

The 1988 Forest Fires of Yellowstone National Park

by Robert J. Ruhf

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This photo was taken in Yellowstone National Park near the Old Faithful Geyser in June of 1999, eleven years after the fires. Burned out trees remain standing, although new trees are rising to take their place.

(1) Introduction

Yellowstone National Park gained its "national park" status on March 1, 1872 making it the first and oldest national park in the world. Located primarily

between 44 and 45 degrees north latitude and 110 and 111 degrees west longitude, most of the park is found in the state of Wyoming but also has portions in Idaho and Montana. The park covers 3,400 square miles (2.2 million acres or 850,000 hectares), is approximately 83% forest land, has an average summer precipitation of about 33 mm per month, and consists of large volcanic plateaus of Quaternary rhyolitic rocks surrounded by mountains of predominantly andesitic rocks. It is widely known for such features as the Old Faithful Geyser and the Grand Canyon of the Yellowstone, and has been visited and loved by millions of people throughout the world. In the summer of 1988, however, the worst forest fires in the park's 116-year history consumed vegetation faster than even the more experienced fire fighters even thought possible (National Park Service, 1; Renkin, 37-38; Turner, 732; Finley-HolidayVideo).

The amount of acreage that was consumed by fire is quite astonishing. Flames engulfed a grand total of 1.4 million acres in and around Yellowstone, although only 793,880 acres were actually within the park boundaries. This is an amazing 36% of the park! Attempts to extinguish the fires resulted in the largest fire fighting effort up to that time. A total of 9,500 fire fighters came from all over the country to participate in what would eventually become a \$140 million dollar effort. They built more than 800 miles of fire line, used 117 aircraft, brought in more than 100 fire engines, and dropped more than 1,000,000 gallons of fire retardant. In spite of this incredible effort, they failed to stop any of the fires from running their course. In the end, it was only the fall rain and snow that stopped the fires (Billings, 11).

(2) The "natural burn" policy

The 1988 fire season in Yellowstone began when a single lightning strike set a small group of pines ablaze on June 22. Officials weren't initially worried. A Yellowstone Public Affairs Specialist said "We knew it had started naturally, and we assumed the summer rains would keep it in check. What we didn't know was that [the] summer was going to be one of the driest and windiest since the park was established in 1872." The fires were initially allowed to burn under the controversial "natural burn" policy. This policy allowed fires to run their natural course as long as they were not caused by human activity (such as fires started by improperly extinguished camp fires or careless use of cigarettes), and as long as the fires did not threaten human lives, property, endangered species, or natural features. The origins of this policy extend back to 1968 when the National Park Service officially recognized that fire was essential for the maintenance of an ecosystem. A policy was adapted in 1972 that reflected this position. All naturally caused fires, such as those started by lightning, would be allowed to burn without suppression. The "natural burn" area was limited to 300,000 acres in Yellowstone until 1974 when the policy was extended to include nearly the

entire park. When fires began to burn out of control in late June and early July of 1988, critics who did not understand the importance of fire began to refer to the "natural burn" policy as the "let it burn" policy. The fires in Yellowstone were allowed to burn until July 22, 1988 when it was decided that all fires would be actively fought. At this time, however, not even 50,000 acres had been burned. (Yoxall, 16; Hardy-Short, 108-9; Billings, 16,20).

Many politicians, news reporters, and average citizens began to express intense anger because of the "natural burn" policy. Two Wyoming senators demanded that National Park Superintendent William Mott be fired. Secretary of the Interior Donald Hodel told Good Morning America on July 23, 1988, "We're not going to let Yellowstone be damaged by this." The news media was one of the worst critics, however, and frequently used the phrase "let it burn." The Billings Gazette questioned why Yellowstone Park Superintendent Robert Barbee "rode a dead policy into hell." The Richmond News Leader wrote, "If you want to see the world's largest charcoal grill, just visit Yellowstone. Be sure to say, 'Thank you, environmentalists!'" The Wall Street Journal wrote, "Yellowstone Burns as Park Managers Play Politics." (Hardy-Short, 109-114)

(3) Ecological succession

Much of these attacks, however, were rooted in the emotions of people who did not understand the natural cycle of life, death and rebirth. In the years that followed the 1988 fire, two biologists, Dr. William H. Romme and Dr. Don G. Despain, studied the fire dynamics and history of the Yellowstone forest, placing special emphasis on ecological succession. Dr. Romme concluded, "I don't think any fire management policy would have greatly altered the events of 1988." (Stevens, 28)

The findings of Dr. Romme and Dr. Despain were published in the November 1989 issues of *BioScience* and *Scientific American*. The stages of succession are summarized as follows (Stevens, 28):

- **The first stage:** Small plants and young lodgepole pines spring up among dead trees, both standing and fallen, that have been left after a large forest fire. This stage lasts about 50 years. The forest is not very flammable because the trees are widely spaced and the vegetation is low lying, green, and moist.
- **The second stage:** The pines form dense stands up to 50 feet tall, and their shade blocks the growth of much ground vegetation. This stage lasts about 100 years. Flammability is low at this stage. There is still some deadwood on the ground, but should this ignite, the treetops are too high to be affected.
- **The third stage:** The original pines are thinning out and ground vegetation is increasing. Fir and spruce trees appear. This stage

lasts about 100 years. Green vegetation on the forest floor prevents large fires until late in the stage when small trees can provide fuel by which fire can spread into the canopy high above.

- **The fourth stage:** The original lodgepole pines are dying. Woody fuel is abundant, and this is the most flammable stage. The forest is ready for a major outbreak of fire. However, weather conditions must be exactly right for a major outbreak of fire to occur.

(4) Weather, wind, and drought

The forests of Yellowstone were in the fourth stage of succession in 1988. There is some disagreement among scientists, however, as to how much of a role ecological succession played in the Yellowstone fires. Many scientists have noted that the fires of 1988 spread quickly through all four succession stages of forest and appeared to be most influenced by weather conditions such as lack of precipitation, wind speed, and wind direction. These scientists believe that the major reason that the fires were so extensive was because of the unusually severe drought and high winds that characterized 1988. The fires were also aided by the fact that Yellowstone was covered with extensive and continuous forests. Ecological succession was a factor, but it was not the primary cause of the severity of the fires. Other scientists believe that ecological succession played a major role in the fires, and that the fires of 1988 could have happened any time after 1930 when many of the trees entered the fourth stage. Whatever the role of ecological succession, all scientists seem to be in agreement that the summer of 1988 provided the right combination of heat, drought, and strong winds, and these coincided with multiple fires ignited primarily by lightning. It is believed that the last time fires of this magnitude occurred in Yellowstone was in the 1700's. (Turner, 732; Stevens, 28)

The table on the top of the next page is a summary of the fire seasons from 1972 through 1988, and shows the exceptional drought conditions that existed in 1988. (Renkin, 39)

It is clear that 1988 was the driest year, with only 32% of the normal precipitation falling. In fact, the region started drying out as early as the fall of 1987 when the expected autumn rains failed to manifest themselves. A record low snow pack and early spring run-off followed the winter. By June of 1988, the Palmer Drought Index, which measures precipitation, soil moisture, and evaporation, indicated extreme drought conditions in Yellowstone. During the period of 1972 through 1988, 335,833 hectares burned, but an astonishing 95.7% (321,833 hectares) burned during 1988 alone! (Billings, 17; Renkin, 39)

Year	Total fires	Lightning Caused-fires	Area burned (hectares)	% Normal Precipitation
1972	21	15	2	155
1973	33	24	59	103
1974	38	28	529	60
1975	26	18	2	75
1976	30	19	649	166
1977	29	18	27	119
1978	24	12	6	65
1979	54	29	4546	73
1980	25	21	2	122
1981	64	57	8335	77
1982	20	13	1	118
1983	7	4	1	137
1984	11	11	1	138
1985	53	43	13	90
1986	33	27	1	114
1987	35	29	390	117
1988	45	39	321,273	32
Total	548	407	335,833	*
Average	32	24	910**	*

* No data ** Does not include 1988 data

(5) "Black Saturday" and the heart of the fire season

The worst of the fire season did not begin until Saturday, August 20, 1988, a day now referred to as "Black Saturday." A cold front passed through during the morning hours. Winds increased to and sustained themselves at 30 to 40 miles per hour with gusts as high as 70 miles per hour. The fires exploded into gigantic firestorms that sent flames as high as 200 feet into the air. Fires grew so large that they created their own wind. An additional 165,000 acres burned on "Black Saturday," an increase of more than 50%. Smoke pushed up to 30,000 feet. A fire on the northeast end of Yellowstone, named the Storm Creek fire, made a 10-mile run. A fire on the north side of Yellowstone, named the Hellroaring fire, ran an average of one mile per hour for 8 hours. The fire season had only just begun! (Billings, 37-52; Finley-Holiday Video)

One reporter from the Billings Gazette spent "Black Saturday" with fire fighters at a fire on the western side of Yellowstone named the North Fork fire. He described the sound of a firestorm just before a shift in the wind direction brought the flames toward the group and send people running toward their vehicles to make an escape (Billings, 39):

As it nears, a wildfire creates much the same sensation as an approaching train. First you hear - almost feel - a distinct rumble. Puffs of black smoke appear in the columns of gray - a sign of greater burning intensity - and the sound of the fire increases. Then whiffs of air hit the back of your neck as you face the fire, evidence that the fire is creating its own wind, sucking oxygen from around the ground to sustain itself, then blowing it thousands of feet into the air in a boiling column of smoke. As the inferno nears, it roars like a jet engine as the blaze sucks more and more in. You can feel the heat and see the flames half a mile away. Thick smoke occasionally obscures the blaze and noise dissipates for a moment as the flames gasp momentarily for air before making the next leap.

Flames and firestorms threatened settlements and towns in and around Yellowstone. They would continue to devour the forests until fall rains and snows put them out. A firestorm swept through Old Faithful on September 6, destroying 16 cabins but sparing Old Faithful Inn. All attempts to stop the fires would fail until the first significant rain came on September 11. Snow fell the following morning, and light precipitation fell off and on over the next several days. The fires were all out by the end of October.

(6) Rebirth and the cycle of life

Many people thought that Yellowstone would never recover. Scientists, however, knew that fire was a necessary part of the cycle of life in a forest. Life would not only go on, but would also benefit from the fire. The fires left large patches of cleared ground opened to the sun. Seeds released from pinecones took root almost immediately. Lodgepole pine seedlings began to grow at the rate of an inch or two per year. Wildflowers were abundant by the following spring, and the grasses and shrubs were a rich green. Nutrients from the ash caused the vegetation to prosper. Trees that didn't fall became feeding grounds for insects, and the insects in turn attracted many woodpeckers. The holes left by woodpeckers attracted many birds that used them for nests. Yellowstone was far from dead! (Yoxall, 16)

The fire had very little negative effects on the animals. There were 396 large animal deaths from the fire, most by smoke inhalation, including 9 bison, 6 black bears, and 333 elk. Thousands of elk perished during the following winter

because of a lack of food, but the elk population rebounded to pre-fire numbers by 1993. (Billings, 99)

The fire had many short-term consequences on terrestrial ecosystems including a greater availability of nutrients from ash, widespread soil modification, and changes in water chemistry in rivers and streams. Increases in suspended-sediment loads in streams resulted in a greater fish mortality rate, but scientists studying this phenomenon expected the concentrations of suspended-sediment in streams to decline as terrestrial vegetation recovered and as soils stabilized. (Bozek, 91)

There does seem to be one casualty of the fire. The aspen are not recovering as expected. Aspen is a minor species in Yellowstone covering only about 2% of the park, but is significant because it is the only deciduous tree found in the forest. Aspen, located primarily in the northern winter range of Yellowstone, support a large number and a wide diversity of birds and animals. Fire destroyed 22% of the northern range, including many of the mature aspen, but new sprouts were produced. These sprouts, however, were fed on by thousands of elk that spend the winter months in the northern winter range. The aspen are not expected to recover to pre-fire levels. The last major episode of aspen tree regeneration occurred between 1870 and 1890, a historically unique time when elk, beaver, and moose were not as abundant because market hunting in the 1860's and 1870's reduced the populations. Several large fires had occurred in the region prior to 1886. These fires produced a large number of new sprouts. With a low number of animals to feed on the sprouts, the aspen were allowed to prosper. Climatic conditions were moist in the late 1800's which could have enhanced the regeneration of aspen. Better summer growing season conditions advanced the aspen sprouts, and deeper snows during the winter months probably protected many of the seedlings from being eaten. A combination of these factors has not occurred since that time. For example, there was a dramatic reduction in the elk population during the 1950's and 1960's, but this occurred during a dry climatic periods with no fires. There was a moist decade in the 1910's, but this coincided with a high population of elk, numerous beavers, and no fires. Extensive fires occurred in 1988, but were accompanied by high elk densities and generally dry climatic conditions. (Romme, 2097-2099, 2104)

The fate of the aspen, however, should not be seen as being characteristic of the park as a whole. For the most part, Yellowstone has benefited from the fires of 1988. It will again have beautiful and healthy forests, although it will take several decades for the forest to be restored. People must remember that the beauty of Yellowstone before the fires was actually the result of previous fires. The fires are a necessary part of the natural cycle of life, death, and re-birth. Yellowstone is far from dead! (Hardy-Short, 119)

Bibliography

- The Billings Gazette staff. *Yellowstone on Fire!* Billings, Montana: The Billings Gazette, 1995.
- Bozek, Michael A., and Michael K. Young. "Fish Mortality Resulting from Delayed Effects of Fire in the Greater Yellowstone Ecosystem." *The Great Basin Naturalist*, Vol. 54, No. 1, January 1994, pp. 91-95.
- Finley-Holiday Films. "Yellowstone Aflame." A 1989 video highlighting actual film footage of the 1988 Yellowstone National Park fire season.
- Hardy-Short, Dayle C., and C. Brant Short. "Fire, Death, and Rebirth: A Metaphoric Analysis of the 1988 Yellowstone Fire Debate." *Western Journal of Communication*, 59, spring 1995, pp. 103-125.
- National Park Service. "Yellowstone National Park." <http://www/nps.gov/yell/>
- Renkin, Roy A., and Don G. Despain. "Fuel moisture, forest type, and lightning-caused fires in Yellowstone National Park." *Canadian Forestry of Forrest Research*, Vol. 22, No. 1, January 1992, pp.37-45.
- Stevens, William K. "Biologists Add Fuel to Yellowstone Fire." *Journal of Forestry*, Volume 88, No. 6, June 1990, pp. 27-28.
- Romme, William H., Monica G. Turner, Linda L. Wallace, and Jennifer S. Walker. "Aspen, Elk, and Fire in Northern Yellowstone National Park." *Ecology*, Volume 76, No. 7, October 1995, pp. 2097-2106.
- Turner, Monica G., William W. Hargrove, Robert H. Gardner, and William H. Romme. "Effects of fire on landscape heterogeneity in Yellowstone National Park, Wyoming." *Journal of Vegetation Science*, Vol. 5, No. 5, 1994, pp.731-742.
- Yoxall, Patty. "Yellowstone after the fire." *Current Health 2*, Vol. 21, No. 4, December 1994, pp. 16-18.