

# Experimental Burning in Park Management

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THE NATIONAL parks contain the finest examples of America's natural heritage that have been set aside and preserved for specific uses and enjoyment of the people. On June 30, 1864, just one year after the bloody conflict at Gettysburg, President Abraham Lincoln signed the bills setting aside Yosemite Valley and the Mariposa Grove of Big Trees to the State of California to be managed as a public trust.

The first real concern of the first guardian, Mr. Galen Clark in a report to the Board of Commissioners was over the threat of fire, especially man-caused fires which might be started outside the jurisdiction of the Yosemite Grant.

In 1865, prior to the State acceptance of these lands, Olmsted (1952) wrote:

The Commissioners propose also in laying out a road to the Mariposa Grove that it shall be carried completely around it, so as to offer a barrier of bare ground to the approach of fires, which nearly every year sweep upon it from the adjoining country, and which during the last year alone have caused injuries, exemption from which it will be thought before many years would have been cheaply obtained at ten times the cost of the road.

In 1880 Mr. J. M. Hutchings in his guardian's report saw the grove . . . in great danger of being irreparably injured, if not destroyed



FIG. 1. Dense growth of ponderosa pine, California black oak—below Giant Forest, Sequoia National Park (4500'-6000'). Crystal Cave Area.

by fire. Immense masses of rotten wood and of fallen trees, full of pitch, lie immediately contiguous to, and, in many instances, directly against the base of these noble monarchs, inviting their destruction should fire ever enter their impressive precincts. There can be little doubt that no time should be lost in removing this inflammable material to a safe distance, and carefully burning it to protect this wonderful grove from destruction.

In 1889 a wildfire reportedly surrounded the grove and invaded it at many points. This threat initiated a clean up campaign and by 1894 virtually the entire grove had been treated and the project was placed on an annual budgetary bases in order to avoid a repetition of the conditions.

Since the 1850's man has altered the natural scene and has caused vegetational changes in Yosemite Valley through use patterns. Meadows were used for pasture and garden purposes in the early days and by 1880 there was considerable concern due to these conditions. "Closed fields are being invaded by willows, wild roses and other growth to the damage of their value and of the beauty of the valley. The upper portion of the Valley is largely overgrown with willows and young pines. The views are obstructed, the pathways destroyed, and the appearance injured." (Hutchings, 1880)

In the portion of the Sierra where Sequoia and Kings Canyon National Parks now exist, man was leaving his mark. Pioneer cattlemen and sheepmen caused unnatural disturbance to the country by the over-grazing of cattle and sheep. Dense invasions of lodgepole pine and other woody plants seem to have occurred during this

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period as indicated by annual ring counts from trees cut in these mountain meadows.

Man's activities for the past 100 years have profoundly altered the forests and meadows in Sequoia-Kings Canyon and Yosemite National Parks. Suppression of natural fires on the west slope of the Sierra, and cessation of the Indians' practice of light burning followed by the early cattlemen burning off the vegetation cover in the fall as they moved the cattle to the San Joaquin Valley have produced, as stated by the Advisory Board on Wildlife Management appointed by the Secretary of the Interior (Leopold, *et al.*, 1963, page 6), ". . . a dog-hair thicket of young pines, white fir, incense cedar and mature brush—a direct function of overprotection from natural ground fires. Within Yosemite, Sequoia and Kings Canyon the thickets are even more impenetrable than elsewhere. Not only is this accumulation of fuel dangerous to the giant sequoias and other mature trees but the animal life is meager, wildflowers are sparse!"

Recent research by Dr. Richard Hartesveldt, Woody Metcalf and Dr. Harold Biswell suggests that today's unnatural accumulation of



FIG. 2. Dense woody mature chamise is prevalent at lower elevations today. Middle Fork Kaweah River, Sequoia National Park; elevation about 2000'.

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ground litter effectively prevent the establishment and survival of sequoia seedlings and constitute a fire hazard to sequoias of all ages. The increasingly rapid invasion by white fir threatens to substantially alter the sequoia ecosystem by transferring predominance from sequoia to white fir. Unless this unnatural, protection-encouraged invasion can be halted reasonably soon, irreparable damage is likely to occur to the uneven age structure within the sequoia stands. Similar situations are developing in sugar pine stands as the result of invasion by white fir and in the formerly open, park-like groves of ponderosa pines by large scale entry of incense cedars. Build-up of litter is likely to affect the composition and quantity of herbaceous ground cover as well as the shrub and tree understory, thus further aggravating this undesirable situation.

These apparent results of fire suppression urgently require detailed studies and experimental projects designed to provide safe and feasible corrective management practices for approximating the conditions of the original ecosystems. To be effective, efforts must be guided by hard facts and sound ecological principles.

A sound management and interpretive program must be based on adequate and comprehensive knowledge of three kinds:

1. Condition of the Parks natural resources.
2. The condition existing prior to present fire control procedures.
3. The best and most feasible methods of restoring the resources and their associated environmental influences as nearly as possible to the ecological state requisite for their continuing natural evolution.

At the least, incipient trends toward additional instances of resource deterioration must be identified, so they can be corrected at an early stage.

Of the various methods of manipulating vegetation, the prescribed use of fire is the most "natural" and much more inexpensive to apply. Once the fuel is reduced, periodic burning would be a relatively simple operation, with a high degree of safety and at low expense.

The only areas within the Western Region of the National Park Service where the prescribed burning should be permitted at this time are Sequoia and Kings Canyon and Yosemite National Parks. These Parks are suitable for prescribed burns because fire control

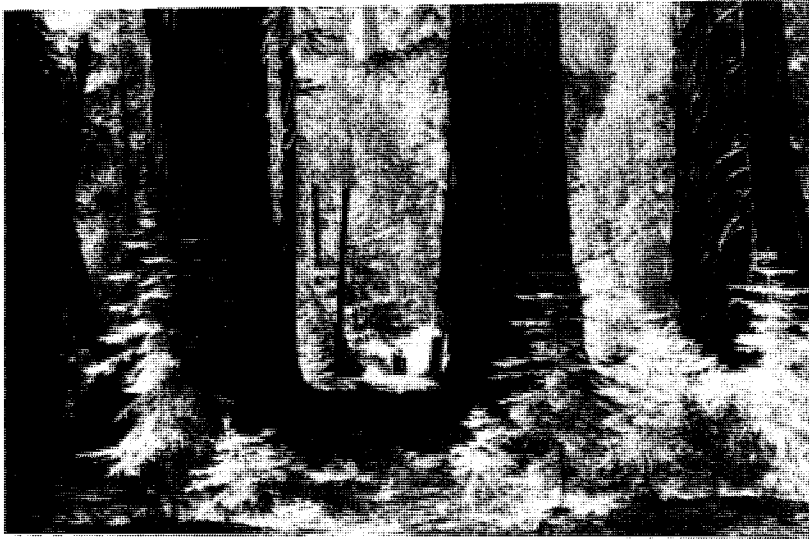


FIG. 3. Mixed conifer forest (4500'-8000') white fir, sugar pine, ponderosa pine, giant sequoia.

practices have been in effect in these areas for the last forty years. Fire atlases have been maintained on all fires occurring in these areas as to cause, size, location and cost. In some instances there are photographs of the vegetative types dating back 100 years indicating the change that has occurred over the years. The flora and fauna are similar in Yosemite and Sequoia-Kings Canyon. Early use patterns were the same with sheep and cattle grazing and saddle and pack stock use on mountain meadows. Large fire severity is similar. The climatology of the areas are similar and weather summaries for these areas are available from the U.S. Weather Bureau and have been on file in these parks for at least 36 years. Other park areas will be included as research and experience is increased.

The objective of the National Park Service is to manage and perpetuate the natural areas within its boundaries. The Director has approved the following policy statements for fire and fire control.

The presence or absence of natural fire within a given habitat is recognized as one of the ecological factors contributing to the perpetuation of plants and animals native to that habitat.

Fires, in vegetation, resulting from natural causes are recognized as natural phenomena and may be allowed to run their courses when such burning can be contained within predetermined fire management units and when such burning will contribute to the accom-

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plishment of approved vegetation and/or wildlife management objectives.

Prescribed burning to achieve approved vegetation and/or wildlife management objectives may be employed as a substitute for natural fire.

Any fire threatening cultural resources or physical facilities of a natural area or any fire burning within a natural area and posing a threat to any resources or physical facilities outside that area will be controlled and extinguished.

The Service will cooperate in programs to control or extinguish any fire originating on lands adjacent to a natural area and posing a threat to natural or cultural resources or physical facilities of that area.

Any fire in a natural area other than one employed in the management of vegetation and/or wildlife of that area will be controlled and extinguished.

Wildfire, or any fire burning on Park lands must be under surveillance and subject to control if deemed necessary. Prescribed burning can only be used by professionally competent men.

Opportunity for prescribed burns could be found during the late fall, winter and early spring at lower elevations. During the winter months the air mass over the central valley is stable and an inversion occurs in the air mass. Ground fog from the valley may last for three or more weeks at a time. Fires burning at upper elevations would be under excellent control and the smoke from the fire would be able to penetrate the inversion releasing it into the upper air mass eliminating the possibility of air pollution over the valley.

Another opportunity for a safe large burn in the brush fuels could be obtained during the early winter when snow covers the higher elevations. Soil moisture would protect the root structures and soil from damage. The clear sky would dissipate the smoke column and the snow line would afford a natural barrier. A burn of this nature would restore browse habitat for deer and protect and improve quail and other bird life habitat. The accumulated dead fuels would be removed eliminating the major cause of large wildfires.

During the summer months prescribed fire could be used on areas above 8000' elevation with safety where natural barriers exist and



FIG. 4. During the winter months, an inversion occurs in the Valley which slowly rises during the day up the mountain slopes, to about the 6000' elevation by the evening. Burning at upper elevations would be under excellent control when the inversion layer covers the fire area. Smoke would penetrate inversion, eliminating the possibility of air pollution over the Valley.

when other safeguards are taken before the decision is made to burn.

At the present time only one area has been authorized to use fire in a prescribed manner in the Western Region of the NPS. This is the experimental fire-Sequoia regeneration studies conducted by Dr. Richard Hartesveldt, Dr. H. T. Harvey and Dr. Howard Shellhammer in the Redwood Mountain grove of Big Trees in Kings Canyon National Park.

To insure against the fire spotting over the control line, several small dense patches of white fir were cut on the 2-acre plot and a mineral soil fire line was constructed around the unit to be burned. Snags within 500 feet of the plot were also felled.

The burn took place in September 1965. The average burning conditions at the time were:

Temperature	56
Relative Humidity	60
Fuel Moisture	12
Wind	9 mph

The quantity of fuel available in both Yosemite and Sequoia ranges from extremely dense to non-available. From the lower chaparral covered foothills to the Alpine Zone there are some significant differ-

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ences in species composition between Yosemite and the others, owing in part to the more southerly location of the other two parks, and the elevation range. As can be seen fuel distribution varies from dense continuous conditions to open sparse situations.

For planning a prescribed burn the following elements must also be known. Slopes, total fuel, distribution, size, arrangement, moisture content and the available fuel that will actually burn.

Fuels at lower elevation from 1400' to 6000' are for the most part continuous and heavy and located on steep slopes. High daytime temperatures exist during the summer season.

From an elevation of about 8000 feet and above, fuel distribution is light. Daytime temperatures are cool and night temperatures produce dew and frost. Occasional east winds will bring warm dry air into the Region causing severe burning conditions; normally moist air produces thunderstorms in this area through the summer season.

To study the various forest management techniques which might encourage giant sequoia regeneration, four study areas have been established. They are the Ridge Study Area, North Study Area, Trail Study Area and South Study Area. Dr. Hartesveldt and Dr. Harvey selected the plots that would be needed to make the study and then asked the park staff if the prescription could be filled. The decision to burn the plots was made and the North Study Plot was burned in the fall of 1964. This plot had a heavy concentration of logs and snags on it as well as many white fir snags surrounding the plot. The prescription for burning the plot required all snags on and within 500 feet of the plot to be felled. These snags on the plot were bucked up in 8 foot lengths for ease of handling and were piled with the logs that were on the ground. Thirty piles were made on this 2-acre plot by the small cleat-track bulldozer. The dozer was used to blade a fire line around the plot and then blade out dense patches of white fir reproduction. Burning was done after the first fall rain. Due to the isolation of the plot, continued rain and snow storms, and the high water content of many logs, the piles were not completely consumed. The remaining logs were restacked and burned in the summer of 1965.

Dr. Hartesveldt's goal for the Ridge Study Plot was to have a burn as near natural to ground fire as possible without prior manipulation of any sort.



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The possibility of fires spotting over the fire line and into nearby snags was alleviated by the high humidity at the time the burn was planned. Fire intensity was very high in the brush piles on the plot and by the first day these hazardous fuels were burned up insuring complete control of the burn. Firing was accomplished by means of drip torches and burning was directed in an uphill direction to enable the fire to dry out the light fuels on the open ground. By the third day the ground litter was almost all consumed.

The Trail Study Plot of four acres took considerable preparation. The heavy concentration of logs and snags in the Trail Area necessitated felling of snags, piling of logs and white fir reproduction. Snags were felled within 500 feet of the plot and a mineral fire line constructed around the unit. The plot was burned on October 1, 1965. The burning completed October 10, 1965. The average weather was:

Temperature	70
Relative Humidity	21
Fuel moisture	5.0
Wind	10 mph

Actual wind on the plots was 2 to 3 mph due to the tall trees and dense forest cover in the grove. Weather records were taken at the fire weather station at Park Ridge located on an open ridge above the grove.

The South Area was manipulated in the fall of 1966 by means of a bulldozer equipped with a special brush blade. The logs and other debris were pushed into long windrows and burned.

Preliminary plans have been developed for prescribed burning studies on a long term management basis in the wilderness of the Middle Fork of the Kings River within Kings Canyon National Park. Proposals for prescribed burning have not yet been submitted for Yosemite National Park. When detailed plans are developed research will be carried out in this area.

Decision to use prescribed burning in the Parks must be based on consideration of how it will affect the park features, the park visitor and the biotic associations. We must maintain the basic concept of the National Park and the purpose for which the parks were created. To reestablish the typical environment, the biotic association must be studied and known so that the proper management will be done.

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