Case Study: Yellowstone National Park

Yellowstone and Fire

Yellowstone National Park, established in 1872, is known for its unique geologic features and stunning wildlife. Geysers, hot springs, mudpots, and waterfalls are just a few of the natural attractions that Yellowstone has to offer. A greater number and variety of plants and wild animals live there than in any other natural habitat in the lower 48 states.

North American landscapes, such as those seen in Yellowstone, have long been shaped by fire, and many of Yellowstone's plant species are adapted to fire. Several of the park's trees even require fire for survival, such as the following:

- Lodgepole pines—which make up 80 percent of the park's extensive forest—produce two types of cones, one of which opens after being heated to at least 113º F (45º C). This type of fire-dependent cone ensures seedling establishment after a fire. The other type of lodgepole pine cone opens up to release seed once grounded, as the first cone may wait 100 years or more because of the intense heat required to open and release seeds. Lodgepole seedlings also require an open canopy with plenty of sunlight, a condition that is possible only if mature trees are periodically thinned by disease, fire, or other natural agents.

- Older Douglas fir trees have thick bark that resists damage by ground fires. Fire-scarred trees can be found among dense Douglas fir stands in the valleys, showing how the trees survive one fire after another.

- Aspen is a broadleaf tree that needs frequent fire to flourish. Fire stimulates the growth of suckers from the aspen's underground root system. Fire also opens up the stand to sunlight and prevents conifer trees from taking over.

Young Aspen forest.

Fires may stimulate regeneration of sagebrush, aspen, and willows, but the interactions between those plants and fire are complicated by other influences such as grazing levels and climate. Even though above-ground parts of grasses and wildflowers are consumed by flames, their below-ground root systems typically remain unharmed, and for a few years after a fire, such plants commonly increase in productivity.

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Fires of 1988

During the summer of 1988, forest fires burned more than 1.0 million acres (405,000 hectares) of Yellowstone National Park. The acreage burned in 1988 was significantly higher than in previous years. The unusually dry summer, coupled with the small amount of snow during the previous winter, created ideal conditions for fires to ignite and burn. Most of the fires were started by lightning, but some fires were caused by humans. Most fires started on lands adjacent to the park and, with high winds and dry conditions, quickly spread throughout the park. Some areas experienced high soil heating that damaged soils and blackened trees. Other areas escaped with low surface burning, thus causing less damage to soils and the landscape. More than $145 million was spent fighting the fires, but only the rain and snow finally extinguished them.

In all, about 1.2 million acres (485,623 hectares) were scorched, and 793,000 of the park's 2,221,800 acres (320,916 of 899,131 hectares), or approximately 36 percent, were burned. Nearly 70 structures were destroyed, including 18 cabins used by employees and guests in Yellowstone. Estimated property damage totaled more than $3 million.

The fires also dramatically affected wildlife populations within Yellowstone National Park. Surveys found that 345 elk, 36 deer, 12 moose, 9 bison, and 6 black bears died as a direct result of the fires. Most of the animals were trapped as fire quickly swept down two drainage areas. A few small fish kills occurred as a result either of heated water or of fire retardant dropped on the streams.

After the Fires

After the vast burns of 1988, people could not imagine that Yellowstone would ever return to a place of beauty and breathtaking landscapes. The fires had burned more than one-third of the national park and extended onto adjoining private lands. However, only 0.1 percent of the park had dangerously hot fires, and damage to the majority of large trees and the soils was minimal. In addition, the fires created a patchwork of severely burned areas, slightly scorched areas, and unburned areas, a pattern that allowed the forest to regenerate relatively quickly.

As with most fires, plant growth was unusually lush in the years after the 1988 Yellowstone fires. The ash from the fire enriched the soil, and the burning opened up the forest and brought an abundance of sunlight, thereby creating ideal growing conditions. Fire stimulated the growth of many forest species, including the native fireweed plus a variety of trees. Many plants sprouted from existing roots or rhizomes. Aspen stands grew back thicker and more vigorous than before. Serotinous lodgepole pine cones produced a significant amount of viable sprouting seeds immediately after the fires. Within five years, new lodgepole pines became visible among the burned remains, and the forest started to become green again.

The landscape had changed with the fires, but Yellowstone was still very much alive. Although the long-term effects on plants and animals are still being studied, most wildlife populations rebounded quickly from the fires or were not affected by it in the short term. Studies found, for example, that the fires did not significantly reduce the park's grizzly bear population and that the bears actually preferred the burned areas to unburned areas.

Case Study: Yellowstone National Park (cont.)

Human visitors also quickly returned to Yellowstone after the 1988 fires, contrary to fears at the time. Just 1 year later, in 1989, more than 2.6 million people visited Yellowstone, the highest annual visitation level of the 1980s. Through continued public education, scientific research, and professional fire management, Yellowstone hopes to preserve the process of natural fire on the landscape.

The Fire of 2009

In 2009, a fire now known as the Arnica fire ignited in Yellowstone on September 13. Significantly smaller than the 1988 fires, the Arnica fire burned just 0.4 percent of the entire park, but the lessons learned from the 1988 fires affected the response to the Arnica fire.

The Arnica fire was caused by lightning in a lodgepole pine forest, but the fire was not detected by park employees until September 23. Named for its close proximity to Arnica Creek, the fire spanned only 4 acres (1.6 hectares) when it was first detected. With warm, dry, windy weather, the fire grew to 10,700 acres (4,330 hectares) by September 28.

By contrast to the 1988 fire responses, fire personnel did not immediately suppress the Arnica fire, but they allowed the burn to progress naturally in areas where ecological benefits could be achieved. With minimal firefighters on the ground and with helicopters dropping water from above, firefighters were able to cool portions of the fire's perimeter to protect nearby ecosystem features that were at risk. Measures were also taken to protect structures by, among other things, clearing brush around buildings and setting up fire hoses and sprinkler systems.

Safety of park visitors was still a major concern for park employees, and smoky conditions were expected to affect air quality. While fire personnel let the fire burn naturally through some of the sections of the park, officials kept visitors from areas where the danger was deemed too high.

For several days, the fire was monitored by ground, air, and from the local fire lookout tower. On September 30, Yellowstone received an early blanket of snow and cold temperatures. This weather doused most of the flames, but many big fuel deposits smoldered for quite some time. On October 1, the fire was estimated to be greatly reduced but not completely extinguished. At that time, park employees removed all firefighters and let nature take its course. The fire was monitored from a distance and eventually, with the continued cold temperatures and snow, the fire died out.

Yellowstone Fires Today

Although the fires of 1988 were the most extensive ever recorded in the park, fire continues to influence the landscape of Yellowstone National Park to this day. Every year, fires are ignited in or near the park by both natural and human-made influences. Fire continues to be an issue for park foresters, who learned a great deal from the 1988 fires and now have access to advanced technological tools for fire control. In recent years, models predicting fire movement have been developed on the basis of a variety of different factors, including wind velocity, direction, available fuels, and past fire history.

The Yellowstone fires influenced officials at other parks to reevaluate their fire policies and prompted the U.S. federal government to update its national fire plan. The National Fire Policy has been evaluated many times since the Yellowstone fires of 1988, thus adding clearer definitions and stricter guidelines for the management of wildfires. Fire is now identified as a need in a wildland ecosystem and—more often than not—is now allowed to burn itself out.

The current overall aim of the National Fire Policy is the improvement of ecosystem health and the reduction of fire hazards, not suppression. The policy includes five primary focuses: (a) improving fire preparedness, (b) restoring and rehabilitating burned areas, (c) reducing hazardous fuels, (d) assisting local communities, and (e) conducting research.