

Fire Ecology

For millions of years, fire has been part of the Earth's natural cycle and has influenced natural selection and plant evolution. Over time, plants have adapted to periodic fires, thus developing various mechanisms that enabled them to survive and reproduce in fire-prone environments. As a result, many types of forests and other natural ecosystems (grasslands, deserts, prairies, and so forth) now depend on fire as part of their life cycles.

The Role of Fire

Fire is an important and necessary part of the life cycle of many forests. Fire promotes a healthy forest ecosystem consisting of mixed-aged trees, which allows for a self-sustaining cycle of life and death. Fire clears dead trees and dry leaf litter, thereby opening up the forest floor for new growth. Fire also aids in recycling nutrients. Fire's mineral-rich ash nourishes the soil and provides an ideal environment for the germination of many seeds and the regeneration of certain plants.

Fire supports the process of natural selection as it improves growth opportunities for stronger, healthier trees by thinning small trees and removing weak and insect- or disease-ridden trees. Certain species of conifers that produce closed, or serotinous, cones rely on heat from fire to open the cones and to release the seeds, thereby helping to reseed the area after a fire. In addition, because recently burned forests contain very little deadfall and litter, those forests are less likely to burn again soon. If the forests do reburn, they usually do so with a cooler, smaller flame and with a less-damaging fire.



While it has many benefits to the ecosystem, fire can also be a serious threat to homes and communities, as well as to human life. Preventing, controlling, and suppressing wildfires is becoming a greater priority as more people build homes in woodlands and other natural areas. Fires in the wildland-urban interface, where buildings are interspersed with natural lands, can be very dangerous and damaging.

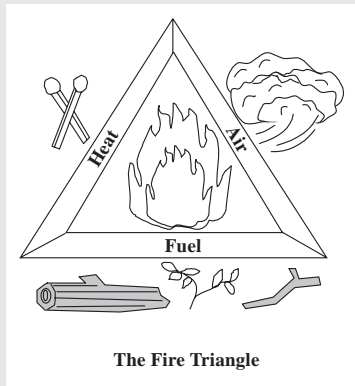


Forest fires also create smoke that can greatly affect air quality and human health. Smoke from wildfires is a mixture of gases and fine particles from burning trees and other plant materials. Such smoke can irritate the eyes and respiratory system, and it can worsen chronic heart and lung diseases, including asthma.

Fire Ecology (cont.)

The Fire Triangle

Fires need heat, fuel, and oxygen—the three components of the “fire triangle.” Without any one of those components, a fire will not burn.



Heat—Heat is required to start a fire and is also needed to maintain the fire. The initial heat, or ignition, may come from natural causes (lightning or volcanic activity) or through human activities (deliberately setting the fire, failing to put out campfires, using matches improperly, burning debris, and so forth). In the United States, 90 percent of all forest fires are caused by humans.

Fuel—Fuel is any kind of combustible material. Natural fuels include dry or dead trees and limbs, leaf litter, and dry grass. Additional fuels include human-made structures, such as homes, barns, fences, and sources of gas or petroleum (such as leaking tanks of gasoline or oil, gas grills, or abandoned automobiles).

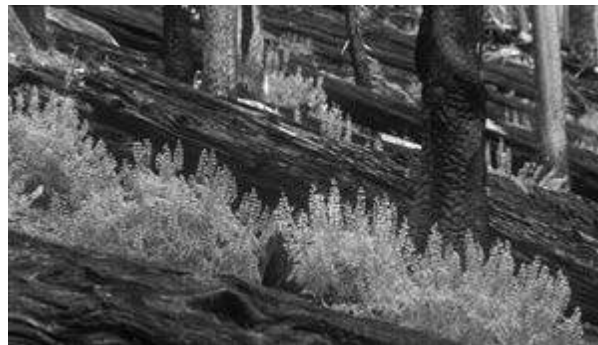
Oxygen—Oxygen is needed for the chemical processes that occur with a fire, and this oxygen comes from the air. During windy conditions, the supply of oxygen available to a fire is replenished more quickly than in still air because a greater volume of air flows over the fire. The rising column of hot air generated by a fire draws in cooler, oxygen-rich air from the surrounding air mass, creating a fire-driven wind that helps a fire sustain itself as long as fuel is available.

Fire as a Renewal Agent

Both fire and decomposition result in the breakdown of organic material into nutrients that are returned to the soil. Those nutrients can be recycled and used for new plant growth. In dry climates, moisture that aids decomposition is low, thus making fire critical for restoring nutrient levels to the soil.

In the damp, lush forests of Florida, fire reduces the abundant fuel buildup every 3–7 years, creating a cycle pattern of growth and burn. This pattern can be found throughout most forest ecosystems, although it may occur on a different time scale. For example, Western forests historically have burned every 150–300 years.

After fire, a natural process of forest succession occurs. Within days after a fire, grasses may begin to grow and “green up” the recently burned forest floor. Wildflowers often flourish after a fire as a result of the high nutrient levels and germination of new seeds. Over time, the seedlings and other plants will form a young forest. Only in cases where the fire burned extremely hot from high levels of debris will people need to plant seedlings to help regenerate the forest.



*Lupine wildflowers growing back in a burned forest in Montana.
Photo by Nelson Kenter.*

Fire Ecology (cont.)

Fire Season

Weather greatly influences when fires occur and how they spread. Hot temperatures and dry winds can dry out trees and grasses, making them available as fuel for a fire to consume. Wildfires do not usually occur when the fuels (trees, shrubs, and grasses) are wet and cold.

In the Southeastern United States, the “fire season” lasts from March through May, a period in which 75 percent of forest fires occur. Fire season in the West usually runs from June through October, during the very dry months of the year. In southern California, the height of fire season arrives with dry, late-summer “Santa Ana” winds, which threaten areas containing dry debris or fuel. In the Northeastern United States, fire season lasts from March through May and then again in the fall, when trees drop their leaves.

Managing Forest Fires

The earliest signs of humans using fire date back as long ago as 1.5 million years in southern Africa, where fire was probably used for warmth, for light, and to frighten away predators. Many cultures have since also used fire as a tool to shape their environment. American Indians, for example, deliberately set fires to reduce unwanted pests and to increase game animals, including buffalo, antelope, deer, rabbit, and ground-nesting birds. Different farming cultures have long used fire to clear forests and grasslands for farmland or as a way to replenish soil.

During the European settlement of North America, settlers routinely cut and burned forests to clear land. By the late 1800s, however, people began to realize that the forests were limited and that cutting and burning them was beginning to have an adverse impact. In 1905, Congress created the U.S. Forest Service to oversee the nation’s forestlands, and the agency’s leader promoted controlling fires and suppressing forest fires at all costs.

At that time, fire suppression, or preventing the forests from burning, seemed like a reasonable way to protect forests. In 1935, the Forest Service enacted the “10:00 a.m. Fire Control Policy,” which required that all fires on national forestlands be controlled and suppressed as quickly as possible, or at least by 10 o’clock the following morning. That policy prevailed well into the 1980s, when forest ecologists began to see that fire suppression was changing the makeup of the forests themselves.

Today, fire is understood as a necessary component for healthy ecosystems, and fires are often allowed to burn through vast forest landscapes. Foresters use fire in a number of ways to manage forests, grasslands, and other ecosystems. A prescribed fire (one that is planned, ignited, and managed by trained individuals) may be used to prepare a logged area for reforestation, to enhance wildlife habitat, to protect a native plant species, to control insect populations or disease, or to reduce wildfire hazard by reducing burnable fuels.



Prescribed fire in Connecticut.

Fire Ecology (cont.)

Prescribed fires are different from unplanned fires, which may be caused by nature or by people. Most natural fires are ignited by lightning, but the majority of forest fires in the United States are started by humans. In 2009, for example, just under 10,000 U.S. wildland fires were started by lightning, while almost 70,000 fires were caused by human activities. City, state, and federal government agencies work to prevent unplanned fires through enhanced public awareness. Clearing vegetation around homes and businesses near the wildland-urban interface greatly reduces the number and severity of unplanned fires.



Prescribed fire in Connecticut.

Suppressing unwanted wildfires is expensive but often necessary. Some agencies will allow naturally occurring fires to burn under certain weather and fuel conditions. However, when a fire no longer meets those conditions or when it threatens life or property, the fire will be suppressed.

The issues of when, where, and how—or whether—to control forest fires through preventive strategies, suppression, or prescribed burn tactics have been the subject of debate at the local, state, and national levels for many years. The evolving discussion underscores the difficulty of balancing the needs of society against the needs of the forest ecosystem.