



"By forces seemingly antagonistic and destructive Nature accomplishes her beneficent designs—now a flood of fire... again in the fullness of time an outburst of organic life..."

—John Muir

Fire is a force of nature. Started naturally by lightning and lava flows, it shapes the planet on a daily basis. It is also a tool. For better and for worse, humans have used fire to survive, destroy, and flourish.

Fire is part of the national park story. In the late 1800s the first national parks were created. The science of ecology did not exist, and few understood the best ways to care for parks. Wildland fires were seen as a threat to grand scenery and were put out. At about the same time, fires destroyed communities and killed hundreds of people in the West and Midwest. The public agreed that fire was an enemy to be fought.

For much of the 20th century great emphasis was placed on fire suppression, not just by the National Park Service but by many agencies. During the Depression of the 1930s, facilities for fighting fires were expanded as the Civilian Conservation Corps was put to work on public lands nationwide.

By the 1950s some people were thinking differently about fire's role on the land. By the 1960s several parks had begun using fire to manage lands. Since then the National Park Service has been a leader in fire science and research.

In 1968 National Park Service policy changed. Protecting human lives and property remained the first priority, but naturally caused fires and prescribed fire were used to keep some park landscapes healthy or to reduce threats to property or resources. However, the 1988 Yellowstone fires, the loss of more than 200 homes in Los Alamos, New Mexico, in 2000, and numerous large fires in recent years demonstrate that fire is not easily mastered.

As an agency and as a nation we must keep learning about fire to address the challenges we helped create. Decades of fire suppression, long-term drought, and other factors have increased burnable trees, shrubs, and grasses. Continuing development has placed some homes and communities at risk. As our understanding of fire increases we will be better able to live with fire, which is an integral part of our world.

What is Fire?

Given three ingredients—fuel, oxygen, and heat—fire moves as conditions dictate. It may creep along the ground as a surface fire, consuming only brush and litter with low-intensity flames.

Or, high winds may sweep it into a hot crown fire, igniting entire trees and burning fallen trees to ashes. Embers, carried aloft by rising flames, may start spot fires miles ahead of the

main blaze. This spotting allows a fire to jump major natural or human-made barriers.



Grassland ecosystems depend on fire to maintain plant and animal diversity and to keep out encroaching trees. Like sheets of paper, grasses burn quickly, and fire can be driven many miles per hour in extreme conditions.

Fire as a Natural Process

Fire is one way nature maintains a landscape. Without the culling, recycling, and regenerative contributions of fire, a dynamic ecosystem becomes a stagnant garden, with less plant and animal diversity. Some ecosystems, like the tall grass prairie, need fire to exist. For centuries, humans have used fire to drive game, enhance food supplies, and clear land for crops. Where these practices have continued for generations they have shaped the landscape we see today. Around the world, 90 percent of all fires are started by people. Whether started by lightning, lava, or people, each fire is unique. It varies by the materials and conditions under which it burns. Fires often create a puzzle-like mosaic of habitats by burning intensely in some areas and less so in others.

Fire turns dead plant material into soil nutrients. Nitrogen from ash fertilizes the soil, encourag-

ing new seeds to sprout. Fewer trees, brush, and mature plants mean that more sunlight reaches seedlings, allowing them to grow.

Some plants need fire to reproduce. Fire melts the pitch of the cones of table mountain, jack, and lodgepole pines, releasing the seeds inside. It opens the outside coating of mountain lilac seeds and stimulates germination in southern California chaparral. Aspen, birch, and willow sprout from their roots after a fire. The wide variety of plant and animal life people enjoy in national parks is partially the result of fire. What may at first look like devastation soon becomes a panorama of new life.

Fire is a jolt to living systems, the beginning of a new stage of life on the land. National parks protect and encourage nature at work. Fire must continue to resume its natural role; its influence must be either allowed or imitated.

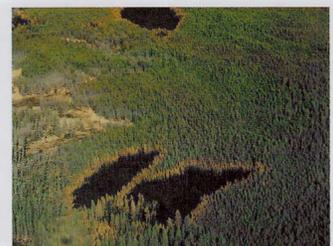


What Happens to Wildlife in a Fire?

Wild animals evolved with fire and generally survive all but the fastest moving fires. Birds and many larger animals leave the immediate area. Some animals escape to streams or ponds,

and rodents return to their burrows. Usually few animals are killed by fire itself. Some predators, including humans, take advantage of fire by hunting animals fleeing

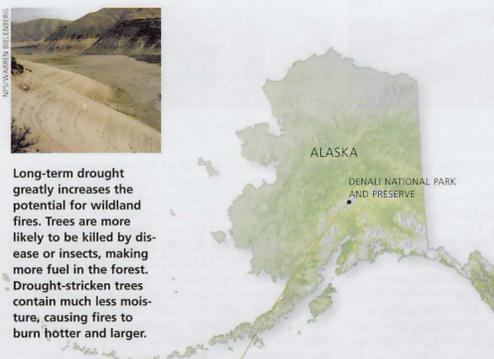
the fire. For centuries people the world over have used this practice.



Spotting

Fires typically burn a mosaic pattern as wind-driven flames, varying fuel moistures, and spotting create a patchwork of green, brown, and black. This mosaic, with

its edges and variety of habitats, is key to plant and animal diversity.



Long-term drought greatly increases the potential for wildland fires. Trees are more likely to be killed by disease or insects, making more fuel in the forest. Drought-stricken trees contain much less moisture, causing fires to burn hotter and larger.



Different Places, Different Plants, Different Fires

The National Park Service protects ecosystems from the Arctic to the Tropics. One thing all the places have in common is that plant material becomes fuel and will burn when conditions are right.

The pattern of fire that occurs on the land is called the fire regime. Elements include frequency, time of year, and intensity of fires. The fire regime depends upon the plants, climate, and weather in a particular area. Some vegetation types found in national park areas and their typical fire patterns are listed with photos below. More than 260 vegetation types have been identified across the country and each burns differently.

Decades of attempting to put out all fires have altered natural fire cycles. We have changed plant communities and allowed fuels to increase. We have also built houses and communities without full regard for the local fire regimes and weather patterns. During periods of long-term drought, which much of the West has experienced in recent years, the accumulated fuels can lead to large fires that burn intensely, potentially threatening homes and towns.

<p>Boreal forest Denali National Park & Preserve, Voyageurs National Park</p> <p>Spruce, pine, and fir dominate northern areas to the tree line. Large, intense fires occur every 25 to 150 years.</p>	<p>Chaparral Santa Monica Mountains & Whiskeytown national recreation areas</p> <p>Mixed shrubs and low trees grow in dense masses. Explosive fires scour the hillsides bare every 12 to 50 years.</p>	<p>Ponderosa pine Grand Canyon National Park</p> <p>Spacious forests of trees hundreds of years old have frequent fires (5 to 25 years) that clear the ground but seldom kill large trees.</p>	<p>Lodgepole pine Yellowstone & Glacier national parks</p> <p>As the dominant tree in these parks, this pine grows in dense stands. Sections may burn wholly every 200 to 400 years.</p>	<p>Pinyon-Juniper Mesa Verde National Park, Bandelier National Monument</p> <p>Transitional woodland dominated by pinyon pine and juniper with associated grasses and shrubs has frequent ground fires and infrequent stand replacement fires every 35 to 100 years.</p>	<p>Tall and shortgrass prairie Badlands & Theodore Roosevelt national parks, Tallgrass Prairie National Preserve</p> <p>Perennial and annual grasses can survive flames better than invasive brush. Grass is renewed by moderately intense, fast-moving fires every 7 to 12 years.</p>	<p>Wetlands Big Cypress National Preserve, Everglades National Park</p> <p>Sawgrass needs fire to kill competing vegetation. Small patches may burn to the waterline every few years.</p>	<p>Southern pine Cumberland Island National Seashore</p> <p>Southern pines grow in park-like stands with an understory of grasses or short shrubs. Mild surface fires clear dead vegetation every 3 to 5 years.</p>	<p>Eastern mixed forest Great Smoky Mountains & Shenandoah national parks</p> <p>Mixed coniferous and deciduous forests with associated shrubs are found in shifting ratios determined by climate, soils, topography, and a mosaic of fires. Low intensity fires occur more frequently than severe fires that kill most trees.</p>
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Managing Wildland Fire

Wildland fire has the potential to change park landscapes more often than volcanoes, earthquakes, or even floods. Such forces of change, except human-caused fires, are completely natural. Many plants and animals cannot survive without the cycles of fire or flooding to which they are adapted. If all fire is suppressed, fuels build up making bigger fires inevitable. Under certain conditions, large, hot fires can threaten public safety, devastate property, damage natural and cultural resources, and be expensive—and dangerous—to fight.



USFS/LOGAN BRUDENELL

Preparing Parks for Fire

National Park Service policy stresses managing fire, not just suppressing it. This means understanding fire regimes, planning for fires, and using fire as a land management tool. The goal is to protect lives, property, and resources while restoring fire's role as a dynamic and necessary natural process in maintaining healthy ecosystems.

Fire management starts with a plan. Managers study the land, plants, animals, weather, and the history of fire in the area. They identify critical or fragile habitats and watersheds, historic areas, human development, air quality and public safety concerns, and visitor use in and near the park. They meet with appropriate agencies, neighbors, and the public.

The plan sets objectives such as restoring or maintaining a historic scene or habitat or reducing the amount of hazardous fuels. It outlines ways to accomplish these tasks. These include managing naturally occurring wildland fires under favorable conditions, imitating natural fires according to a burn plan or "prescription," or using hand or power tools and equipment to reduce fuels.

Finally the plan includes trigger points for increased staffing in times of high fire danger and outlines when and how to aggressively fight naturally or human-caused wildland fires.



NPS/YELLOWSTONE NATIONAL PARK

The history of fire management in national parks dates back to Yellowstone, the world's first national park. In 1886 the U.S. Army was brought in to protect the park from hunting, trapping, grazing, logging, and fire. The soldiers were this nation's first paid wildland firefighters.



More than 100 Civilian Conservation Corps camps in national parks housed thousands of "boys." Much of their work was in fire detection and suppression, common themes of that era. They cleared brush, planted trees, and built trails, roads, lookout towers, and patrol cabins. Many CCC-built facilities are still being used today.



NPS/EVERGLADES NATIONAL PARK

In the 1950s Everglades National Park in Florida began using prescribed fire to maintain natural vegetation complexes (photo at left).

Prescribed fire is one of the most important tools used to manage fire today. A scientific prescription for each fire, prepared in advance, describes its objectives, fuels, size, the precise environmental conditions under which it will burn, and conditions under which it may be suppressed. The fire may be designed to create a mosaic of diverse habitats for plants and animals, to help endangered species recover, or to reduce fuels and thereby prevent a destructive fire.

Prescribed fire also can be the most cost-effective way to maintain certain historic scenes. These include the open grasslands of the Revolutionary War era at Saratoga National Historical Park in New York, the oak-prairie savanna of the Civil War era at Wilson's Creek National Battlefield in Missouri (photo below), and the vista of the Nez Perce War of 1877 at Big Hole National Battlefield in Montana.



NPS/JENNIFER RIDGLE

Tools of the Trade



NPS/MICHELLE FEILER



NPS/KARA LEONARD



NPS/BRYAN DAY



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NPS/KAREN WATTENMAKER



NPS/KAREN WATTENMAKER

The National Park Service fire program has evolved from one of suppressing fire to one of managing fire. While suppression remains important, new approaches and technologies are used to provide for better public safety and resource protection.

Fire managers use infrared sensing, satellite imaging, and computer modeling technology to predict fire behavior and to plan actions. Research-based computer models and geographic information systems (GIS) show how fuels, weather, and topography affect fires.

Models also help estimate how fast and far a fire may travel and how big it might become under different conditions. Smoke impacts on visibility and visitor health are carefully monitored with specialized equipment.

Wildland Fire Use—Naturally-ignited wildland fires are managed to fulfill planned ecological objectives. Fire personnel monitor, map, and assist with fire behavior predictions to help the fire meet specific objectives.

Fuels Management—Fuels are removed mechanically or by burning to reduce the number or intensity of fires in an area. This can improve firefighter and public safety and reduce potential damage to property.

Fire Suppression—This remains an important part of fire management. It requires trained wildland firefighters qualified in a number of tasks. They are directed by command staff and supported by others who provide technical, logistical, and administrative assistance.

Firefighters' most important tools are their brains. For their safety and that of the public, they must maintain awareness of the constantly changing environment of any fire. Other tools include flame-retardant clothing, hand tools, water pumps, and heavy equipment. Helicopters and airplanes are sometimes used to drop chemical fire retardant or water. Whether using a shovel, rake, or a water-drop, the purpose is to collapse the fire triangle by removing fuel, oxygen, or heat from the fire.

Less than four percent of fires escape initial suppression actions and require additional control efforts. Specially trained interagency teams direct suppression efforts on large fires. Personnel and equipment from federal, state, local, and Tribal agencies can be mobilized quickly and efficiently like a military operation. Fire camps resembling small cities may be set up with showers, meals, and medical facilities for 1,000 to 2,000 firefighters. National Park Service employees work alongside firefighters from other agencies in fire management activities across the country.

Learning from and about Fire

Planned or not, fires affect human, plant, and animal communities in and near them. Park scientists work in partnership with other professionals and agencies to study these effects and continuously improve fire management.

Smoke Impacts

The National Park Service works closely with state and local air-quality agencies to reduce the impact of smoke on visitors, neighbors, and employees.

While large, unplanned fires can produce tremendous amounts of smoke, prescribed fires are carefully executed to minimize the impact of smoke on the public. We have learned that prescribed fires can minimize the spread of larger fires that would produce significantly more smoke.

Rehabilitation of Burned Areas

Wildland fires and fighting them sometimes cause damage requiring rehabilitation. Steep areas may need to be mulched for erosion control. Monitoring, removal of exotic species, and selective planting could be necessary to encourage the return of native species. Archeological sites and features may require mapping, stabilization, or additional preservation work.

Monitoring and Research

Scientists and technicians have studied the effects of fire in national parks since the early 1950s. They carefully compare plants growing before and after prescribed fires in study plots, where subtle ecological changes can be measured.

Their discoveries help park managers better accomplish their mission of protecting park resources. Researchers at Everglades National Park in Florida found that 33 native plant species in the Everglades depend on fire for long-term survival. Restoration research at Dinosaur National Monument in Utah and Colorado has increased native grasslands with the prescribed burning of unnatural concentrations of sagebrush at critical growth stages.

At Yosemite National Park in California, research showed that white fir trees act as ladders that fire can use to climb into the crowns of giant sequoia trees. Prescribed fire is now used to replicate the once naturally occurring ground fires to kill white fir trees and help protect the giant sequoia groves.

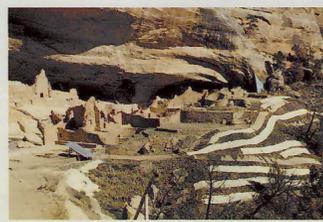


NPS/ALEX VIKTORIA

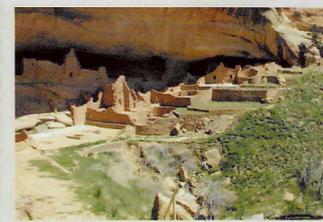
Monitors (above) measure and record fire behavior and fire effects information to assess subtle ecological change.

The areas burned by wildland fire at Mesa Verde National Park in Colorado were rehabilitated by

using matting (below left) to hold soils and seeding (below right) to return native species.



NPS



NPS/CHRISTINE PETERS

Fire Smart, Fire Safe

When you are visiting a national park, take a moment to learn about and follow the latest fire regulations. They are often posted at entrance stations, visitor centers, ranger stations, campgrounds, and trailheads or announced at the start of ranger-led walks, hikes, or programs.

The next time you're in the great outdoors, remember that only you can prevent unwanted fires!

- Be careful with all smoking materials. If fireworks are permitted, use cautiously.
- Observe all fire restrictions and regulations.
- Obtain fire permits where required.
- Build fires only in designated fire rings or grates in developed campgrounds and picnic areas.
- Keep a shovel and bucket of water handy.
- When you leave a fire, make sure it's out—dead out.
- Report all unattended fires to the nearest visitor center or ranger station.

For more information, including a special section just for kids, go to www.smokeybear.com.

But don't stop thinking about fire safety when you get back home. Be fire wise and take steps to protect your home from wildland fire. You don't have to live in the middle of a big western forest to be at risk! Here are just a few important tips:

- Store firewood at least 30 feet from the house. Remove dead and dense vegetation from within 30 feet of the house.
- Make sure there are no tree limbs around your chimney or dead branches that hang over your roof. And keep an eye on any limbs that may come in contact with power lines.
- Keep your gutters, eaves, and roof clear of leaves or other debris.

- Inspect your home for deterioration, such as breaks and spaces between roof tiles, warping wood, or cracks and crevices in the structure, where sparks might enter.

For more suggestions and information visit www.firewise.org.

Many parks have special publications or offer programs about fire and fire ecology. Check the park newspaper or bulletin board for information—or just ask a ranger!

Working with our many interagency and community partners, the National Park Service uses the latest and most appropriate techniques to manage fire to protect human lives and personal property.

There are more than 380 parks in the National Park System. The National Park Service cares for these special places saved by the American people so that all may experience our heritage. To learn more about parks and National Park Service programs in America's communities visit www.nps.gov.

To learn more about fire management in the National Park Service, visit www.nps.gov/fire.

