# THE ROLE OF FIRE IN YELLOWSTONE

**Chapter 1**

***Matchsticks from heaven***

Since the last glaciers retreated about 12,000 years ago and forests spread across much of the Yellowstone area, fire has been an integral part of its continuing evolution as an ecosystem. Charred trees may be contrary to our idea of a scenic landscape, but periodic fire plays an important role in nutrient recycling and plant succession, and is therefore an essential reason why Yellowstone looks the way it does. The earliest photos of Yellowstone, taken in the late 1800s, show many trees that have been killed by fires and insects. Subsequent aerial photography has made it possible to see the sharp transitions from young to old forest, marking the boundaries of fires that occurred decades and centuries ago.

## Recycling Forest Litter

To survive, plants need minerals such as nitrogen, phosphorus, potassium, magnesium, and calcium—nutrients that are usually absorbed by the plant's roots from the soil. Such nutrients may remain in fallen leaves and limbs for years, until bacteria, fungi and other "decomposers" feed on the dead matter, returning the minerals to the soil where they can be used again by other plants. But these decomposers work slowly in the cool, dry areas of the northern Rockies, where even summer nights may bring freezing temperatures. Most of Yellowstone's trees are lodgepole pine, which has shallow roots that make it easily toppled by strong winds; these trees and their pine needles may accumulate as litter on the forest floor for decades, resistant to decay and hindering the growth of leafy plants.

In areas such as Yellowstone, fire is often the most efficient agent for recycling nutrients back into the soil. Thunderstorms that release lightning but little precipitation often occur in the park on summer afternoons, and when sufficient dry fuels have accumulated to carry a fire, they will eventually be ignited. Although lightning may strike Yellowstone

*Bunsen Peak, September 1988.*

thousands of times a year and rip the bark off a tree in a shower of sparks, it usually fails to ignite anything. Up to 58 fires in the park have been attributed to lightning in a single year, but most soon go out on their own because the fuel is too sparse or the weather too damp.[1] Unlike the slow process of decomposition by bacteria and fungi, fire releases nutrients in sporadic bursts that may be separated by decades or hundreds of years.

Fire affects plant succession.

As a plant community develops, each species is differently affected by climate, fire, and other disturbances, and by the competition it faces in obtaining light, water and nutrients. Whether a plant thrives or dies and becomes part of the litter, it alters the landscape for the plants that succeed it. After a Yellowstone forest has been opened up by fire, the major pioneer plant is usually lodgepole pine, which requires direct sunlight. More shade-tolerant species may then sprout beneath the lodgepole pine, eventually leading to an "old growth" forest containing trees of many size and ages, as well as low shrubs and leafy plants. But without fire, the lodgepole pine may grow old and die without replacing themselves, for their seedlings cannot survive in the shade of a developing spruce and fir canopy.

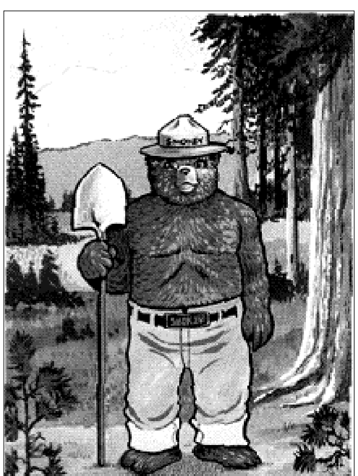
In Yellowstone's grassland areas, lightning-ignited fires occur more frequently than in a the forest, and are part of what keeps them grassy. In the absence of fire, sagebrush can grow large enough to form a significant canopy of shade, and trees begin invading from surrounding wooded areas, creating clumps that may eventually coalesce into forest.

## Yellowstone's Fire History

The U.S. government's first attempt to fight fire in a wilderness area began in August 1886 with the 50 U.S. cavalrymen who arrived in Yellowstone to serve as the park's first rangers. They spent the rest of the summer trying to put out dozens of fires, many of them set by frontiersmen who were rankled by the park's infringement on their hunting grounds. But Yellowstone did not begin keeping a formal fire record until 1931, when lightning ignited the Heart Lake fire. Fought with the techniques available at the time, the Heart Lake fire burned about 18,000 acres before rain put a damper on it. It was the largest fire in the park's history until 1988.

Nature's fire ledger.

Although park staff have only been tallying fires for seven decades, nature has been keeping its own record in the landscape for thousands of years. In Yellowstone, this fire chronology has been ascertained from three kinds of evidence: the annual growth rings in trees; the sediments that have been deposited in alluvial fans along stream banks for up to 7,000 years; and the charcoal preserved in layers of lake sediments that date back 17,000 years.



Remember Only
YOU Can Prevent
Forest Fires!

*Not when lightning strikes.*

When fire burns deeply enough to kill the living cells under the bark on one side of a tree but leaves enough cells alive on the unburned side, the tree survives with a scar. Mature Douglas-fir, which have a thick protective bark, often survive fire and live for up to 400 years. By counting their growth rings, the fire history of an area can be determined as far back as the oldest tree. Lodgepole pine rarely have fire scars, but they are usually well-established within a few years after a stand-replacing fire, making it possible to estimate the last fire from the year in which the oldest trees became established.[2]

The frequency of fire has varied widely in the Yellowstone area as a result of differences in local climate and vegetation, both of which are affected by altitude. On the lower-elevation grasslands of the northern range, fire scars on Douglas-fir indicate that the fire interval averaged 20 to 25 years for about three centuries prior to the park's establishment in 1872.[3] But higher elevations generally have shorter growing seasons and longer periods of snowpack, cold weather, and high fuel moisture, creating conditions less conducive to burning. In Yellowstone forests above 2,000 feet, hundreds of years may pass before enough fuel has accumulated to support a fire that can burn through an entire stand of trees.

Partly to defend the "naturalness" and inevitability of the 1988 fires, it has been suggested that Yellowstone is inextricably tied to a major fire cycle lasting some 200 to 300 years—the time it takes for lodgepole pine forests to mature and create the fuel load needed for extensive crown fires. But although the last fires comparable in scale to those of 1988 apparently occurred in the early to mid-1700s, the area of mature forest has been increasing since the park was established without a corresponding increase in annual burned area.[4] Yellowstone's forests have never all burned in the same year, so even areas that have similar elevation, soil type, and vegetation are at different stages of succession and become "ready" to burn again at different times.[5] And ready or not, virtually all forest types and ages burned somewhere in drought-stricken Yellowstone in 1988; whether a particular area burned was affected by its topography and the wind speed and direction, as well as how long it had been since the last fire there. Similar to wildlife mortality, which varies from year to year but may increase abruptly during an unusually severe winter, large fire is an episodic force that occurs only under optimal fuel and weather conditions.

No long-term cycle.

After all, the fire record provided by tree rings represents only a small interval of environmental history. Researchers looking further into the past have found no evidence of a long-term recurrent cycle. The debris flows that occur in severely burned watersheds during intense rainstorms carry charcoal that is deposited in alluvial fans at the mouths of ravines. By radiocarbon-dating these deposits, geologist Grant Meyer of Middlebury College in Vermont has determined that stand-replacing forest fires have been a major factor in sediment export from tributary basins in Yellowstone for the last 10,000 years, and that such fires have been more frequent in warmer, drought-prone periods, such as from 900 to 1300 AD, than in cooler, wetter periods like 1550-1850, known as the Little Ice Age.[6]

An analysis of the charcoal deposits in several Yellowstone lakes led Cathy Whitlock of the University of Oregon and doctoral student Sarah Millspaugh to conclude that fire frequency has been closely correlated to the intensity of summer drought for at least the last 17,000 years.[7] Long-term fluctuations in the solar radiation that reaches Earth during the summer have caused gradual climate shifts by altering atmospheric circulation. Based on a sediment core from Cygnet Lake on Yellowstone's central plateau, Whitlock and Millspaugh determined that fires occurred most frequently (15 per 1,000 years) in the early Holocene period, about 9,900 years ago, when summer insolation was peaking, and warmer, drier conditions were present throughout what is now the northwestern U.S. After that, decreased summer insolation brought cooler, wetter conditions, and fire frequency declined to no more than 2 or 3 fires per 1,000 years on the central plateau.

More frequent future fires?

The implications echo the standard warning about investing in the stock market, "Past performance is no guarantee of future success." While we may look back and perceive certain cycles, nature is no more predictable over the long-term than are economic trends. Based on the length of time since the last big fires in Yellowstone, it appeared the area was due for a blazing summer. But looking at the available data for the park during just the last century, a correlation has been found between certain climate measures (summer temperatures, precipitation, and drought conditions) and annual burned area.[8] During this time, Yellowstone has seen a trend toward higher summer temperatures and less precipitation from January to June, and if this continues, large fires could occur more frequently. They have become more frequent in the U.S. overall in recent decades, although whether global warming is a factor remains the subject of debate.

"The historic trend toward infrequent severe fires, such as those in 1988, will be short-lived and in all likelihood replaced by a regime of many small fires as a result of dry fuel conditions and more frequent ignitions...The forests of central Yellowstone will change not so much in composition as in stand-age distribution. Thus the disturbance regime will serve to perpetuate lodgepole pine where it now grows and allow its expansion to higher elevations."

—Millspaugh, Whitlock, and Bartlein (2000)

## An Evolving Fire Policy

During the first century of the park's history, until 1972, fire was regarded as a destructive force that should be fought in order to "preserve" Yellowstone. But in the park's early years, the limitations of personnel and firefighting techniques meant that suppression efforts were concentrated on the grasslands of the northern range. This area was relatively easy to reach and travel through, but it constitutes only a small portion of the park. In less accessible areas, by the time a fire was large enough for someone to have noticed it and contacted someone in a position to bring in a firefighting crew, the fire had either gone out or grown to such a size that it could not be extinguished by human effort. Outside of Yellowstone, more than 3 million acres burned in northern Idaho and western Montana during the dry summer of 1910, taking the lives of 79 firefighters and 85 civilians. That remains to this day the most extensive fire in the recorded history of North America.

*Two cavalrymen with a guide at the the "Wylie Permanent Camp," 1890.*

### In Need of a Few Rubber Buckets

"Forest fires raged uncontrolled on every side of the park and destroyed millions of acres," Captain Frazer Augustus Boutelle reported to his superiors in 1890 in a burst of frustration-fueled hyperbole. Describing an attempt to quell a fire in Gibbon Canyon, the park's military commander noted that the ascent of the fiery hills was so difficult that "two men had epileptic fits from the effort." What was probably no exaggeration was his complaint that "Up to a late date last season, there was no fire equipment in the park. The few axes and shovels supplied the troops for garrison purposes were the only tools available."

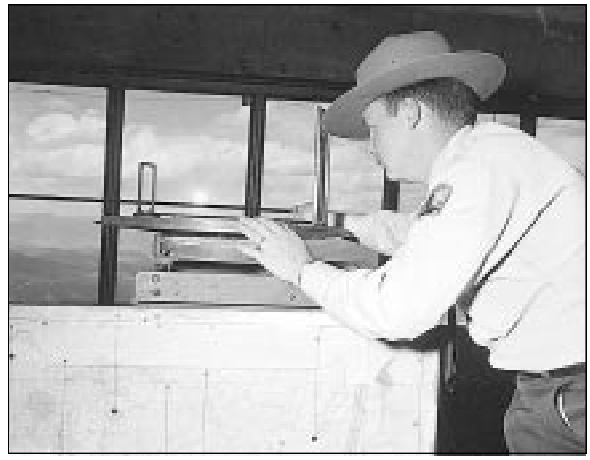
This was not the last time a park manager would plead for more equipment in order to adequately carry out his job, but it may have been the first time that Yellowstone's dire straits inspired a private donation. Upon learning of the predicament, a park visitor gave Boutelle $40 because, "If this great United States government has not money to buy you a few rubber buckets for the protection of this wonderful and beautiful country, I have!"[9]

Park-wide fire detection and suppression efforts were not feasible until after World War II, which gave the Defense Department reason to develop firefighting techniques and brought Yellowstone access to pumper trucks, slurry bombers, helicopters, smokejumpers and chemical retardants. But as Stephen Pyne, author of *Fire in America, A Cultural History of Wildland and Rural Fire* (1982) has pointed out, "Pouring more and more money into fire suppression did not lead to a corresponding diminution in burned area… Suppression is not a neutral act. It does not quick-freeze an ecosystem, which changes by having fire withheld as surely as it changes by being burned."

While park managers were making some progress in their ability to predict and control fires, they were also developing a more sophisticated understanding of their role as guardians of Yellowstone's natural ecology. In the 1930s, predators such as wolves and coyotes began returning to favor; in the 1950s, Yellowstone stopped diverting hot springs into swimming pools; in the 1960s, roadside feeding of bears was no longer permitted so that they would return to their natural foraging and predation; in the 1970s, the focus of the fisheries program shifted from maximizing the number of fish caught by visitors to restoring native fish populations. All of these decisions were part of a long-term trend in national park management, away from efforts to maintain a park in some fixed state thought most desirable to visitors and toward preservation of ecological processes in which change over time is expected.

In a 1972 study of fire-scarred trees to determine the fire record on Yellowstone's northern range, biologist Doug Houston concluded that effective fire suppression during the last 80 years had been a key factor in changes in the relative abundance of certain species and in the increase in density and distribution of conifer forests there.[10] Land management agencies had begun to recognize that fire is not necessarily an enemy to be fought but part of the ecosystem they were trying to maintain, and that total fire suppression was unrealistic and an expensive waste of effort. Scientists began to consider whether fire could resume its natural role in national parks without risking human lives or park facilities. By 1972, Yellowstone was one of several parks that had initiated policies that permitted some lightning-caused fires in backcountry areas to run their course. In 1976, this policy was expanded to include the entire park except developed areas and a surrounding buffer zone.

Under "natural" fire management, human-caused fires are suppressed as quickly as possible, but lightning-ignited fires are to be fought only if they jeopardize human life, park facilities, or personal property, or endangered or threatened species. The result, according to historian and former fire crew foreman Stephen Pyne, has been "a better balance between fire use and fire control, more a negotiated settlement with fire than a continued campaign for unconditional surrender."[11]

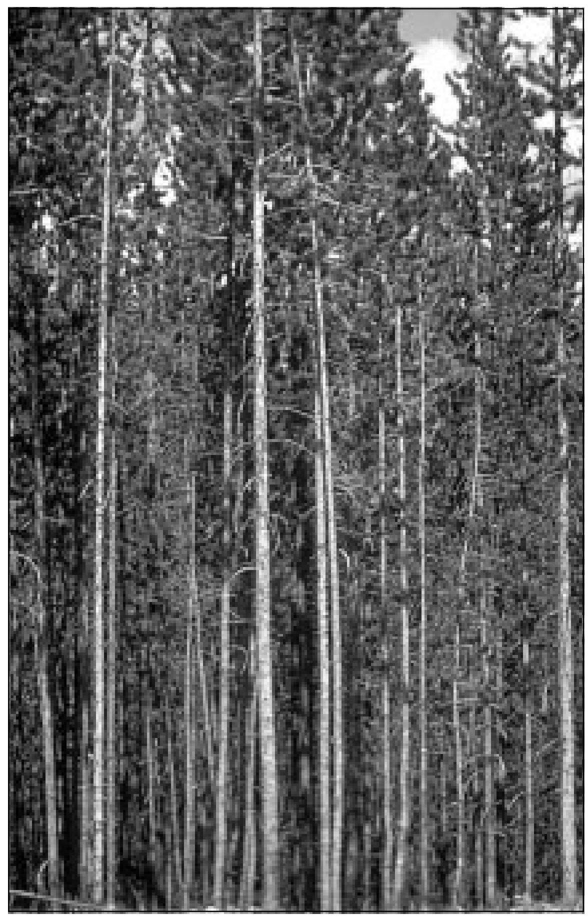


*Park ranger using a "fire finder" at the Mount Washburn fire tower, 1958.*

By 1988, the U.S. Forest Service, which is responsible for 10 million acres in seven forests surrounding the park, had also adopted a policy that allowed certain fires to burn, especially in designated wilderness areas. However, the Forest Service has somewhat different objectives from the National Park Service because national forests are managed for multiple uses that include timber yield. Some fires that are acceptable in the park may be subject to suppression as they approach a national forest boundary.

## After Natural Fire Management Began

Even after Yellowstone adopted a natural fire policy in 1972, most ignitions in the park failed to spread; they either occurred in an area without sufficient fuel to support them or during a period of wet weather. Lodgepole pine are "self-pruning"—they drop their lower branches when they no longer receive enough light to produce more food than they consume. This eliminates a ladder that could enable a surface fire to climb into the canopy, and lodgepole pine-dominated forests usually lack the flammable understory needed to carry fires across large areas in average summer weather.



*It's too dark in this lodgepole pine forest for many species to grow until fire arrives.*

Of the 368 lightning-caused fires that occurred from 1972 to 1987, 235 were allowed to burn; 208 of these fires burned themselves out before covering one acre.[12] When fires were fought because they did not meet the prescribed criteria, the use of heavy equipment that could damage the landscape was minimized. No human lives were lost, no significant human injuries or damage to park structures due to fires occurred, and the new policy was certainly saving money. Even in 1981, when Yellowstone had its busiest fire season during this period, only about 1% of the park (21,000 acres) burned.

Then in 1988, a combination of conditions never before seen in the park's history led to the burning of nearly 800,000 acres in just one summer. One of the lessons of those fires was that there is a threshold between a very dry year and an extraordinarily dry year, and once that threshold is crossed, there's no closing the door on fire.

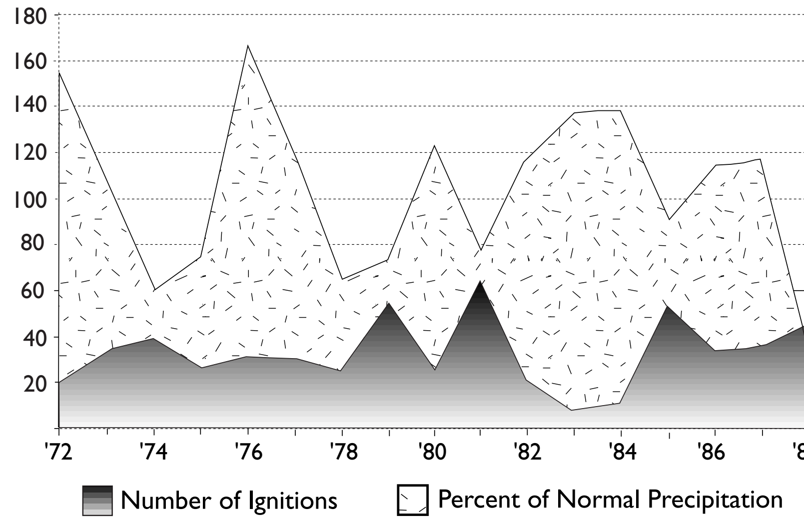
| Year | % of Normal Precipitation | Number of Ignitions | Acres Burned |
|---|---|---|---|
| 1972 | 155% | 21 | 4 |
| 1973 | 103% | 33 | 145 |
| 1974 | 60% | 38 | 1,307 |
| 1975 | 75% | 26 | 6 |
| 1976 | 166% | 30 | 1,603 |
| 1977 | 119% | 29 | 67 |
| 1978 | 65% | 24 | 14 |
| 1979 | 73% | 54 | 11,234 |
| 1980 | 122% | 25 | 4 |
| 1981 | 77% | 64 | 20,595 |
| 1982 | 118% | 20 | <1 |
| 1983 | 137% | 7 | <1 |
| 1984 | 138% | 11 | <1 |
| 1985 | 90% | 53 | 33 |
| 1986 | 114% | 33 | 2 |
| 1987 | 117% | 35 | 964 |
| 1988 | 32% | 45 | 793,880 |

"Normal precipitation" is based on June through September data, 1950-1980. "Ignitions" do not include fires that started outside the park and moved in, of which there were five in 1988.

(Renkin and Despain, 1991)

**When Rain Decreases, Fires Increase**

The Yellowstone Record

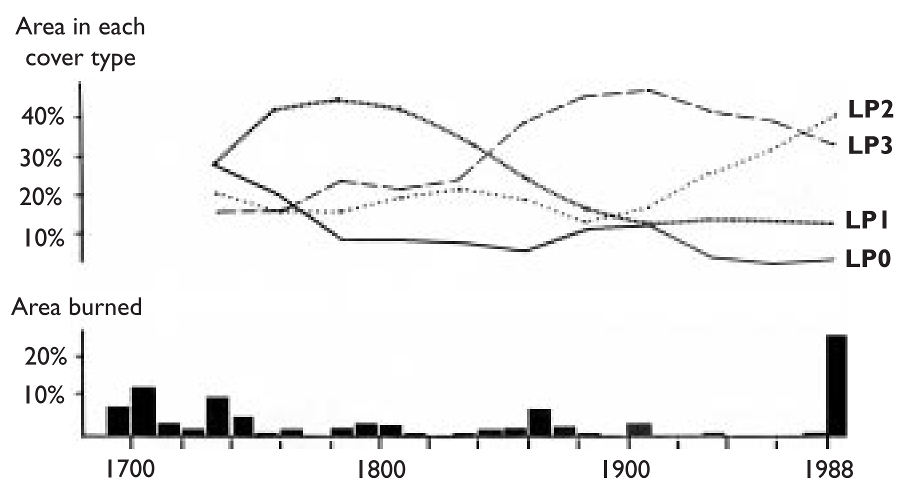



"Preposterous as it may now seem, the experience with natural fire during the prior 16 years of the natural fire program indicated that the Yellowstone landscape was comparatively non-flammable."

— Final Report of the Greater Yellowstone Postfire Ecological Assessment Workshop

*Pinus contorta*
Lodgepole pine

**As the Forest Ages, the Potential for Large Fires Grows**




By studying core samples from lodgepole pine trees in a 129,600-hectare area on a subalpine plateau in Yellowstone, a research team was able to reconstruct both the fire history and the portion of the area covered by forests of different ages, LP3 being the oldest (Romme and Despain, 1989).

When and where fires occur.

The type of vegetation, the length of time since the last fire, and the fuel moisture level are key factors in determining when and where fires occur in the park. Different patches of forest are in different stages of development because they began growing after fires that occurred at various times in the past. Don Despain, a plant and fire ecologist on the Yellowstone staff from 1971 to 1993, developed cover type classifications for lodgepole pine-dominated forest that range from LP0 (recently burned forest) to LP3 (the oldest and most flammable).[13] This mosaic of successional stages tends to be perpetuated over time because lightning ignitions occur more frequently in certain types of old-growth forest, and when a fire starts, more recently burned areas are less likely to burn again. Young, densely packed lodgepole pine forests, in which little sunlight reaches a forest floor almost bare of living plants, can serve as natural fire breaks; the main fuel is in the forest canopy, which a ground fire has no way to reach.

Close canopy before striking.

As it ages, the lodgepole pine forest changes in ways that make it more vulnerable to fire. As some trees die, sunlight reaches patches on the forest floor where shrubs and herbaceous plants may grow along with lodgepole pine seedlings, adding to the litter of downed trees that can carry a ground fire. Where soil conditions permit, Engelmann spruce and subalpine fir begin to grow in the shade of the lodgepole pine, forming an understory that can carry a ground fire into the forest canopy.

The abundant fuel in an old lodgepole pine forest is susceptible to fire, and lightning often provides the spark. But the fuel moisture (the proportion of water to dry material) must be low enough in order for the fire to spread. Fires themselves do not produce enough heat to dry out and consume live fuels that are larger than about ¼-inch in diameter. Dead fuels of larger diameter are consumed, but even in the hottest fires, no more than the outer inch of the tree trunk will burn.[14]

## Forest Succession in Yellowstone

About 83% of Yellowstone National Park is forested, with five recognizable stages of forest succession based on stand structure.[15] A new successional cycle begins each time fire or another intense disturbance kills the forest overstory.

- LP0: During the first 40 to 50 years of lodgepole pine re-establishment, the only fuels are large trees previously killed by fire that are difficult to ignite, an herb-grass layer usually too green to burn, and small dead woody fuels.
- LP1: As the canopy begins to closes, dense stands of small lodgepole pine persist for the next 50 to 150 years post-burn. Fuels on the forest floor consist of rotting logs and a relatively sparse herb-grass layer over a thin carpet of fallen needles, but the primary fuel is the dense and compact crowns typical of even-aged stands.
- LP2: As the even-aged stands begin to break up (150 to 300 years post-fire), a shade-tolerant understory of Engelmann spruce and subalpine fir develops on sites with sufficiently fertile soils; on poor soils, lodgepole pine forms the understory. In the first part of this phase, ground fuels remain relatively sparse, but flammability increases as the canopy thins and the understory proliferates.
- LP3: Stands more than 300 years post-fire are characterized by a mixed canopy of pine, spruce, and fir with a diverse understory. This provides a ladder of live fuels coupled with a large accumulation of dead and downed woody fuel. Understory species eventually replace the mixed canopy and, with ample groundwater, may reach a climax spruce-fir stage that persists until the next major fire or other disturbance. On mid-elevation rhyolitic or other dry soils, spruce and fir cannot thrive, so lodgepole pine dominate both the overstory and the understory.

*Picea engelmannii*
Engelmann spruce

**The fuel moisture threshold.**

As part of the National Fire Danger Rating System used by land management agencies, the moisture content of dead and downed fuel more than three inches in diameter is periodically estimated. After the 1988 fires, Roy Renkin and Don Despain on the Yellowstone staff determined that the flammability threshold is achieved in the park's high-elevation lodgepole pine forests when the fuel moisture level drops to 13%.[16] At this threshold, lightning ignitions can result in visible smoke columns and, if fuel conditions are optimal, the fire will quickly spread. However, even when fuel moisture drops to 13%, fire behavior in Yellowstone is largely determined by forest type. Old growth spruce-fir and LP3 forests occupied only 28.5% of the park's total forested area, yet accounted for 70.5% of the stand-replacing fires that occurred from 1972 to 1987. The Douglas-fir forests of the northern range, although they experienced a preponderance of the lightning-caused ignitions, did not undergo any stand-replacing fire until 1988. They tend to have less dead and downed woody fuel than lodgepole pine forests, and a well-developed herbaceous layer.

To analyze information about the annual extent of burned area from 1895 to 1990 (with only rough estimates prior to 1930) in light of weather records for the same period, Robert Balling of the Office of Climatology at Arizona State University used the Palmer Drought Severity Index (PDSI). This widely used index, which is based on precipitation, temperature, and soil moisture data, has a scale that ranges from below –5 for extreme drought to +5 for extreme wetness. Balling found that Yellowstone's PDSI in 1988 was the lowest (-6) of any year on record, and that for the entire period since 1895 the PDSI could account for about one-third of the year-to-year variation in the amount of burned area.[17]

**The role of weather.**

As became evident in the unusual fire behavior of 1988, extreme weather conditions can overwhelm the constraints imposed by forest type. In highly flammable LP3 forests, isolated tree crowns may torch during even low winds, but crown fire in LP1 is maintained only during high winds when fuel moisture is considerably below the 13% threshold. Although that threshold was crossed for long periods in both 1981 and 1988, stand-replacing fires were more widespread in all forest types in 1988, probably because of the prolonged drought that affected both live and dead fuels, and because of the high winds associated with at least six cold fronts that passed through Yellowstone in August and early September.[18]

### The Difference Between Surface and Crown Fires

Regardless of whether lightning ignites a treetop or a fallen snag, the resulting fire may take on the character of a crown fire or a surface fire depending on factors such as the locally available fuel supply and wind conditions. Both crown fires and high-intensity surface burns may be considered "stand replacement" fires in which most of the trees are killed. But surface fires typically burn only detritus, young or thin-barked trees, and understory vegetation, without consuming needles and branches in the canopy. Because the nutrients contained in the detritus are transferred to ash and most understory plants respond quickly by sprouting, the amount of fine fuels is reduced, but there is little if any impact on total leaf area or erosion.[17]

In areas burned by crown fires, both the forest canopy and most of the litter on the forest floor are consumed, greatly reducing the amount of leaf area and evapotranspiration (the amount of water absorbed by the soil and plants), which in turn increases the portion of precipitation leaving the watershed and the potential for short-term erosion.

## Why Not Controlled Burns?

At the same time that the role of fire has become better understood, most wildlands have become more tightly surrounded by developed areas, eliminating the possibility of an unobstructed fire regime. The suppression of lightning-caused fires that start outside a wildland and would once have burned into it reduces the number of "naturally-caused" fires in the wildland. Most wildland areas are too small and circumscribed by private property to rely on lightning ignitions for maintaining an ecological fire regime. This is less an issue in Yellowstone, which is large enough to receive many lightning strikes in a typical summer, and where fires that originate in adjacent Forest Service wilderness areas are usually allowed to burn into the park. Yet maintaining a completely unhindered fire regime is not a realistic goal in Yellowstone or anywhere else in the United States, except portions of Alaska.[19] Some constraints are necessary to avoid unacceptable risks to human life and property.

To simulate the role of fire or at least reduce hazardous fuel in areas where a natural fire regime is no longer possible, land managers may deliberately set fires, often called "prescribed" burns. Could the Yellowstone fires of 1988 have been avoided or reduced if the park had followed a systematic regimen of prescribed burns? There are two issues involved: the feasibility of using controlled burns for this purpose in Yellowstone, and the appropriateness of doing so.

Hazardous fuels management.

The park has a hazardous fuels management program to reduce the risk of fire to developed areas in or near the park by cutting back vegetation and removing dead wood. Park policy also permits the use of deliberate burns to reduce hazardous fuels or non-native plants, or to compensate for the period of fire suppression on the northern range, during which trees were able to invade the grasslands and grow large enough to resist subsequent surface fires. A plan was developed to burn up to 500 acres in each of two boundary areas, but such proposals were shelved at least temporarily after the prescription burn at Bandelier National Monument went out of control in May 2000.

### Where There's Smoke

- **Natural fire.** Any fire that is not the result of human presence in the park is considered "natural;" the ignition source is usually lightning. Whether it's suppressed depends on whether it is considered "prescribed" or "wildfire."
- **Prescribed fire.** Any fire that is permitted to burn because it meets approved criteria is considered a "prescribed fire" or "within prescription," regardless of whether it started "naturally" or was deliberately set to meet specified land management goals.
- **Wildfire.** It may have been caused by lightning, a dropped cigarette or a deliberately set burn that got out of control, but any fire that threatens human life or property, or does not meet other prescription criteria is considered a "wildfire" and must be suppressed.

*A prescription burn to remove non-native plants outside Roosevelt Arch, 1998.*

However, it would not be feasible in Yellowstone to systematically burn the thousands of acres necessary to avoid fires like those of 1988. Superintendent Barbee's dismissive comment to a *Billings Gazette* reporter that September, that anyone who thought prescription burns could have made a difference was "chewing lotus seeds," was lacking in scientific rigor. But in a presentation to the American Association for the Advancement of Science in 1989, James Brown of the U.S. Forest Service's Intermountain Research Station stated that to prevent fires of the 1988 magnitude, prescription burns would have had to be roughly one mile wide and several miles long, covering about 50,000 acres a year for a period of years.[20]

Prescribed fires are smoky too.

Anyone proposing such fires would have faced overwhelming public opposition for the same reasons that the 1988 fires were so unpopular: because of the smoke, the expense, the inconvenience, the risk to human safety, and the loss of scenic vistas. Instead, prescription burns would have been set only during moderate fire conditions, with the result that only small areas would have burned. Brown believed that even if the park had initiated an aggressive program of prescribed burning in 1972 when natural fire management began, the amount of area burned in 1988 would not have been significantly reduced.

Another difficulty with prescribed burns in Yellowstone is the infrequency with which the environmental conditions are suitable. For most of the year, the park has too much snow on the ground or moisture in the air to get a large fire going. Even in the summer, a large prescribed forest burn could be either difficult to keep going, or hard to control once it was started. As evident in the pre-1988 fire record (see chart on page 12), very little land burns during the typical Yellowstone summer despite frequent lightning strikes, and only in very dry years do substantial areas burn. Large-scale prescription burning would have to be done under conditions that are very close to the threshold at which fires are difficult or impossible to contain.[21]

Playing with fire in Yellowstone?

Even if it were feasible, however, the widespread use of prescribed burns would not be an ecologically appropriate way to manage the park. Writing after the fires in 1988, Alston Chase claimed that "whereas small, relatively 'cool' fires regenerate critical vegetation and wildlife habitat, hot, so-called 'crown' fires destroy everything— including seeds and organic matter in topsoil, leading the way to soil erosion."[22] But as the research summarized in this book has shown, that kind of destruction did not occur in the crown fires of 1988. Yellowstone's lodgepole pine forests have evolved within a regime of infrequent, high-intensity stand-replacement fires that have a different impact from that of more frequent, low-intensity, controlled burns. A fire that is deliberately set to reduce the risk of a large conflagration entails a choice of fire intensity, size, location, and timing that cannot simulate that of a naturally occurring fire. In ways not yet fully understood, large fires may set in motion processes that are not replicated by the combined effect of many small fires.[23] To preserve its ecological processes, Yellowstone must be subject to the haphazard risk of large, lightning-caused fires.

"…we have already heard from people who believe that if we had had the foresight to clearcut the park and crisscross it with roads and human-set burns, we could have prevented the fires of 1988. But if we treated the park like that, who would care if it burned?"

—Varley and Schullery, 1991