacts on the landscape that European settlers found. When the first European colonists landed in the New World, they were amazed at how much savanna (or grassland) existed. As European settlers advanced across the continent, though, the frequency of fires declined. Consequently, woody vegetation and forests overtook some grassland corridors originally created by the fires set by Native Americans.

Europeans held a view of fire, its effects and consequences that was very different from the Native American view of the natural phenomena. At the close of the 19th century, settlers concentrated on permanent husbandry of the forests to protect watersheds and forest products. Crops also were of concern when **wildfire** control was discussed. As fences began to create a patchwork across the once open expanses of prairie and forest, fire became an enemy capable of destroying all that had been achieved.

Historic Fires



Wildland fire is a natural process; it is not new. Wildfires, floods, earthquakes and similar natural occurrences are of much concern to society — primarily because we cannot completely control or guard against them.

Wildland fires are relatively common natural and human-induced occurrences. There are more than 100,000 fires in natural environments every year in the United States. As you read this, there are probably several fires burning somewhere in the country. Large wildland fires, however, are rare. There have been very few fires that occurred in North America in the last 150 years that could be described as unusually large.

One such large **wildfire** occurred in October 1825, burning from Maine through New Brunswick, Canada. A long drought set the stage for this exceptionally large wildfire. A group of loggers ignited a fire that soon burned out of their control. The fire burned 3 million acres of forest and killed more than 160 people.

Another drought occurred during the summer of 1871 in North America. A violent wildfire struck the town of Peshtigo, Wisconsin, killing 1,300 people in a single night. In total, more than one million acres were burned. The Peshtigo wildfire is considered the most devastating fire in U.S. history in terms of human lives and property lost. Wildfires such as these are the exception rather than the rule.

More recently, the 1988 fires in Wyoming and Montana burned across almost one million acres in and around Yellowstone National Park. This fire brought fire and fire policies to the forefront of the public's attention.

Fire Ecology

Fire ecology is a branch of ecology that concentrates on the origins of wildland fire and its relationship to the living and nonliving environment. This school of thought recognizes that fire is a natural process operating as a component of an ecosystem. To understand an ecosystem requires looking beyond the system's present state. Full understanding includes an investigation of the ecosystem's origin, possible future stages of the ecosystem and the cycles the ecosystem progresses through. Fire, similar to floods, earthquakes, storms, etc., can be viewed as one catalyst promoting changes in an ecosystem.

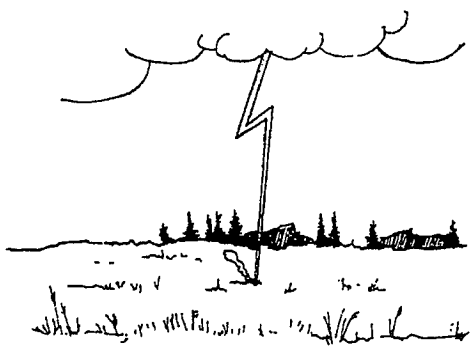
In the 1930s, researchers in the southern U.S. challenged the negative notions about fire. They argued that fire was essential to animals and the longleaf pine forests of that region. This idea of **fire dependence** is the first concept of fire ecology. Fire dependence applies to species of plants that rely on the effects of fire to make the environment more hospitable for their regeneration and growth. For example, fire prepares the soil for seeding by making nutrients more available for plant uptake. As a result, competition from other species that may absorb needed nutrients or shade out necessary sunlight is reduced.

The second concept of fire ecology is **fire history**. Fire history is described as how often fires occur in a given geographical area. Trees actually record fire history. Each year a tree adds a layer of cells, increasing the width of its trunk. When a fire passes through a forest, trees may be only scorched. A layer of charcoal remains on a living tree and, in time, is enveloped by a layer of new growth. These **fire scars** provide a record that scientists can use to determine when in history a fire occurred.

The role fire plays in an ecosystem varies with the characteristics under which the ecosystem evolved. This role is the third concept of fire ecology, **fire regime**. The interactions of humidity conditions, fuels and ignition sources will determine the fire regime for a particular land area. A fire regime is a function of the frequency of fire occurrence, the fire intensity and the amount of fuel consumed. Both frequency and intensity of fire vary and are interdependent. Frequency of fire is largely determined by the ignition source(s) and the duration and character of weather which favors the spread of fire. Intensity of fire is determined by the quantity of fuel available and the fuels' combustion rates. The interaction between frequency and intensity of fires also will be influenced by wind and topography.

Wildfire Causes

As many as 90 percent of wildland fires in the eastern U.S. are caused by humans. Some human-caused fires result from campfires left unattended, the burning of debris, negligently discarded cigarettes and intentional acts such as arson. Most of the remaining 10 percent are started by lightning. In the western U.S. and in Alaska, the majority of fires are started by lightning.



Lightning is described as having two components — leaders and strokes. The leader is the probing feeler sent from the cloud. The return streaks of light are a series of strokes that produce the actual lightning bolt or flash that we see.

There are two types of lightning — cold lightning and hot lightning. Cold lightning is a return stroke with intense electrical current but of relatively short duration. Hot lightning has currents with less voltage, but these occur for a longer period of time. Fires are usually started by unusually long-lasting or hot lightning bolts.

Wildfire Prevention History

Smokey Bear, perhaps the most successful fire prevention education icon in the United States, is promoted primarily to address accidental human-caused wildfires. The need for Smokey Bear's messages is as relevant today as it was in 1945 when the idea was first put forth.

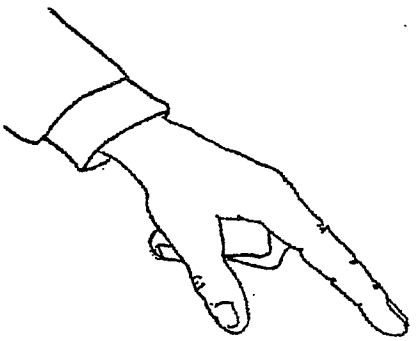
Smokey Bear's message must not be interpreted as "all fire is bad." Managed or **prescribed** fire is one of today's modern ecological management practices. A need exists to help our society distinguish among unwanted human-caused **wildfires**, unwanted lightning-started wildfires, desirable lightning-started wildland fires (those fires acceptable under a management policy that recognizes lighting as a natural process) and the **management-ignited prescribed fires** that are part of fire ecology management. With the proper interpretation, Smokey Bear's messages can help clarify the distinctions between desirable and undesirable fires.

Evaluation of Wildland Fires

When wildland fires begin, two major questions are asked: (1) Where is the wildland fire located — in a forest or grassland, or in a human-dominated landscape? and (2) Does the wildland fire threaten people and their personal property? Where people and property are threatened, all efforts are made to extinguish the fire. In some locations, such as large national parks and forests and where the wildland fire is started by lightning, a natural fire may be permitted to burn its course — this is a **prescribed natural fire** as discussed in previous sections.

Wildland fire managers must constantly assess the threat of human-caused fire to wildlands and the threat of wildland fires to humans. By more fully understanding wildland fire, managers can better plan for potential desirable and undesirable effects of wildland fire. Although managers can seek to be prepared, fires cannot be planned for completely nor always controlled.

What Students Need to Know



Each educator is encouraged to formulate the strategies and instructional objectives that are most relevant to the students' needs, the school's curriculum and the ecosystem with which the students are most familiar. In order for students to have a sound basis for understanding wildland fire and prescribed fire as a technique for natural resource management, the following concepts should be considered for inclusion:

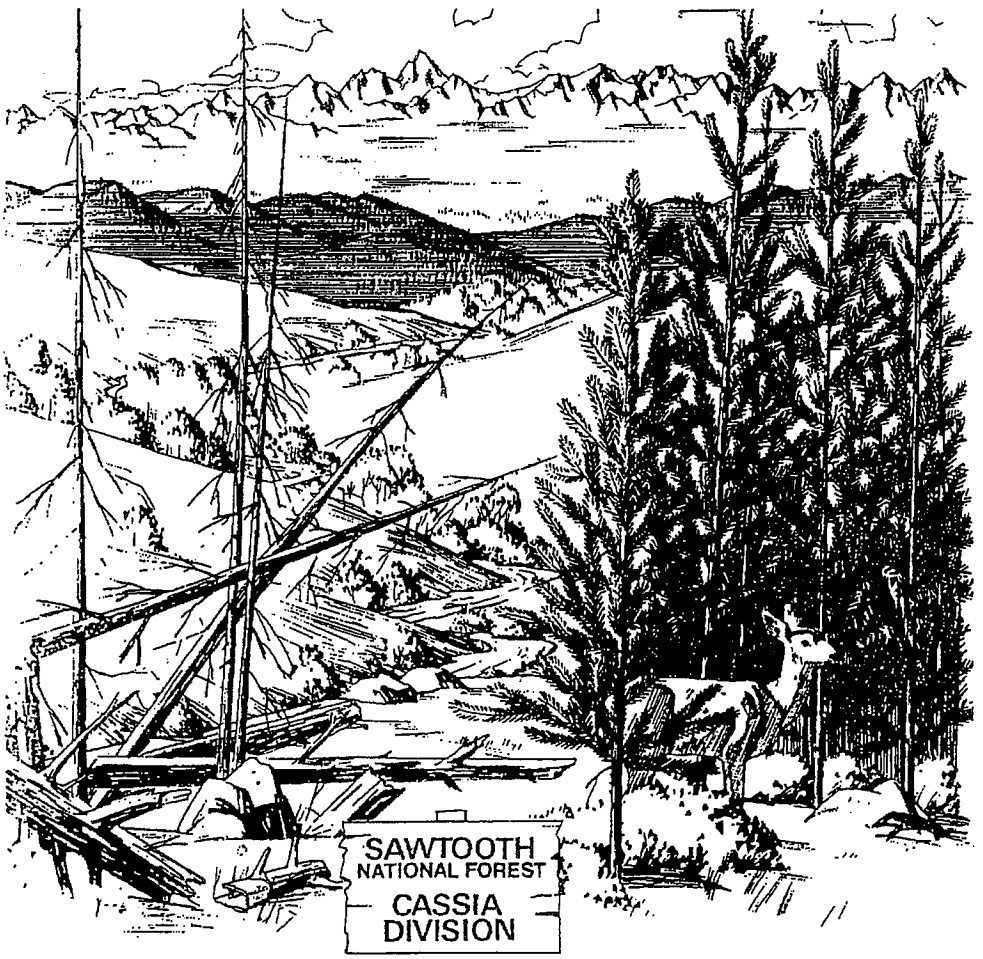
- Wildland fire is a natural element/process similar to floods, earthquakes, etc.; natural processes cannot always be controlled.
- Fire requires combustible material (fuel source), an ignition source (heat) and oxygen; remove or significantly reduce any one of the three and the fire cannot exist.
- Fire conditions are influenced by many factors, including humidity, fuel moisture content, wind speed, slope and air temperature.
- Humans use fire for their benefit (e.g., to prepare soil for seeding, for heating, light, cooking and natural resource management).
- Research and planning techniques have helped to control undesirable wildfires, but all fires, especially larger ones, cannot always be controlled. The Smokey Bear messages are most appropriate, especially for undesired wildfires caused by humans.
- Prescribed natural fires provide benefits for habitats such as reduction of fuels, increased forage, pest/disease control and return to earlier successional stages.
- In order for society to fully appreciate the role of fire as a technique for natural resource management, citizens must understand that fire can be beneficial if properly managed.
- We as a society usually define wildland fire as good or bad, based on resource management policy, law, politics, social issues, values, etc.

APPLICATIONS

Fire is an interesting subject for students to explore; it is as common as a match and as complex as a high-rise building on fire. Because of familiarity, this everyday concept has the potential to become a superlative concept with strong possibilities for student interest and interaction.

Fire is an appropriate subject to be included in physical, biological and social science courses. Teachers working with students on value-clarification, social science and economic units also may find that wildland fire is an excellent mechanism to help explore these broad issues. Students involved in planning and performing a skit about wildfire or conducting a role-playing public hearing on fire management policies can be led by their teacher to explore a wide array of social, economic and biological issues that face society each day.

Wildland fire and similar conservation-related topics can bring together students' science, social studies, math and language arts skills. This can provide a situation where students refine their problem-solving skills and explore what they value and believe. Out of these types of classroom explorations come students who understand conservation issues in the broadest sense of the term.



Fire Facts - Student Background Information

Introduction

WILDLAND FIRE! When you hear those words, what do you think? Do you think about a prairie or a forest fire? You should remember that wildland fires can help certain ecosystems stay healthy and productive.

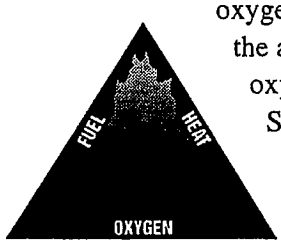
Fires have burned across the Earth for millions of years. Evidence of fires that burned in the past exists today in petrified trees — trees that lived long ago and have, over many years, turned hard like a rock. Some petrified trees have fossilized charcoal called **fusain** in their trunks. The charcoal marks, which indicate that the tree was once in the path of a fire, are called **fire scars** on a living tree.

Fires occur naturally with the help of lightning, but most fires are started by people. Approximately 90 percent of wildland fires are started by humans! Some human-started fires are set on purpose (arson), but most are accidental. The remaining 10 percent of wildland fires are started by lightning. Did you know that lightning strikes the Earth about 100 times each second or that lightning temperatures can sometimes reach more than 50,000° F (28,000° C)? That's more than five times hotter than the sun's surface! Imagine what happens when lightning strikes a field of dry grass.

There Must Be All Three

Each year more than 100,000 wildland fires occur in the United States. Somewhere a wildfire fire probably is burning while you are reading this!

Before a fire can start, three components must be present: oxygen, fuel and heat. At least 16 percent **oxygen** must be in the air for a fire to start. The air we breathe has 21 percent oxygen. **Fuel** is any living or dead material that will burn. Some fuels such as dead plants, dry leaves, pine needles and grass are more likely to burn than moist green plants because the dead material contains less moisture or water than living plants.



Heat can be supplied by lightning striking a tree or grass. People also can provide heat by using a match, carelessly starting a fire or leaving a fire unattended. Fires are dangerous. Fire safety must be carefully practiced to prevent unwanted fire.

Fire as a Natural Resources Management Technique

Many cultures have stories about great fire creatures and recognize fire as a part of nature. The Egyptians told a make-believe story of a brightly colored bird named the Phoenix. It could live for as long as 600 years! At the end of its life, the Phoenix would burn itself in a fire. After the old Phoenix disappeared in the fire, a new bird would rise from the ashes. The new Phoenix would then live for another 600 years.

Fire was a way for the Phoenix to renew itself. Natural resource managers use fires as a means to renew the natural environment. To protect natural resources and keep the environment healthy, managers study an area and write a **fire prescription** for that area. This prescription is like what a doctor orders to make you feel better.

A **prescription** indicates when or if a fire will be ignited by trained professionals or when a fire ignited by lightning will be allowed to burn. A prescription may include the following information: how wet the fuels must be, the maximum speed wind may be blowing or the highest outside temperature.

Natural resource managers start fires called **management-ignited prescribed fires** to allow natural processes to occur. These fires are permitted in large parks or forests that have a prescribed fire plan (a prescription) and when humans and their property are not in danger. When a management-ignited fire occurs or when a fire is started by a lightning strike (also called a **prescribed natural fire**), the blaze is monitored daily by fire experts.

Dangers of Fire

Although fire can benefit an ecosystem, it may threaten human life or property. If the weather conditions are very dry or windy, fire burns much faster. Also, a fire burning near homes may damage those houses. Damage also can be caused by smoke. Smoke in a building smells unpleasant, leaves ashes and impacts human health. Smoke also can make it difficult to see when driving.

Remember that fire is a powerful force. Only trained professionals should decide when and where a prescribed fire is to be started or permitted to burn. Campfires or the burning of garbage should only be done after reviewing important rules and regulations and after careful consideration of the chances that the fire will not burn out of control. High winds, hot days and lots of dry materials in the area are dangerous conditions for starting a fire. Like Smokey Bear says, "Help Prevent Wildfires."

Other Interesting Fire Facts

Did you know that.....

- warm, dry winds called "Chinook Winds" (pronounced shin-ook) occur on the eastern slope of the Rocky Mountains and can help cause severe fire hazard conditions? These winds can blow more than 100 miles per hour.

- temperatures of fuels such as wood found in an open field may be warmed to as much as 160°F by the sun?

- lightning is like a gigantic spark between a negatively charged lower cloud and the positively charged Earth?

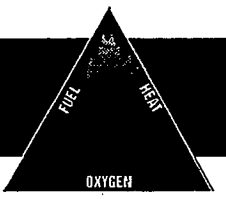
- a test fire is used before starting a prescribed fire to determine the exact burning conditions and how the fire will behave?

- Native Americans used fire to help with hunting more than 4,000 years ago?

- some pine cones, called **serotinous** cones, rely on fire to help them open so they can release their seeds?

Visit your school or community library to read more about fire, conservation and natural resources.

FIRE ADAPTATIONS



TEACHERS' GUIDE

DESIGN A PLANT OR ANIMAL THAT WOULD BE ADAPTED FOR WILDLAND FIRE SURVIVAL.

OBJECTIVES:

Students will be more aware of how plants and animals adapt to wildland fire.

ACTIVITIES:

Discuss plants' and animals' adaptive strategies to survive fire. Observe plants and animals in your local area. Design a plant or animal that is adapted for fire survival.

ORGANIZATION:

Who: Individual students
Where: Classroom
Time: 1 hour

MATERIALS:

Paper, pencils, crayons, markers, three-dimensional art supplies if desired

SUBJECTS:

Art, Language Arts, Science

BACKGROUND

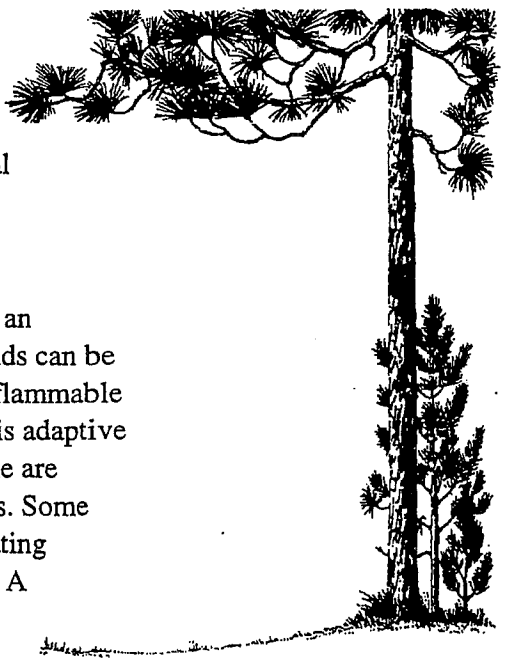
To survive a fire, most plants have adaptive traits or abilities that allow them to reproduce or regenerate. Most animals will either flee the fire or, in the case of burrowing animals, move deeper underground. An **adaptive trait** is a behavior, physical feature or other characteristic that helps a plant or animal survive and make the most of its habitat. For example, the saguaro cactus, which inhabits the deserts of the southwestern U.S., can store water. This adaptation helps the cactus survive through long periods of drought.

All living things have some traits that are adaptations to disturbances and constraints of their environments. Disturbances include physical and biological disturbances, of which fire is one.

NOWHERE TO RUN ...

Plants have a distinct disadvantage, compared to animals, in the face of fires. Plants are unable to run, fly, creep or crawl out of a fire's path. Plants have adapted other methods to survive fires.

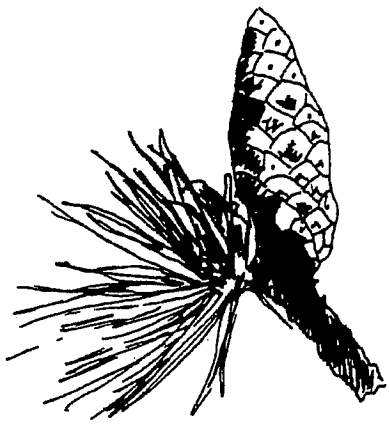
Individual plants have **adaptations** to ensure their survival through a fire. To survive a fire, a plant must be able to insulate itself from the heat of the flames. Bark thickness is the most important factor determining fire resistance of trees. Ponderosa pine, longleaf pine, slash pine, loblolly pine and giant sequoia are examples of trees with thick bark that acts as insulation from forest fires.



Small woody plants and shrubs normally have thin bark. These plants use the soil as an insulating layer to protect themselves. Individual plants resist being killed in fires by producing new growth (shoots) from underground organs or roots.

Some plants protect their buds as an adaptive strategy to survive a fire. Buds can be protected by layers of succulent, nonflammable foliage. Longleaf pine exemplifies this adaptive strategy. The buds of the longleaf pine are protected by a thick cluster of needles. Some plants even protect their buds by locating them within the main stem and roots. A few poplar tree species possess this trait.

Retention of seeds by plants and stimulation of seed dispersal by fire are other examples of fire-adaptive strategies. A number of pine species have pine cones that open only after a fire. These cones are said to be **serotinous** (pronounced sir-OT-in-ous). Jack pines have cones that are held closed by a resin that is sensitive to high temperatures. These cones will not open to release their seeds until the critical temperature is reached. Lodgepole pine cones (a western U.S. variety of tree) vary from serotinous to free-opening. When these trees grow in areas subject to frequent fires, the cones are serotinous. However, if lodgepole pine grows in areas where fire is less frequent, the pine cones open and release their seeds more often without fire.



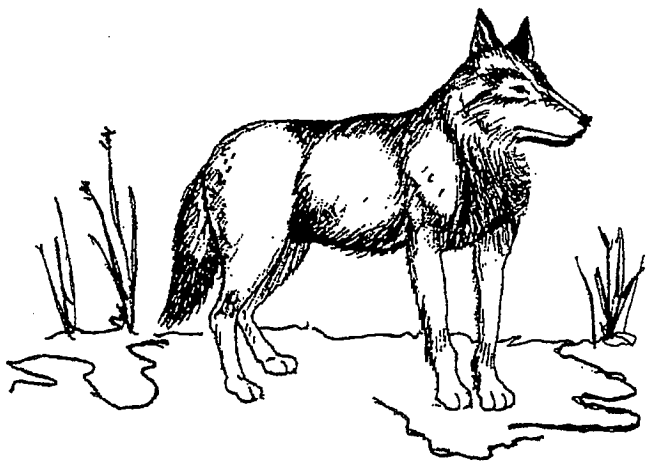
Fire Effects on Wildlife

Environmental changes, such as those caused by fire, flooding and deforestation, determine the presence and abundance of animal species in a given area. Fire in the natural environment can have a profound effect on the wildlife of an area.

When people hear about a wildland fire, many of them ask, "Where do all the animals go?" When a fire occurs, the most important behavior for animals is escape and survival.

Wildlife species have developed different methods or strategies to escape fires. Animals such as deer, elk, bear and fox are accomplished runners and use this skill to escape the flames. Other animals not so adapted for running hide in underground burrows, in rock cliffs or other refuges. Rats, mice, moles, shrews, snakes, lizards and turtles burrow to escape fire.

Birds that have the ability to fly retreat to a safer area until the flames have passed. However, nestlings and chicks of wild turkeys and other birds may not be able to fly. Often these and other animals cannot escape the fire's path. Their remains attract **scavengers** and **predators**, such as coyote, to recently burned areas.



After a fire, populations of organisms that inhabit the litter or **humus layer** (the top few inches of soil) often decrease. Some of the insects in the humus layer are considered undesirable because they damage timber stands. Sawflies, the red pine

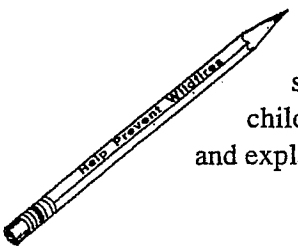
cone beetle and the maple leaf cutter are examples of nuisance pests whose numbers are reduced by fires.

While some insect populations decline as a result of fire, ants seem to thrive. Ant populations have been recorded as more numerous in burned areas than in unburned areas. An important species in prairies, ant populations increase after a prairie fire.

Plants and animals that have physiological and behavioral adaptations to survive in habitats frequented by fire live in **fire communities**. Today, people are beginning to recognize that fire is not always destructive. Fire is merely a means of change in ecosystems.

Activity

Review the background information with the students. Use plants and animals from your area as examples of species with adaptive strategies to survive fire. Ask each student to design a fictitious plant or animal that has adaptations for fire survival. Have each student draw the plant or animal and give it a name. Ask each child to share his or her feelings about wildland fire with the class and explain how the animal or plant is adapted for a fire community.



Extension

Have the students interview two adults to find out what the interviewees know about wildland fire. Students should ask the adults if they know of any plants or animals in their area that have adaptations for fire habitats.

Important Terms

- **adaptation**
- **fire communities**
- **humus layer**
- **predators**
- **scavengers**
- **serotinous**

Fire Adaptations Quiz

Name _____

1. Circle the example of an adaptation that helps plants survive fires.

Fuzzy buds Black leaves Thick bark Wide branches

2. What does adaptation mean?

_____

3. Name one adaptation that plants have to survive a fire.

_____

_____

4. What does serotinous mean?

_____

_____

_____

_____

5. Complete this sentence about fire.

A fire in the forest or grassland makes me feel ... _____

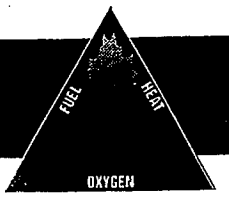
_____

_____

_____

_____

HOT QUESTIONS



TEACHERS' GUIDE

DISCOVER WHAT FRIENDS AND TEACHERS THINK ABOUT WILDLAND FIRES.

OBJECTIVES:

Students will refine interviewing and researching skills.

ACTIVITIES:

Develop a questionnaire. Conduct interviews. Calculate statistics on the results.

ORGANIZATION:

Who: Groups of two students
Where: School yard at recess, after school and lunch time
Time: 30–60 minutes on the first day; 30–60 minutes on the second day

MATERIALS:

Paper, pencils, markers, clipboard, flip chart, and calculator

SUBJECTS:

Language Arts, Math, Science

BACKGROUND

Fire policies for public lands have evolved over time. Previously, natural resource managers advocated suppressing all fires. More recently, though, policies changed to include a fire management perspective, a scientifically based philosophy that examines each fire situation individually.

From the late 1800s until the mid-1950s fire was considered to be detrimental to the health of ecosystems. During the 1930s, the National Park Service and the U.S. Forest Service adopted identical fire policies. According to these policies, any wildland fires would be extinguished by 10 a.m. the following day. This is commonly referred to as the **10 a.m. rule.**

During the 1930s, though, some researchers began to suggest that fire was a natural component of ecosystems. Finally, in the 1960s and 1970s, fire policy began to shift from suppressing all fires to allowing some fires to burn and even to igniting prescribed fires.

The fires of Yellowstone National Park and the surrounding area in 1988 brought fire policies to the public's attention. The public questioned the management of wildlands we consider as part of our United States national heritage. Public concern prompted review of fire management policies.

The opinions and knowledge of the people of the United States greatly influence the management of public lands. It is important for land managing agencies to understand public opinion and how much the public knows about fire management.

QUESTIONNAIRES

Questionnaires are used to gather all types of information. Businesses often use questionnaires to find out if customers are satisfied with the business or service. **Opinion polls** (asking respondents for their opinions) are conducted and reported in newspapers. Topics such as which candidate is preferred in the presidential election are often examined through polling.

ACTIVITY

- How many people have ever witnessed a wildland fire?
- What do people think about wildfires?
- Do people think that the effects of fire are good or bad?
- Why do they think this way?
- Do people have other feelings about fires?

Your students can find the answers to these and other questions by making a fire questionnaire and asking friends, family, teachers and neighbors to participate in an opinion poll.

Review the background information with your students. Divide the class into groups of two students. Have each pair develop a four- to eight-question survey. They can ask any questions about fire ecology, but suggest the following as guidelines:

- ✎ Most questions should be short and easy to answer, such as yes/no or multiple choice.
- ✎ Include people from different age groups and both sexes.
- ✎ Keep a record of the age and sex of each person they question.
- ✎ Have all groups interview the same number of people.

Some examples of questions that could be asked are:

- ▼ 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 wildfires each year?
  a. lightning
  b. humans
- ▼ Do you think that wildland fires should be allowed to burn if human life and property are not threatened?

After each team has written its questions, ask the groups to exchange questionnaires. Each team can read and evaluate another team's questions. This will help ensure that the questions are clear and understandable. Each student should be required to interview at least one person. Students should review their team members' answers.

Have the class conduct surveys during recess, lunch time, after school or during other breaks they may have. Emphasize that students should carefully record each respondent's answers.

Once the data are collected on the survey, ask each group to tally their results and share the information with class members. Discuss how the respondents felt about fire. Did the results show a positive or negative attitude toward fire? Are there any differences in responses between males and females? Are there differences among age groups? Do you think if these people were taught about fire ecology their answers or feelings toward fire would change?

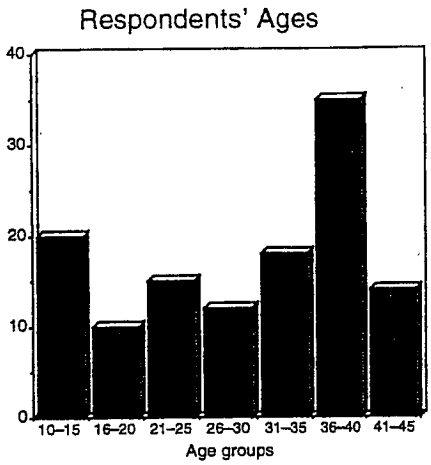
Extensions

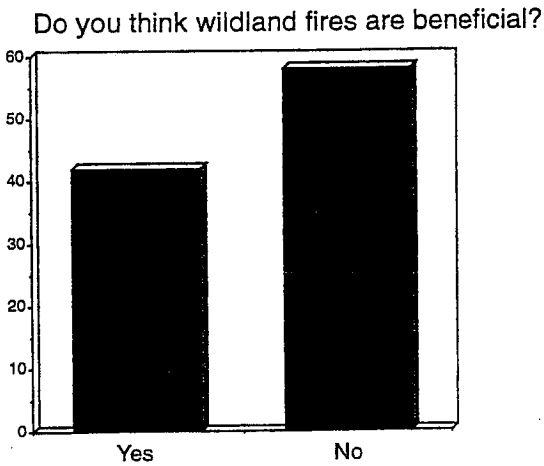
To better interpret the results of the polls, guide the entire class through calculating some survey statistics. Groups can calculate:

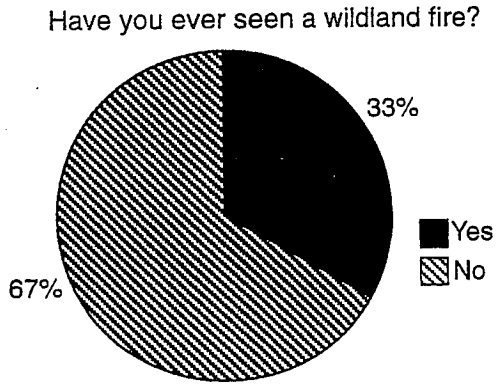
• The average age of those polled: add all of the respondents' ages and divide by the number of people. This is known as the **mean**.

• The percentage of males and the percentage of females who answered the poll. For example, if the group polled 100 people and 40 of the 100 were female, then 40 percent were female ($40 \div 100 = {}^{40}/_{100} = 0.4$ or 40%). From this, groups can figure the percentage of male respondents (100% total – 40% female = 60% male).

Groups can design graphs and charts to better communicate the findings. See examples below.







Important Terms

- **10 a.m. rule**
- **mean**
- **opinion poll**
- **questionnaire**

HOT QUESTIONS QUIZ

NAME _____

1. Wildland fire always has been thought of as beneficial. ☐ True ☐ False

2. Everyone has the same opinion of fire. ☐ True ☐ False

3. Polls are used to find out people's opinions. ☐ True ☐ False

4. Fire is a not a natural force in ecosystems. ☐ True ☐ False

5. Describe how you feel about wildland fires.

_____

_____

_____

_____

_____

6. What was your favorite story about wildland fires talked about in your class?

_____

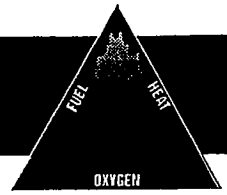
_____

_____

_____

_____

FIRE FEELINGS



TEACHERS' GUIDE

USE ROLE PLAYING TO DISCUSS FEELINGS ABOUT THE POSSIBLE EFFECTS OF FIRE.

OBJECTIVES:

Students will learn positive and negative effects of wildland fire and will begin to form their own positions toward or opinions about fire ecology.

ACTIVITIES:

Explain some possible positive and negative effects of wildfires.

ORGANIZATION:

Who: Groups of four or five students
Where: Classroom
Time: One hour

MATERIALS:

Butcher paper, pencils, crayons, markers

SUBJECTS:

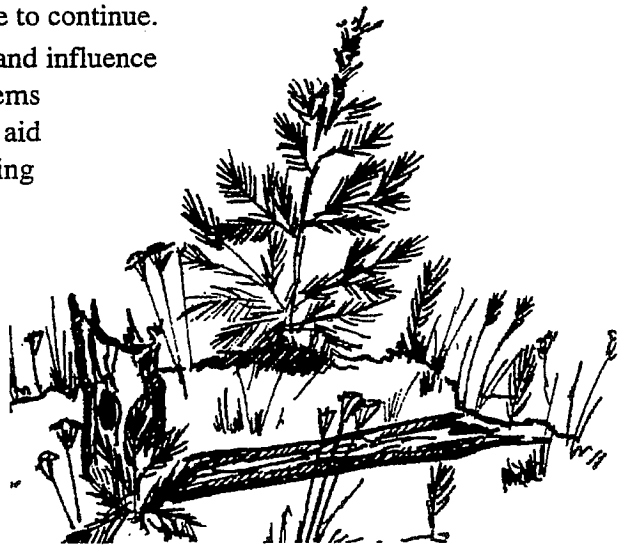
Science, Language Arts

BACKGROUND

Fire has always been an important component in most **ecosystems** in North America. Over time, land management agencies have accepted fire as part of an ecosystem's natural cycle. Previously, agencies labeled all fires as bad or detrimental to the health of wildlands. Land managers' efforts in the past, therefore, concentrated on suppressing all fires.

Today, some **wildland fires** are allowed to burn, and some fires are ignited by trained fire specialists. Fires started by professionals are termed **management-ignited prescribed fires.** Fires started by other forces such as lightning are called **prescribed natural fires** if managing agencies determine before the blaze ignites that fire is desirable in that specific ecosystem. A prescribed fire is any fire that helps attain management goals for a particular area.

Before a fire is set or allowed to burn, weather conditions are assessed for likelihood of the fire burning out of control. Many conditions can affect the size and intensity of a fire. Winds, soil and fuel moisture content, and slope of the land are a few factors that influence fire behavior. These factors are weighed carefully before decisions are made about whether to start a burn or allow an already burning fire to continue.

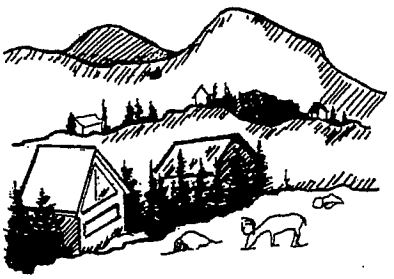


Wildland fires occur in and influence nearly all terrestrial ecosystems in North America. Fires can aid a plant community in returning to an earlier successional stage. **Succession** refers to the orderly, gradual and continuous replacement of one plant or animal community by another. For example, grasslands are often maintained by periodic fires that burn woody plants. Without fire, grasses would eventually be shaded out by larger shrubs, and many of the shrubs would be shaded out by tree species in regions of the country with adequate rainfall for tree growth.

In forests, fires help diminish the threats of insect infestation and disease. By burning infected, dead or dying trees that harbor unwanted pests, fire reduces the likelihood that insect- or disease-related problems will occur. Burned standing and fallen logs provide food and shelter for animals such as millipedes, termites, ants and some bird species.

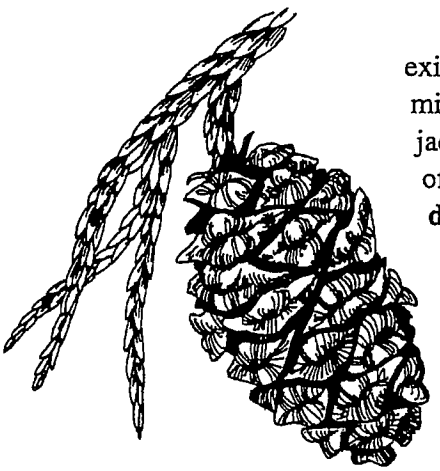
Effects of Fire

Fire can be a threat to humans. **Wildfires** burn timber that often would have been harvested for lumber or paper products. Fire can destroy homes and other structures. More and more, human communities are vulnerable to the effects of fire. As human populations grow, city boundaries expand and neighborhoods develop in wildlands — areas called the **wildland/urban interface**. These areas have a greater chance of being impacted by fire because they contain large amounts of plant landscaping, fuel sources and structures that could sustain a fire. Most **wildland fires**, however, occur in sparsely populated areas and are controlled to remain within park or forest boundaries. Large, damaging wildfires can be minimized with proper management, but they never will be eliminated.



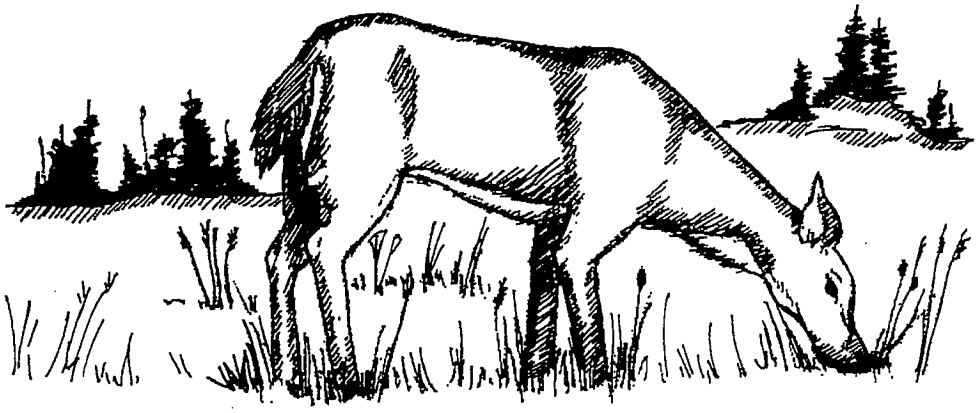
Wildland fires can be beneficial. They reduce **fuel loads**, such as dead standing or fallen limbs, logs, leaves, pine needles, shrubs, excess grass and also living trees and shrubs. Such periodic burning reduces the intensity of each fire that occurs in subsequent years, consequently decreasing the impact of fire on fire-tolerant plants and burrowing animals. If fuel loads are not reduced, the forest can become a fire hazard similar to a basement packed full of newspapers. When the fuel loads are reduced, undesired fires can be minimized.

When fires are allowed to burn, nutrients are released into the soil that would otherwise be held in leaf litter and undergrowth. Once these nutrients are released, grasses and other plants often spring to life and cover the ground in recently burned areas. Underground plant structures, such as roots, rhizomes and bulbs, also are stimulated to sprout if the fire does not burn extremely hot.



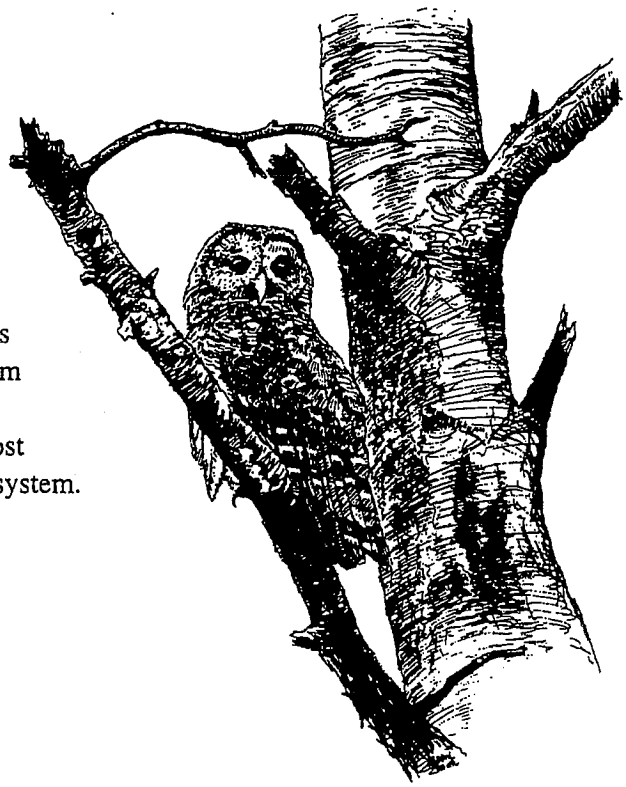
Some **habitats** rely on fire for their existence. The tallgrass prairies of the midwestern U.S., chaparral of California and jack pine forests in Michigan are examples of ecosystems that can be considered **fire dependent ecosystems**.

In the absence of fire, fire dependent ecosystems would be unable to reproduce or would be out-competed by other species. For example, in prairie ecosystems, fire removes less fire-tolerant non-native species of plants that out-compete native prairie plants. Also, some pine cones will not open and release their seeds until they have been through a fire. These type of cones are called **serotinous**. Lodgepole pine and the giant sequoia trees have serotinous cones.



Fires help provide large herbivores such as bison and deer with enhanced grass species. The nutrients that are released after a fire provide the lush, green growth that is preferred by many grazing animals. Some species, such as the Kirtland's warbler, favor young jack pines for nesting. Periodic burning is required to kill larger jack pines and permit growth of young trees. Larger trees that are killed provide cavities for nesting birds, such as pileated woodpeckers and bluebirds.

As fire burns across an area, not everything is impacted. Wildland fires create a mosaic pattern, often leaving some parts of the burn zone untouched. Inside the fire perimeter, some areas are completely burned, other areas have various levels of impact and some areas are completely untouched. This mosaic pattern provides for a diversity of vegetative regrowth and, in turn, a diversity of animal life. This **biological diversity** (the sum total of all living organisms and their interactions) is most important for a healthy ecosystem.



Role Playing Activity

People have many different attitudes toward fire. Why would some individuals think wildland fires are harmful or bad? Why would others view wildland fire as OK or good?

Review the background information with the class. Discuss why some people view fire as a positive force and why others view it as bad. Assign each group a role to play.

- ➤ Park/forest manager, "Ms. Oak"
- ➤ Owner of a home adjacent to the fire area, "Mr. Shingle"
- ➤ Elk, deer or other grazing animal, "Sir Elk"
- ➤ Timber company that wants to harvest the lumber from the area that is burning, "Mrs. Paper"
- ➤ Termites, millipedes and other critters who live in and eat dead wood, "Mr. and Ms. Leggs"
- ➤ Other characters added by students

How would each of these individuals feel about a fire in their area? Would they feel differently if it was a lightning-caused or human-caused fire? Divide the class into groups of four or five students. Allow the groups a few minutes to discuss how their characters may feel about wildland fires. Ask each group to share with the other groups what its character(s) might feel and say about a wildland fire. Discuss the commonalities and differences between the groups' feelings. Ask each group to list some positive and negative feelings it has about wildland fire. Address how education about fire management may influence some people's opinions about wildland fire.

Extensions

Have each group design a poster to support the opinion of the character it portrayed in the role play.

Important Terms

- ▲ **biological diversity**
- ▲ **ecosystem**
- ▲ **fire dependent ecosystems**
- ▲ **fuel load**
- ▲ **habitat**
- ▲ **management-ignited prescribed fire**
- ▲ **prescribed natural fire**
- ▲ **serotinous**
- ▲ **succession**

Fire Feelings Quiz

Name _____

1. Explain what a "prescribed fire" is.

_____

_____

_____

2. Define succession.

_____

_____

_____

3. I feel that wildland fires are useful because ...

_____

_____

4. I feel that wildfires are not useful because ...

_____

_____

WORD (F)UN Scramble

Unscramble these words about fire ecology.

s-t-s-u-e-r-o-n-o-i _____

c-u-s-s-e-s-c-i-o-n _____

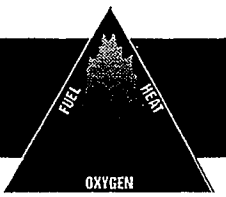
l-e-u-f _____

b-r-u-n _____

t-i-h-g-l-g-n-i-n _____

f-e-i-r _____

REPORTING THE BLAZES



TEACHERS' GUIDE

STUDENTS REWRITE DESCRIPTIONS OF A FIRE SO THE REPORTS ARE LESS NEGATIVE ABOUT THE EFFECTS OF FIRE.

OBJECTIVES:

Students will learn about sources of public information and how opinions are formed.

ACTIVITIES:

Define sensationalism.
Discuss reporting styles and identify words that may influence the readers'/viewers' opinions about forest fires.

ORGANIZATION:

Who: Groups of two students
Where: Classroom
Time: 1 hour

MATERIALS:

Pencils, paper

SUBJECTS:

Language Arts, Science

BACKGROUND

The fires that burned in Yellowstone National Park and throughout the western United States in 1988 brought fire policies of public land managing agencies under close scrutiny. The fires were widely publicized in all forms of media. Consequently, media reports played an important role in forming public opinion about the fires and about how agencies responded to the fires.

In a highly tense situation such as the burning of Yellowstone National Park, a national icon, public concern and emotion increase. Reporters, working in the dramatic setting of an ongoing blaze, collect information from fire-weary officials. Many of the statements made and stories reported reflect the emotion and drama of the moment. Emotion combined with the intensity of the flames and smoke insures a very sensational story.

While the public does have a right to know about emotional, newsworthy events such as fires, the media has the responsibility to report the event accurately. Too often, news reports fail to include the real story of wildland fire, the **fire history** or recovery rates for different ecological communities (the amount of time required for a plant or animal community to reestablish following a fire).

Much of the omission of ecological science components from media reports is not intentional. The nature of the burning landscape appears very sensational, affecting our emotions. Thus, we focus less on the scientific aspects of the fire and more on the emotion.

Usually ecologists and natural resource managers cannot begin to address the impact of a fire until after the blaze is extinguished. Natural resource managers evaluate if they and the media over-sensationalized the fire and if either provided incorrect or too little scientific data about fire ecology to the public. Communicating to the public what is happening, why it is happening and what potential long-range consequences exist is the manager's goal.

In reviewing the Yellowstone fires of 1988 it is clear that although the fire was spectacular and did damage structures, some of the information provided and some of the information reported was incorrect and/or **sensationalized**. Conrad Smith explains the reporting of the 1988 Yellowstone fires in the article included in this section.

Activity

Review the background information and Conrad Smith's article with the class. Have the students read the descriptions of a wildland fire in the boxes below. How do the descriptions make the reader feel about fire? Are there words that paint a negative or destructive picture of wildland fire? Are all the effects of a fire mentioned or just the negative effects?

Divide the class into teams of two students. Ask the students to rewrite the descriptions listed on page 5 using words that describe wildland fire as an ecological force instead of a force of devastation.

Discuss particular words that may help make the story seem like a catastrophe. Have your students replace those words with ones that are more factual and descriptive instead of sensationalized. Include a list of words that are more dramatic and another list of more factual words that may be substituted for them. Feel free to alter or expand the list to fit with your expectations and your students' skills.

Discuss the differences between the students' fire descriptions and the ones given. Which ones were more exciting? Explain how audience ratings are important to news programs and to print media, such as newspapers and magazines. Discuss why television networks and print media publishers may decide to use sensationalized reporting techniques to attract more viewers or readers. Discuss how using more sensational words and omitting certain characteristics of wildland fire can lead people to view fire only as a life-threatening force.

Explain why it is important for each person to review all sides of an issue or story before forming an opinion about the situation. Question 3 on the Quiz requires the teacher to set a scenario for the students and review terms.

Fact-Based Descriptions	Words that Sensationalize
• burned vegetation • removed vegetation • burned forest allows a different type of vegetation, such as grasses, to grow.	• devastate • charred • destroyed • blackened moonscape

Some Positive Aspects of Fire	Some Negative Aspects of Fire
• lessens fuel loads • opens up new habitat for wildlife • opens up new areas for different types of plants • can rid areas of harmful insects	• kills some wildlife • destroys certain plants • changes views or vistas • may destroy property, such as fences, homes or other structures

Media coverage of the 1988 Yellowstone Fires

The Yellowstone wildfires became a 1988 media event, especially in early September as flames approached the Old Faithful geyser and two tourist towns northeast of the park. On 29 different nights, network news viewers saw television stories about monster wildfires, destroyed forests, beleaguered tourists, suffering merchants, brave firefighters, inept public officials, flawed fire policy and—occasionally—about the fiery rebirth of nature. Newspaper stories had more details and usually less hype, but were written in the same spirit.

There were some surprising errors. An August 30 ABC television story contained an interview with a man identified as "Stanley Mott, Director, National Park Service." He appears to be a tourist*. A September 22 *New York Times* story stated categorically it is Park Service policy never to suppress natural fires, and that all fires are suppressed in national forests**. Among 112 newspaper and news magazine stories about the fires for which I contacted named sources, nine percent of those sources said they were misidentified. Ten percent said their names were misspelled. Sources quoted by the *Chicago Tribune, Washington Post and USA Today* said comments attributed to them were fabricated. According to one source, a September 8 *Chicago Tribune* story contained more errors than facts.

> **"Journalism, like any other storytelling activity, is a form of fiction"**
>
> *Robert Manhoff and Michael Schudson,* Reading the News.

Other studies of reporting accuracy have found similar kinds of errors occurring with similar frequency. Journalists correctly argue that mistakes will happen under deadline pressure, especially in the chaos that surrounds any kind of natural catastrophe. The 1988 wildfires were largely inaccessible to reporters, and it was difficult even for experts to obtain accurate figures about the fires' effects. Reporters had difficulty keeping track of whether specific fires were caused by lightning or people, and had difficulty keeping track of whether individual fires had started inside or outside of Park Service jurisdiction. Some even had trouble understanding that the Park Service and Forest Service are separate agencies.

Reporters accustomed to urban structure fires that are extinguished in hours may have had difficulty understanding the inability of authorities to suppress wildfires with equal speed. Local residents who believed all fires could easily have been extinguished if only there had been more bulldozed firebreaks often succeeded in catching reporter's attention. Never mind that wind-borne embers sometimes started spot fires a thousand bulldozer-widths away.

Many Americans were left with the cumulative impression that Yellowstone Park burned down in 1988, and that National Park Service wildfire policy was the reason. This perception persists in spite of the fact that the largest fire was fought from inception, and in spite of the fact that several of the fires started outside the park's jurisdiction where park fire policy did not apply. It persists despite the fact that the fires often burned only the forest floor, leaving many trees untouched. How did this misperception occur?

The literature on science reporting, environmental reporting and disaster reporting indicates that news stories in these contexts usually focus on discrete events rather than interpretation of those events. Stories about delays in construction of the Tellico Dam in Tennessee, for example, focused on the endangered snail darter fish rather than on the related environmental issues. Most reporters are generalists, and natural catastrophe stories are covered in standard ways. There is an event (wildfires), victims (local residents) and cause (government policy). It didn't help that our culture interprets fire as the menacing kind of phenomenon that destroys urban dwellings and chases Bambi from the forest. And it didn't help

*The man interviewed was William Mott.
**NPS/USFS permits fires to burn under prescribed situations.

that the behavior of the 1988 fires confounded experts with decades of experience predicting wildfire behavior. The belief early in August that the fires were under control made their unexpected September runs even more newsworthy.

Just about everyone who ordinarily interprets these kinds of events was caught off guard. Weather predictions based on a century of records were incorrect. Scientifically based predictions about what would burn were incorrect. The public belief that wildfires can be suppressed was incorrect. The normal context for reasoned interpretation simply evaporated under the collapse of so many culturally accepted values. The fires may not have been as ominous and menacing as press accounts implied, but they were impressive. They damaged few structures, but caught the public imagination because of Yellowstone's symbolic value as a national icon.

For more Americans, the media have already interpreted the 1988 Yellowstone wildfires. If journalism is fiction, the fires were a great story. The challenge facing park interpreters is to put the story into an environmental context, and to help the public understand that Yellowstone did not burn down in 1988. It may be possible, one visitor at a time, to undo the inaccurate impressions about what happened in 1988.

Conrad Smith, Assistant Professor of Journalism,
The Ohio State University.

Descriptions of a Wildfire Found in Popular Literature or News Reports

- Wildfires raged out of control killing all in their path.
- The forest is a blackened pile of ash.
- A forest fire devastates a forest in Montana.
- The fire has left a path of destruction 20 miles wide.
- Fires charred and destroyed 13,000 acres of forest last week.
- Grasslands were consumed by fire yesterday leaving a blackened landscape void of vegetation.
- The wildfire left a blackened moonscape in its wake.

Extension

Ask your students to watch any television news story and write down (1) words that they *would use* if they were the newscaster and (2) sensationalized words that they *would not use*.

Ask your students to make up a newspaper or magazine article about a wildland fire. Student-drawn pictures could accompany the articles. Have students share their articles and pictures with the class and discuss the accuracy/sensationalism of each report.

Ask students to help you create a bulletin board illustrating the positive and negative effects of fire.

Show video tapes of television network news reports about wildland fires. Examine the different reporting styles and the topics examined in the reports. Discuss with the class any similarities and/or differences they see among the different presentations of fire stories.

Important Terms

▲ **fire history**

▲ **sensationalize**

REPORTING THE BLAZES QUIZ

NAME _____

1. Name three possible benefits of wildland fires.

_____

_____

_____

2. Name three possible negative effects of wildland fires.

_____

_____

_____

3. If I were a television news reporter "covering" a story on wildland fire in the forest, I would tell my TV viewing audience: (write your own one-minute newscast about a fire that you can imagine).

_____

_____

_____

_____

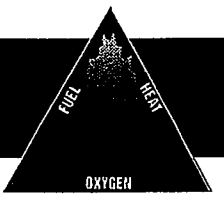
_____

_____

_____

_____

FIRE FIELD TRIP



TEACHERS' GUIDE

TAKE STUDENTS ON A FIELD TRIP TO OBSERVE A PRESCRIBED FIRE.

OBJECTIVES:

Students will learn why, how and when prescribed fires occur in tallgrass prairies.

ACTIVITIES:

Witness a prescribed fire. Create photo and written documentation of the event.

ORGANIZATION:

Who: Groups of 15 students per adult supervisor
Where: Prescribed burn at a tallgrass prairie conducted by a natural resource management agency
Time: Day field trip

MATERIALS:

Cameras, paper, pens, pencils, field/hiking clothes

SUBJECTS:

Physical Science, Biological Science, Social Science

BACKGROUND

No wildland fire is more visually stimulating than one that takes place on a **tallgrass prairie**. Prairie fires are a natural occurrence and essential to maintenance of the ecosystem. Most prairie ecosystems in the eastern and central U.S., where tallgrass prairies are found, would not exist without fire.

Though tallgrass prairies are one of the most diverse ecosystems in North America, the extent of the ecosystem's diversity is not always visible to the casual observer. Threatened and endangered insects, including numerous moth and butterfly species, inhabit prairies and depend on the ecosystem's ecological makeup for survival. Tallgrass prairies frequently are found in association with wetlands. The wetlands could be sensitive and endangered **bogs** or **fens**. Fire is important to these prairie bogs and fens.

Random fires ignited by lightning and **management-ignited prescribed fires** prevent unwanted vegetation from competing with rare prairie plants and prohibit the area from following a natural **succession** into wooded growth. Fire also encourages **microbial activity** (the activity of microscopic organisms that are responsible for the decay of dead materials). This activity increases the level of soil nutrients that plants require for growth. In addition, fire stimulates germination of many prairie plant seeds.

While encroachment of woody plant growth threatens to disturb the natural diversity of tallgrass prairies, succession is not the main threat to prairie ecosystems and wetlands. Human encroachment poses the greatest danger. Encroachment in this sense means that human development is located so close to a prairie that prescribed burns are difficult to carry out because of the potential risk to homes and other structures.

Often, instead of seeing a rare tallgrass prairie or a prairie fen, many people see fields that have no value other than for agricultural or land development purposes. Learning about prairies and the ecosystem's value will help future generations to: 1) know how to identify and protect these fragile areas and 2) understand that fire is one technique used by natural resource managers to protect and foster prairie growth.

Ingredients for a Prescribed Fire

A **management-ignited prescribed fire** (also called a prescribed or controlled burn) is a calculated and carefully planned event. Fire managers construct a fire plan that considers elements such as wind conditions, weather, season, humidity, dampness, and quantity and availability of fuel (natural build up of leaf litter and woody growth). As part of the plan, fire managers determine how hot the fire will burn and in what direction the blaze will travel. Using that information, managers carefully station each member of the fire crew so that the fire site is well managed and the crew is safe. A safe fire plan should include precautions to prevent the fire from becoming an uncontrolled wildfire. In addition, a fire plan must outline emergency procedures to handle an uncontrolled fire, should it become necessary. At a meeting prior to the prescribed burn, the fire manager outlines the details of the fire plan so that all crew members know their role in this concerted effort. In addition, all supplies are inventoried and checked for proper operation.

The fire crew is well-trained and well-equipped. Training includes practice of fire suppression, administration of the fire and education about the nature and behavior of fire. Fire crews wear Nomex clothing, a bright yellow fire-resistant material, for protection and so that team members are easily seen. The crews' outfit also includes a hard hat, goggles and a mask for protection. Feet and hands, a fire crew member's most vulnerable parts, are outfitted in fire-resistant gloves and boots.

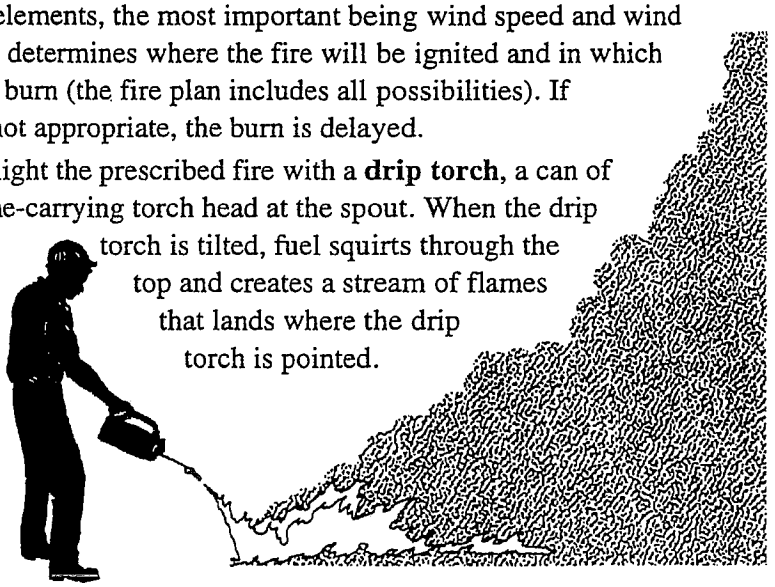
Inviting the local fire department to the prescribed burn can be both a security measure and an educational mechanism with which the community can learn about the benefits of management-ignited prescribed fires.

Prescribed Burn

In preparation of the fire plan, fire managers carefully study the site to minimize the risk of fire escaping from the target (planned burn) area. One way managers decrease the risk is by constructing a barrier around the prescribed burn site. Natural **firebreaks** such as roads, ditches, water or other physical features devoid of natural fuel are the best barriers. Most often, however, a firebreak must be built ahead of time to burn away materials that would fuel a wildfire. Occasionally, mowing or "wetting down" an area will prevent fire from burning outside the prescribed area.

On the day of the prescribed burn, the fire crew considers all environmental elements, the most important being wind speed and wind direction. Wind determines where the fire will be ignited and in which direction it will burn (the fire plan includes all possibilities). If conditions are not appropriate, the burn is delayed.

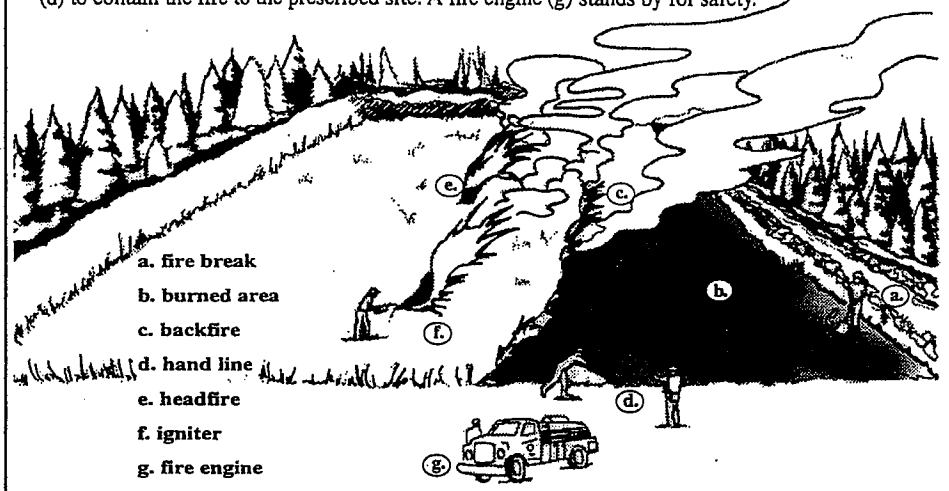
Fire crews light the prescribed fire with a **drip torch**, a can of fuel with a flame-carrying torch head at the spout. When the drip torch is tilted, fuel squirts through the top and creates a stream of flames that lands where the drip torch is pointed.



The fire manager or crew leader usually determines where the fire should be placed and operates the drip torch.

The Anatomy of a Prescribed Burn

Natural resource managers locate a natural fire break, such as a creek (a), along which they ignite a downwind backfire (c). This creates the burned area (b) at which the headfires (set at e and f so that wind carries the fire toward the backfire) will stop. Fire crew members work at the hand line (d) to contain the fire to the prescribed site. A fire engine (g) stands by for safety.



adapted from ***Nature Conservancy***, September/October 1993

Two types of burns are used in a prescribed fire — **backfire** and **headfire.** Fire crews ignite a backfire downwind along the fire break and let the fire slowly burn toward the center of the site. Eventually the backfire meets the headfire. Headfires are set so that the wind fuels the fire and carries it toward the backfire. Most fire crew members work to contain the fire to the sides of the site — an area termed the **hand line**. Crews use rakes, flappers and backpack pumps filled with water to maintain the hand line. Other crew members located along the fire break and perimeter extinguish runaway flames. A nearby fire engine can be mobilized if the prescribed burn escalates into a wildfire or if the climate is dry and threatens to reignite the blaze.

After fire crews complete the prescribed burn and extinguish smoldering remains, the site looks charred and lifeless. Usually, in less than three days the basal (base) leaves of tallgrass prairie plants such as big bluestem, Indian grass, switchgrass and prairie dropseed appear under the charred remains. In contrast, invaders or unwanted species such as Queen Ann's lace, poison ivy, tree seedlings and shrubs, wild rose and others do not make such a successful resurgence after a fire.

Activity

Arrange a field trip to permit your students to view a prescribed burn with an agency that conducts management-ignited prescribed fire as part of their natural resource management plans. Suggested agencies include: The Nature Conservancy, your state natural resources agency, the Audubon Society, federal land management agencies or other park or land management agencies. Arrange transportation, safety training, a pre-trip orientation and a follow-up activity. At a minimum, students can participate in the field trip and engage in follow-up discussions. As part of a pre-trip activity, suggest that the fire manager visit the classroom and discuss prescribed burns.

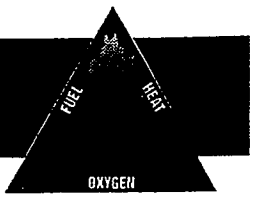
If the activity takes place in the spring, a follow-up visit later in the season will show the students how a management-ignited prescribed fire stimulates prairie growth. Conduct a photo poster session, written essays and/or a poetry/prose workshop for the students. Place students into three groups and instruct them to illustrate with words, drawings or photos (1) before the burn (the prairie before the burn and the preparation and materials for the burn), (2) the prescribed burn taking place and (3) the result after the burn and how the prairie plants respond.

Although this can be an exciting field experience, much attention should be paid to safety. Also, teachers must be prepared for a "no burn" decision based on unacceptable environmental conditions (e.g., high wind, high temperature) for prescribed burning.

Important Terms

- **backfire**
- **bog**
- **fen**
- **firebreak**
- **hand line**
- **headfire**
- **microbial activity**
- **succession**

FIRE IN MY BACKYARD



TEACHERS' GUIDE

BACKGROUND FOR A 15–20 MINUTE DISCUSSION WITH STUDENTS WHO ARE FAMILIAR WITH FIRE ECOLOGY CONCEPTS.

OBJECTIVES:

Students will increase their awareness of fire in the wildland/urban interface and learn fire prevention measures.

ACTIVITIES:

Discussion of conflicts and difficult decisions made concerning fire and wildland/urban interface.

ORGANIZATION:

Who: Class of students
Where: Classroom
Time: 15–20 minutes

MATERIALS:

No special material required. See references for video, *Firesafe Inside and Out*

SUBJECTS:

Geography, Social Studies

BACKGROUND

As urban areas expand into wildland areas and as an increasing number of "vacation" homes are built near wildland recreation areas, the conflicts associated with wildland fire become more commonplace. Just as people and their property are threatened by wildland fires, wildlands are threatened by human-caused fires. Thus students, parents and their communities benefit by knowing the risks and protection strategies related to home development in wildlands.

In the 1980s, wildfires burned large tracts of land across the United States. More fires have impacted even larger tracks of land and personal property in the 1990s. A dream home built in an idealistic wildland setting can be razed by fire in a matter of minutes. Likewise, the exemplary scenery that attracted homeowners to the setting can be altered, often because of the inadvertent action of the homeowner.

Students should have an opportunity to learn strategies to protect their home, family and the wildlands. The *National Wildland/Urban Interface Fire Protection Initiative* organized by the National Fire Protection Association (NFPA) provides an excellent educational experience to help students begin to understand the complexity of wildland/urban fire interplay (see page 3).

Wildland/urban interface refers to the geographical areas where formerly "urban structures — mainly residences — are built in close proximity to the flammable fuels naturally found in wildland areas, including forests, prairies, hillsides and valleys. The results can be aesthetically desirable...or disastrous" (NFPA, see references).

THE ISSUES

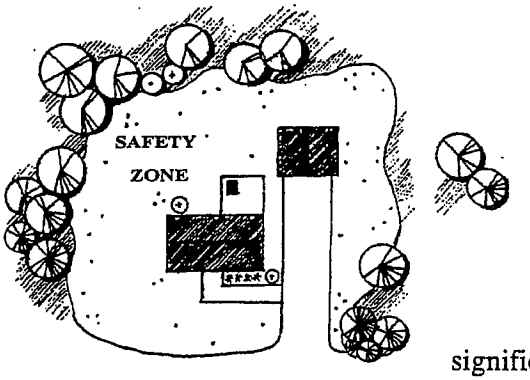
In a case study of a destructive wildland/urban interface fire, NFPA lists four reasons for the increased risk of fire occurrence in wildland/urban interface:

- Wildfires continue to ignite and threaten homes in the wildlands.
- Wildfires continue to present particular problems to fire protection agencies.
- Lack of good vegetative management predisposes areas to wildfires.
- Unless specific preventive measures are taken by homeowners and local governments, homes will continue to be lost and people's lives will continue to be in danger.

You Can Help

Though people can never fully protect their homes and adjacent wildlands against wildfires, you can take steps to reduce the risk. For example:

■ Remove combustible vegetation from the vicinity of any structure. Thin out continuous tree and brush cover and remove dead limbs, fallen trees, leaves, twigs and evergreen tree cones within 30 feet of the structure to create a "**safety zone** of low fuel density all around the home" (NFPA). Likewise, prune tree branches to 10 feet above the ground and remove leaves and twigs from beneath trees, in the yard, on roofs, patios and landscaped shrubs.



■ Limit the number and density of landscaped vegetation and do not use highly flammable landscaping near structures. Maintain a greenbelt or noncombustible zone around the home; avoid using bark or wood chip mulch in the safety zone.

■ Stack firewood uphill at least 15 feet from a house. Fire risks increase when wooden decks, patios and woodpiles are placed close to structures or when flammable materials are stored near structures.

■ Be aware that roofs and walls made of untreated flammable materials such as wood shanks and shingles pose a significant fire threat. Wind-carried embers or the intense heat from a nearby fire can ignite such fuel sources. Fire does not need to "burn over" a structure for it to catch fire.

■ Clean roof and gutters. Remove pine needles and leaves to eliminate fuel sources.

■ Prepare for water shortages. Lack of piped water to protect against fire is a major problem in wildland/urban interface settings. To protect a structure, develop an external water supply, such as a small pond, well or pool, for fighting fires. Publications such as *Planning for Water Supply and Distribution in the Wildland/Urban Interface* (see references in this section) provide valuable information for preparation of homes and protection systems in the event of wildland fire.

■ Choose home location wisely. Building structures in canyons and on slopes increases the chances that those homes will be destroyed by wildfire. Canyons and slopes serve to channel fires up in elevation, similar to the way chimneys channel fireplace emissions. When upland slopes and canyons are selected for home sites, downhill or lower elevation areas should be clear of excess fuel, to add an additional element of protection. If a home is on the crest of a steep hill, thin the fuel sources at least 100 feet below the crest.

■ Mow tall grass and keep it to a maximum height of two inches within the home safety zone. Avoid tall grass around driveways, areas susceptible to ignition by automobile exhaust systems.

■ Inspect and clean chimneys regularly. Equip chimneys for wood-burning heating units with spark arresters.

■ Avoid all outdoor burning to decrease the likelihood of fire ignition near a home structure.

■ Prevent mishaps with outdoor cooking grills by carefully maintaining the grill and using caution during grill use.

■ Have the right tools. Equip home with smoke detectors. Keep fire tools in good working order and store in an easily accessible area of the house.

Conflicts

Fighting wildfires often requires setting a fire — a **backfire** to remove fuel from the path of a major, oncoming fire. To prevent fires, natural resource managers authorize **management-ignited prescribe burns (fires)** to remove excess fuel from the ground without destroying the major vegetation. Conflicts arise when the prescribed burn area or the backfire is too near the homes in a wildland/urban interface. Who will make the difficult decision about where and when to burn? How would you respond if your home was nearby? What if your entire vacation-home community had to be sacrificed to stop an advancing wildfire that could alter an extensive forest ecosystem? These are difficult questions to answer. How would you make the decision?

Activity

This activity is most important and relevant to students living in wildland/urban interface areas and areas where wildland fire is a regular, familiar phenomenon.

During the presentation of a fire unit or a lesson on fire awareness, discuss the subject of wildland/urban interface and fire to help students better understand the difficult questions which eventually will require controversial decisions. This discussion is more appropriate for students who have explored the other materials in this fire ecology unit. *Firesafe Inside and Out*, a 22-minute video may be shown. Order and provide each student a copy of *How to Protect Your Home —Wildfire Strikes Home* (see references).

More Information

To receive additional information on wildland/urban interface and fire, contact your local fire department or forestry agency or any of the following organizations:

- ❑ National Fire Protection Association
  Public Fire Protection Division
  1 Batterymarch Park
  P.O. Box 9101
  Quincy, MA 02269-9101
  617-770-3000

- ❑ United States Department of Agriculture–Forest Service
  Fire & Aviation Management
  P.O. Box 96090
  Washington, D.C. 20090-6090
  202-205-1483

- ❑ National Association of State Foresters
  444 N. Capitol Street, NW
  Washington, DC 20001
  202-624-5415

- ❑ Boise Interagency Fire Center
  Publications Management System
  3905 Vista Avenue
  Boise, ID 83705
  Fax: 208-387-5573 or 5548

REFERENCES

Fire Control Division, Washington State Department of Natural Resources. (no date). *Fire risk rating for homes* [Brochure]. Lacey, WA: Author.

National Fire Protection Association. (no date). *Black Tiger fire case study* [Brochure]. Quincy, Massachusetts: Author.

National Fire Protection Association. (no date). *Planning for water supply and distribution in the wildland/urban interface* [Brochure]. Quincy, Massachusetts: Author.

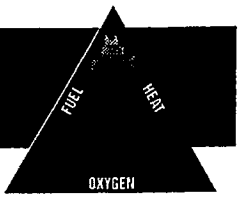
Northwest Fire Prevention Cooperatives. (1992, February). *Firesafe inside and out northwest version* [Video].

USDA Forest Service, USDI Bureau of Land Management and State Foresters. (no date). *How to protect your home — Wildfire strikes home!* [Brochure].

IMPORTANT TERMS

- **backfire**
- **management-ignited prescribed burns (fires)**
- **safety zone**
- **wildland/urban interface**

GLOSSARY OF FIRE TERMS



10 A.M. RULE A fire policy advocated in the 1930s which stated that all fires would be extinguished by 10 a.m. on the morning following their ignition.

ADAPTATION An alteration in structure or function of a plant or animal that helps it change over the course of successive generations in order to be better suited to live in its environment.

BACKFIRE Fire set downwind along a fire break.

BIOLOGICAL DIVERSITY The sum total of all living organisms and the interaction thereof.

BOG A poorly drained wet area containing floating water-soaked masses of plantlife such as sedges, heaths and sphagnum (a form of peat moss).

CHEMICAL REACTION A change in the nature of a material or materials that can release energy in the form of light or heat.

CROWN FIRE A fire that burns primarily in the leaves and needles of trees, spreading from tree to tree above the ground.

ECOLOGY The science that studies the ways in which plants and animals live together in the natural environment of our planet.

ECOSYSTEM An area in which energy, nutrients, water, and other biological and geological influences, including all living organisms, work together and influence one another.

FEN An alkaline wetland community usually supplied with water from calcareous (calcium-rich) gravel deposits from glacial periods or from artesian springs.

FIRE A self-sustaining chemical reaction that can release energy in the form of light and heat.

FIRE BEHAVIOR The manner in which a fire reacts to fuel, weather and topography; common terms used to describe fire behavior include smoldering, creeping, running, spotting, torching and crowning.

FIRE COMMUNITY A plant or animal community that is adapted to live in a habitat that is frequented by fires.

FIRE DEPENDENCE Plants or plant communities that rely on fire as one mechanism to create the optimal situation for their survival.

FIRE HISTORY The chronological record of the occurrence of fire in an ecosystem.

FIRE LINE A strip of land cleared of vegetation to stop the spread of a fire.

FIRE PRESCRIPTION A document written by natural resource managers to indicate when or if a fire will be ignited by trained professionals.

FIRE REGIME The role fire plays in an ecosystem; a function of the frequency of fire occurrence, fire intensity and the amount of fuel consumed.

FIRE SCARS Scar tissue that develops if a tree or shrub is burned by a fire but is not killed. The fire leaves a record of that particular burn on the plant. Scientists can examine fire scars and determine when and how many fires occurred during the plant's lifetime.

FIRE STORMS Large fires that consume so much oxygen that strong erratic winds are created.

FIRE TRIANGLE An image of the three components that are necessary for a fire to take place and for the fire to keep burning; the ingredients are heat, fuel and oxygen.

FIRE YEARS Years when severe drought, combined with other factors such as high winds, contribute to a large number of wildfires.

FIREBREAKS Natural or human-made lines or areas where fuels are limited or nonexistent.

FLAME-RETARDANT Materials that can break the fire triangle and prevent a fire from burning.

FUEL All the dead and living material that will burn. This includes grasses, dead branches and pine needles on the ground, as well as standing live and dead trees. Also included are minerals near the surface, such as coal that will burn during a fire, and human-built structures.

FUEL LOAD The amount of combustible material (living and dead plants and trees) that is found in an area.

FUSAIN Fossilized charcoal.

GROUND FIRE A fire that burns organic materials in the soil layer (e.g., peat) and often the surface litter and low-growing vegetation.

HABITAT An area that supplies the needs of a population of animals or plants living there.

HAND LINE Fire line constructed with hand tools by natural resources managers and fire crews.

HEADFIRE A fire front spreading or ignited to spread with the gradient (downwind or upslope).

HEAT Necessary ingredient for fire to start; can be supplied by lightning or human sources.

HOT AND COLD STROKES Two types of lightning bolts. Hot strokes are longer and more likely to start fires; cold strokes are shorter and less likely to start fires.

HUMUS LAYER Decomposed organic matter that is found in the top layer of soil.

LITTER The dead debris, including pine cones, pine needles, branches and other material, that covers the ground under a forest or shrub area.

MANAGEMENT-IGNITED PRESCRIBED FIRE The planned application of fire to natural fuels, including logging debris, grasslands and/or understory vegetation, such as palmettos, with the intent to confine the fire to a predetermined area.

MEAN The arithmetic average of a set of numbers.

MICROBIAL ACTIVITY The activity of microscopic organisms that are responsible for the decay of dead material.

OPINION POLLS A process of collecting (polling) opinions from a sample of individuals or groups in order to make generalized statements about the entire set of individuals or groups from which the sample was drawn.

PREDATORS Animals that prey on other animals as a food source.

PRESCRIBED NATURAL FIRE A commonly-used term to indicate a policy of allowing naturally ignited fires, such as those started by lightning, to burn under specific management prescriptions without initial fire suppression.

QUESTIONNAIRE A written instrument used for gathering information on a specific set of questions.

SAFETY ZONE An area of low fuel density created around structures in the wildland/urban interface for protection against fire.

SCAVENGERS Animals that feed on dead or dying animals or discarded materials from human societies.

SELF-SUSTAINING REACTION A chemical reaction that perpetuates (sustains) itself by providing the conditions that were required to initially start the reaction. A fire, for instance, provides enough heat to create still more fire.