1977

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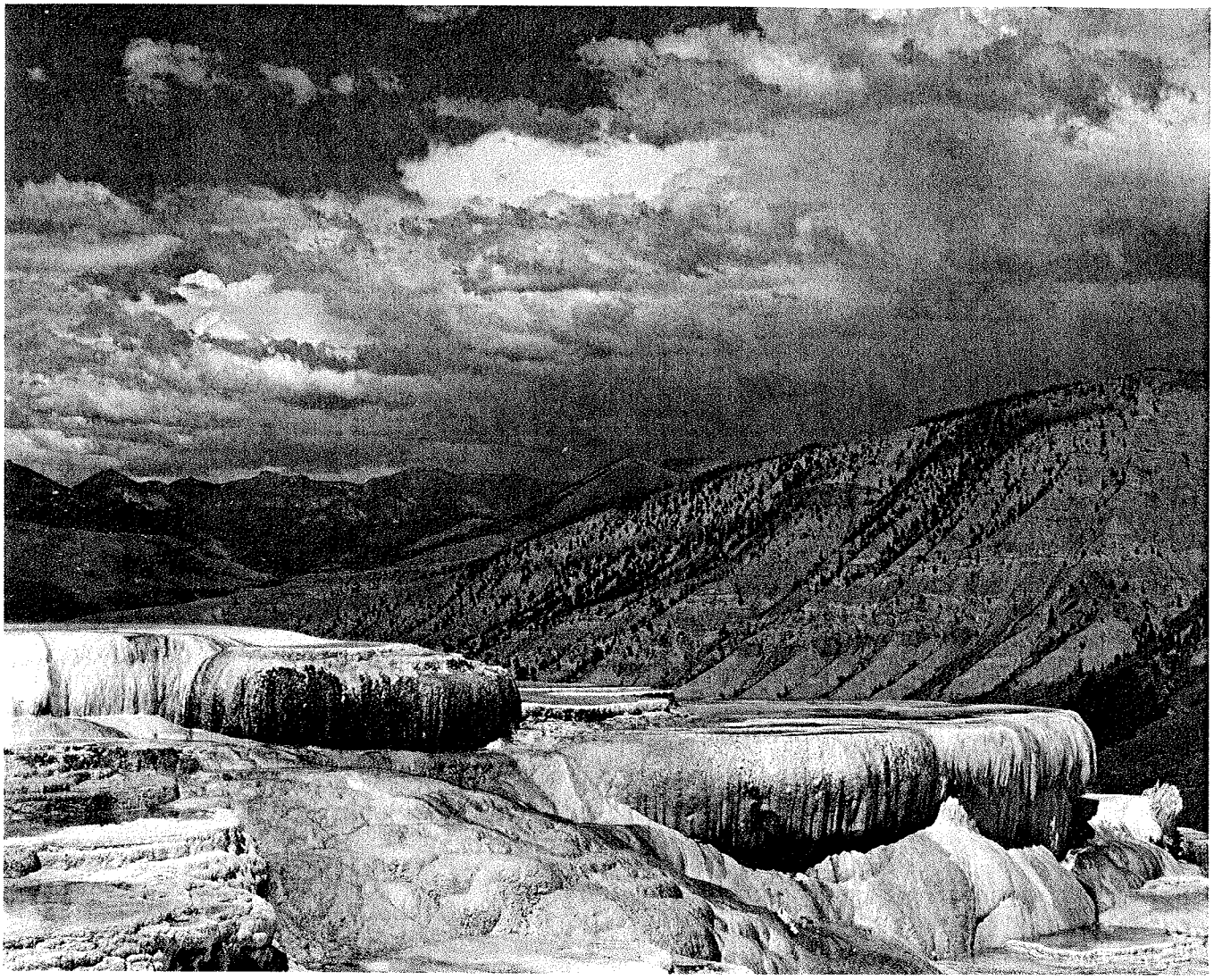


David J. Spear

NATURAL FIRE IN YELLOWSTONE NATIONAL PARK

DON G. DESPAIN

Research Biologist
Yellowstone National Park

ROBERT E. SELLERS

Fire Management Specialist
National Park Service

The objective of management in Yellowstone National Park is to maintain the wilderness quality of the more than 2,000,000 acres of natural environment. This natural area management concept simply means that all natural processes are allowed to continue with a minimum of interference by man.

Fires ignited by lightning certainly qualify as natural processes, but we have controlled these fires to the best of our ability since 1880. Man's interference with the natural role of fire in Yellowstone continued until 1972.

In 1972, Yellowstone began a program to allow natural fires to run their course in some 340,000 acres contained in two blocks of wilderness in the east half of the park. This initial program was well accepted by park visitors and was ecologically and administratively very successful. In 1974, work began on expanding these areas to include all portions of the park currently being managed as wilderness. A plan was prepared to allow natural fire to play its role in approximately 1,700,000 acres within the boundaries of Yellowstone National Park beginning in the fire season of 1976. An Environmental Assessment was prepared in 1975 and received final approval by early spring 1976. A cooperative agreement was then drawn up with Bridger-Teton National Forest where a similar plan is in effect for the Teton Wilderness. This agreement allows natural fires to burn across the common boundary if the fire is acceptable to the receiving agency.

The Plan

Under the plan the National Park Service has the option of allowing some fires to burn and of suppressing others. The plan is flexible, permitting decisions to suppress, partially suppress, or not suppress individual lightning fires. These decisions are based on the cause of the fire and on very careful calculations of fire behavior probabilities under conditions existing at the time of ignition and projected conditions. All man-caused fires are suppressed. Lightning fires are assessed individually with the objective of allowing them to burn if circumstances provide protection for human life, cultural resources, resources outside park boundaries, public acceptance, and so on.

The Test

The plan's latitude for decision making was given a thorough test during the 1976 fire season, during which 29 fires occurred. Ten of these were man-caused and suppressed. Three of the 19 lightning-caused fires were suppressed—two immediately and one after 5 days. Three lightning fires, ironically occurring in one 2-week period, fully tested the flexibility of the plan. Distinctly different management decisions were made on each fire. Following is a review of these fires in the order that they occurred.

The Arrow Fire

Lightning struck a 50-foot spruce tree on the afternoon of June 29; ground fuels were quickly ignited. The fire was about halfway up an east-facing slope, about 200 yards west of the Mammoth-Norris road, between Obsidian Cliff and Roaring Mountain. Park visitors traveling this road prior to the July 4th weekend had an excellent view. The slope was well covered with mature spruce-fir and lodgepole pine and was separated from the road by rather extensive moist meadows. About 50 elk (cows and new calves) frequented these meadows daily. Snow had only recently melted from the slope, so ground fuel moisture was fairly high. Winds were light and temperatures were in the 60°'s. The fire apparently had little potential if weather conditions remained stationary, so the decision was made to monitor the fire closely and allow it to burn. By the end of the day, the fire had crept uphill on the ground, enlarging to approximately 2 acres by 5 p.m. Two forestry technicians were monitoring the fire. A third was stationed on the road to interpret the scene and explain the natural fire program to the traveling visitors.

On June 30 and 31, the fire continued to smolder on the ground with low intensity and rate of spread. Occasional flaming occurred during the afternoon. Several visitors asked the forestry technician what the name of the geyser was. Most were surprised that action was not being taken but were quite receptive to the idea of natural fire's function after it was explained.

On July 1, the fire increased somewhat in intensity, spreading slowly uphill (west) and northerly across the slope with moderate torching in the afternoon, burning about 4 acres by the end of the day. The herd of elk remained in the lush, green meadow below the fire throughout the afternoon and evening, giving park visitors a once-in-a-lifetime opportunity to easily view and photograph elk against a natural fire backdrop. The interpretive program was expanded to broadcast details of the fire to visitors via their car radios. Pamphlets explaining the natural role of fires were freely distributed; reaction by the traveling public was 100 percent positive. At one point, a family stopped to ask if that was a forest fire on the hill. Upon being told "yes" and that it was being allowed to play its natural role in the system, the mother expressed some dismay that nothing was being done about it. An explanation followed and about half-way through the father took over and finished the dialogue. Many visitors needed only to be introduced to the idea in order to see several advantages of natural fire. Some were thrilled to witness such an awesome force in its natural state. A conservative estimate is that over 3,000 visitor contacts were made at the fire scene up to this time.

The morning of July 2 dawned clear, dry, and warm. Visitor interest remained high. The herd of elk continued to graze and rest, showing little interest in the fire, which was still about 5 acres by 10 a.m. Southwesterly winds in early afternoon became stronger, creating some eddying effects on the east-facing slope containing the fire; flare-up and spotting began about 2 p.m. About an hour later the fire activity increased dramatically, burning intensely down to the meadow and spotting across the road to the east and into some forested areas adjacent to the meadow. This activity produced an immediate traffic snarl on the road, requiring adjustments to assure public safety. Spot

fires were suppressed and traffic was hastily moved on. The elk moved on to more peaceful surroundings. The main fire crowned out about 30 acres simultaneously but cooled down quickly so that very little flaming could be seen by 5 p.m. During these first 3 days, fire danger indices went from low to very high, and the outlook was for continued high burning indices.

All decisions on the fire up to this point had been made by the District Ranger and Fire Management Officer, as called for in the fire plan. After the events of July 2, however, the District Ranger and Fire Management Officer discussed the alternatives with other park management personnel to decide how the fire should be handled in the immediate future. This decision-making group is also within the scope of the fire plan and again illustrates its flexibility.

On the night of July 2, this board decided to begin suppression action on the fire. Firefighting crews were moved in during the night and following day.

Since this was a natural fire in a wilderness area, the rationale leading to the suppression decision was based on these facts:

1. Major powerlines were located on the north and east sides of the fire. These lines were about a mile away but the fire would probably reach them within a few days. Disruption of power service to major visitor use areas of the park on a holiday weekend would be a major problem.
2. The fire was close enough to the road to cause continual traffic problems as it moved in a predicted northerly direction through fuels on east slopes. Spot fires near the road, together with smoke drift, could be expected almost daily.
3. Public opinion had been very positive. Acceptance of the program was complete at this time. Would it tend to diminish as traffic inconveniences occurred?

Alternatives discussed were:

1. Allow the fire to continue.
2. Allow the fire west of the road to continue. Suppress all spot fires east of the road.
3. Allow the spot fires east of the road to continue. Suppress all fire west of the road.
4. Allow the fire to burn until it posed a more immediate threat to the powerlines.
5. Suppress the fire immediately while it was relatively easy.

When alternative number five was agreed upon, Fire Management presented the Fire Boss with a suppression plan with a new and different twist: complete suppression and mop-up using a maximum amount of water and minimum amounts of trenching and cutting. The intent was to attempt suppression of the main fire with an "environmental line," or no visible fireline at all. A helicopter bucket would be used to cool off hot spots along the fireline. Spot fires were to be routinely lined by handtools.

The plan was in full operation on the morning of July 3. Water was only available for pumping from a small stream near the meadow areas below the fire, so the stage was set for our hydraulics wizards to test their skills. The various crews ready to go on the fireline were receptive to the plan. Within 2 days, water was available to all points on the perimeter. The environmental wet line was a successful reality by the end of the shift on July 4. All smokes on the fire were out on July 11. Throughout this period, fire danger remained high to very high and no precipitation was recorded.

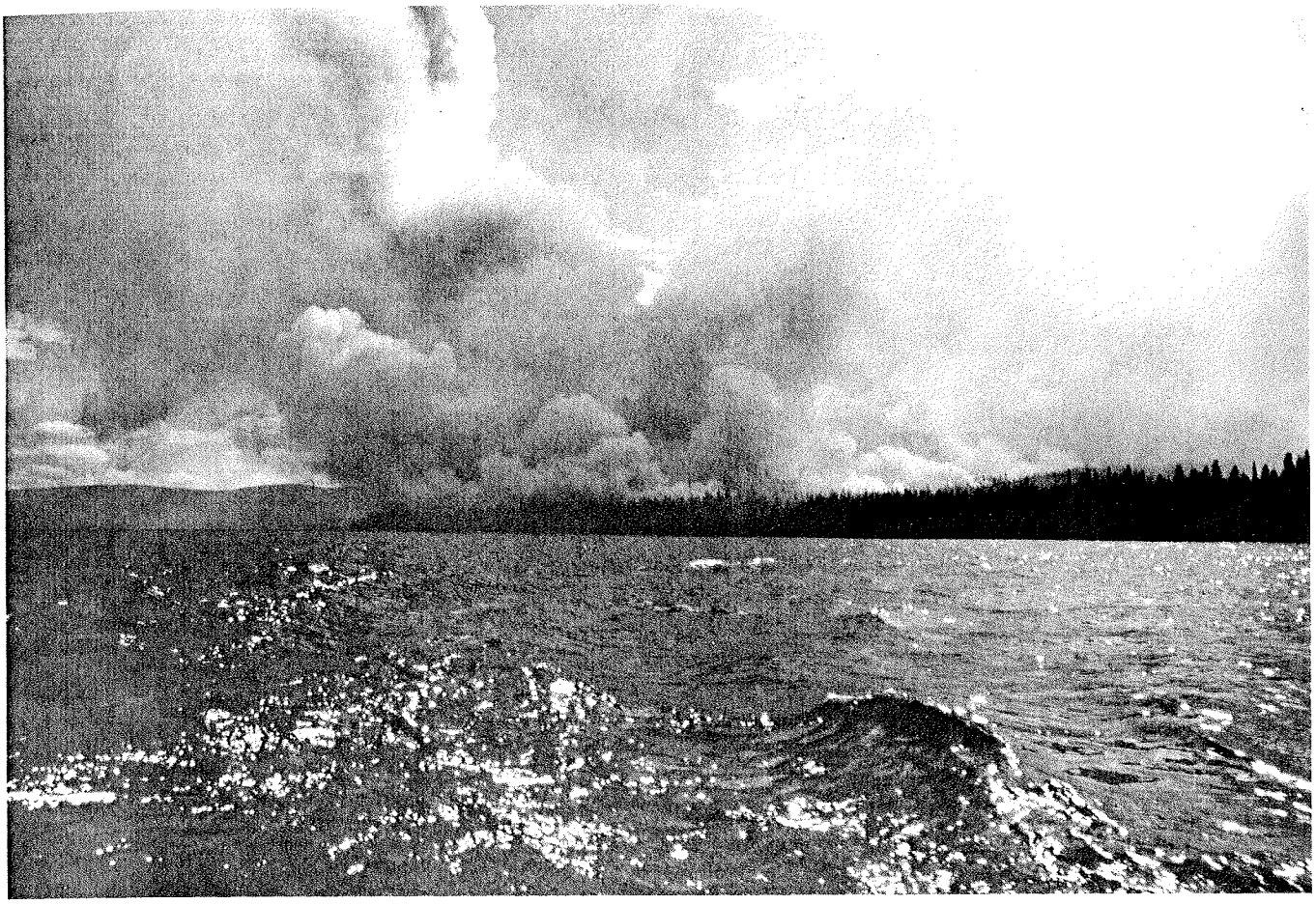
We do not wish to detract from the value and usefulness of standard fire-fighting techniques used to protect commercially valuable resources. On the other hand, when suppression becomes necessary in places where a natural setting is to be preserved, some innovative techniques may be called for—i.e., different standards may apply. Impacts of suppression activities should be fully recognized and weighed against the impact of natural burning.

Yellowstone National Park

If a fire appears to have potential for burning more than a few acres, fuel loads are measured and a permanent plot is laid out. Here, existing prefire vegetation and fuel conditions are being measured.

The Straight Fire

On July 11, 1976, as work on the Arrow Fire came to a close, another lightning ignition took place about one-half mile north of Grizzly Lake on the upper one-third of an east slope. Fuels were mainly subalpine fir, Engelmann spruce, and some lodgepole pine interspersed with green meadows. This fire qualified as a natural fire in a wilderness area, but it too was located in a southwesterly direction from the same major powerline that dictated suppression of the Arrow Fire. For this reason, the decision to suppress was made immediately at the District and Fire Management levels. At the same time, the fire crowned and before the full complement of 24 smokejumpers and helitack could get in position, it had run over the hill and down the west side between Straight Creek and Winter Creek. Five loads of retardant and 35 firefighters finally contained it on July 12. The fire burned 20 acres. Hand line was used exclusively to effect control.



Yellowstone National Park

The hot part of the Divide Fire during the July 16th run of 600-plus acres. It is burning in a spruce-fir forest near the lakeshore.

The Divide Fire

Lightning struck on July 11 on the west side of the South Arm of Yellowstone Lake starting the Divide Fire. Contrary to the other two fires, this one was located in a very remote area, clearly visible from the South Arm of the lake but rather inaccessible from the ground. It did not threaten any developments other than backcountry campsites that could be closed. The decision on this one was easy—it would be allowed to burn. The fire was monitored on the ground until July 13 by two forestry technicians. The fuel type here was predominantly Engelmann spruce and subalpine fir with large areas of lodgepole pine on the east and north sides, where a fire had burned in 1879. The fire started in spruce-fir, which had not burned in the earlier fire. Fire danger was high and on July 14 the fire crowned out about 50 acres of spruce-fir during the afternoon. This performance was repeated on July 15 as the fire traveled in a northerly direction. On July 16, the humidity dropped to 17 percent and 25-mile-per-hour winds pushed the fire southeast to the lakeshore, for a spectacular crowning run of about 600 acres during the afternoon. Interestingly enough, most of the run was made through the spruce-fir—the young lodgepole pine forest seemed to retard fire spread, although 500 to 600 acres received numerous fire brands from the smoke column. This indicated to us that the 97-year-old lodgepole pine was not yet ready to burn.

The fire burned intensely in the adjacent stands of spruce-fir. The reason the fire did not burn into the lodgepole pine is not apparent in the usual statistical data. Stand density (trees per acre) was about the same in the spruce-fir and lodgepole pine stands. The dead fuel load differences do not appear to be the reason. There were more sound fuels greater than 3 inches in diameter in the spruce-fir stand (29.7 tons/acres vs. 6.4 tons/acre), and more fine fuels (less than 1 inch diameter) in the lodgepole pine stand (1.5 tons/acre vs. 0.6 tons/acre). Only the fine fuels are important in carrying fast-moving fires.

There were, however, two major differences between the stands: species and age. These led to differences not apparent in the above statistics. Lodgepole pine trees have coarse trunks and a thin canopy, with the lower trunk self-pruning as tree height increases. When a lodgepole pine falls over, relatively few large, widely-spread branches remain. Fine fuels (less than 1 inch in diameter) are thus more evenly scattered on the forest floor. Both spruce and fir have a more compact growth form, with smaller needles and numerous small branches closer together. The lower branches do not self-prune.

Yellowstone National Park

The interior of the 350-plus-year-old spruce-fir forest near the Divide Fire; this type of forest burned most intensely. Note the abundance of forest floor fuels as well as ladder fuels that allow the fire to easily reach the crowns. Spruce and fir trees do not self-prune, thus they allow lower branches to accumulate.

Yellowstone National Park

The interior of the lodgepole pine forest adjacent to the Divide Fire. Many fire brands fell into this stand during the hot crown fire in the adjacent spruce-fir stand, as evidenced by the number of burned-out rotten logs. Note the lack of ground fuels and ladder fuels. Lodgepole pine trees self-prune and do not produce as many branches as spruce or fir.

The trees in the spruce-fir stand were about 350 years old and had been accumulating branches all that time. The fruticose lichen *Alectoria sp.* had also accumulated in the branches. Fire brands falling in the spruce-fir stand thus had a higher probability of falling into a large fuel bed which could produce flames reaching into the more flammable crowns of the spruce and fir trees. The wind could tip the flame into the next tree crown easily, producing a crown fire. Accumulations of duff and rotten wood also helped the fire last through unfavorable burning conditions.

Numerous fire brands were dropped into the lodgepole pine stands, as evidenced by a large number of burned out, rotten lodgepole pine trunks. However, the fire did not spread beyond the trunk receiving the fire brand and those touching it. If this fire behavior results from the fuel characteristics just described and not from some unmeasured, unnoticed factor in the non-fuel environment, then natural fires may have a feedback mechanism on the frequency of fire in a given area.

Information from the Divide Fire also implies that for a unit of landscape, susceptibility to fire increases with time. Thus, continued fire suppression may increase both the area susceptible to fire and the probability that it will burn when ignited. This burning-frequency pattern will provide good opportunities for research efforts in the future.

The Divide Fire remained fairly active in spruce-fir stands during the rest of July. The fire held at 1,400 acres during a comparatively moist August, but in September it smoldered through another 100 acres on the south end. The last smoke was observed on September 27 from the South Arm; the fire was declared out on October 10 after a snowstorm.

Summary

Since 1972, Yellowstone National Park has allowed a total of 36 lightning fires to run their natural course, burning a total of 2,300 acres. Only seven of these have exceeded 1 acre and only three have exceeded 100 acres in size. In 1976, three separate fires—all natural, all occurring in wilderness, and all burning within 2 weeks of each other—provided effective tests of Yellowstone's Natural Fire Plan. Each fire was looked at individually with the overall objective of allowing fire to play a natural role in Yellowstone if circumstances present at the time would allow. The Natural Fire Plan is flexible; most of its options were applied during a 2-week period. The plan allows natural fires to be completely suppressed from the time of discovery (Straight Fire), to burn for a time and then be suppressed (Arrow Fire), or to burn unsuppressed (Divide Fire). The option to suppress only part of a fire while allowing the rest of it to burn is still untested. Beyond the specifics of a particular written plan, the *need* for such a plan is more important. In the long run it is often the scars of suppression activities that have the greatest adverse impact on a natural environment. If suppression is called for, perhaps we can devise new procedures to insure that suppression damage is minimized.

Much is yet to be learned about the role of natural fire in Yellowstone and how the ecosystem interrelates with it. The fires are providing many research opportunities and are bringing out relationships not thought of before, especially regarding lodgepole pine. With continued public support, fire may be permitted to play its natural role to a larger extent. The discovery of these relationships will continually enhance our understanding and appreciation of the total Yellowstone ecosystem.