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Visual Impacts of Prescribed Burning on Mixed Conifer and Giant Sequoia Forests[1]

Lin Cotton and Joe R. McBride[2]

Abstract: Prescribed burning programs have evolved with little concern for the visual impact of burning and the potential prescribed burning can have in managing the forest scene. Recent criticisms by the public of the prescribed burning program at Sequoia National Park resulted in an outside review of the National Park fire management programs in Sequoia, Kings Canyon, and Yosemite National Parks. This paper evaluates the visual impacts of burning and of not burning in the giant sequoia-mixed conifer forest type. Alternatives to current techniques are suggested which will reduce the negative visual impacts and incorporate scene management as a part of the prescribed burning program. The need for a new awareness of the visual impacts of prescribed burning is discussed.

Dateline Three Rivers. California, November 7, 1985:

> "The sun rising over the Great Western Divide was stained orange this morning by clouds of smoke towering a thousand feet above Giant Forest. The irreplaceable Big Trees of the Sierra were being blackened and eaten into not by lightning fires, but by blazes set and allowed to run.
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> "Now, in the burns under way the litter of down trees and branches that naturally accumulate against the hillside giants has not been cleared in a prudent manner prior to ignition. The result was predictable: raging flames at the butts, deepening and widening the ancient fire scars whichof these giants exhibit. Further, the cinnamon-colored bark was scorched black upwards of forty feet....
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> "The merits of fire to 'restore the eco-system,' are not debated here. Rather, we point to the myopia which cannot perceive that pitchy materials accumulated over decades when set alight will create havoic [sic].... The observable fact, that injury to the base of the sequoias causes the top to 'die back,' is beyond debate. What benefit have we then arrived at with our imprudent burning if we 'restore the eco-system,' but lose the giants of the forest?
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> "With the rationale of protecting the life of the forest community the very specimens we have been entrusted to shield from destruction may be severely weakened.
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> "Take what actions you feel most effective to question any mismanagement of our heritage. Alert newspapers and TV stations. Create caravans of inspection. Take pictures, make tapes. Contact Senators, Congresspersons, and Director. National Parks Service. William Penn Nott, Jr." (Challacombe 1985).

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[1]Presented at the Symposium on Wildland Fire 2000, April 27-30, 1987, South Lake Tahoe, California.

[2]Landscape Architect. San Francisco, California; Professor of Forestry and Landscape Architecture, University of California. Berkeley.

So begins the story of recent criticism surrounding the burning program at Sequoia and Kings Canyon National Parks. Sparked by the zealotry of a single critic, Eric Barnes, media attention focused on previously undoubted management practices. Headlines like "Naturalists fear park service 'charcoal broiling' rare trees," "Controlled fires under sequoias spark concerns," "To burn or not at Sequoia," "Don't take any chances with sequoias," and "Growing criticism over controlled sequoia burns" demonstrated the lurking power of public review, particularly where popular scenery is at stake.

The National Park Service responded to this heat by appointing a panel to review its fire program and by postponing scheduled burns in Sequoia National Park.

By the year 2000, public outcry over perceived defilement of scenic amenity in popular parklands might preclude such a studied response. In the probable future, the public will make increasing use of highly scenic and accessible areas as baby-boomers age into retirement. Public supervision of prescribed fire and other management practices will steadily increase. Popularly perceived and familiar scenic amenities will be increasingly guarded as national resources.

Does this mean there is no future for prescribed burning in sensitive public recreation areas? What visual concerns must be addressed by alternate burn programs to effectively reduce negatively perceived impacts? In the year 2000. will prescribed fire in scenic areas be severely limited or eliminated altogether, or will it be designed to produce acceptable visual impacts while actually improving scenic recreation potential?

BACKGROUND OF THE PROBLEM

The removal of Native Americans and the establishment of fire prevention and control programs by the first managers of National Parks in California resulted in a significant lengthening of the intervals between fires. This change in the length of the fire free interval has been documented by Wagener (1951), McBride and Laven (1976), Kilgore and Taylor (1979), and Warner (1980). Fire-free intevals [sic], which averaged around 10 years during the Native American period, have been extended to around 50 years in many parts of the mixed conifer forest type in California. The effects of the lengthening of the fire free interval has been to (1) increase fuel loading (Biswell and others 1966), and (2) change the appearance of the forest (Cotton and Biswell 1973).

Two important visual changes have resulted from the extension of the fire free interval. The first change has been a reduction in visual penetration due to the establishment of white fire (Abies concolor) and incense cedar (Calocedrus decurrens). Kilgore (1972) used a comparison of photographs taken in the 19th century in giant sequoia (Sequoiadendron giganteum) groves with photographs taken in the 1970's to demonstrate the establishment of an understory of white fir. It is evident from these photographs that visual penetration has been reduced. Visual penetration has been reduced. Visual penetration into the forest understory is a factor that correlates with scenic preference in forested landscapes (Bacon and Twombly 1979. Kaplan 1979, Walter and others 1979). Reduction of visual penetration reduces the variety of the scene. In the case of the giant sequoia-mixed conifer forest, a reduction of visual penetration often prevents the viewer from seeing many giant sequoia trees from a single location.

The second important visual change resulting from the extension of the fire free period has been the change in the appearance of the base and lower trunks of the individual trees. Trees charred by fire have sloughed charred bark in the long intervals between fires. Forest visitors in the second half of the 20th century have seen few trees with any extensive areas of charred bark. The unblackened cinnamon bark we associate with the trunks of the giant sequoia may not have been as common to the Native Americans or the American pioneers who viewed these same trees over a century ago. An examination of photographs by Chorover (1986) of giant sequoia trees in Yosemite and Sequoia National Parks taken prior to 1900 indicate that about 12 percent of the trees have basal bark char. A field reconnaissance of Calaveras Big Tree State Park by the authors revealed less than one percent of the giant sequoia trees have basal bark char, however, all. trees over 10 feet in diameter at breast height (d.b.h.) show some evidence of past fires. People have come to expect an uncharred trunk for a giant sequoia.

The initiation of prescribed burning programs in the giant sequoia-mixed conifer forests has the potential for both positive and

negative visual impacts. Prescribed burning, when coupled with judicious removal of fire-killed understory trees, can restore visual penetration into the forest. Procedures developed by Harold Biswell (1986) at the University of California Department of Forestry and Resource Management's Whitaker's Forest and Glen Walford (1986) at Calaveras Big Trees State Park have restored visual penetration by eliminating areas of dense white fire regeneration. Prescribed burning can, however, have a negative impact on the visual quality of the forest. This negative impact results from the charring of bark and the presence of fire killed understory trees and shrubs. The experience at Sequoia National Park is evidence of the negative impact of prescribed burning. The sudden presence of numerous trees charred bark was probably the key factor leading to the citizens' protest against the prescribed burning program. Charred bark was also a factor in local objections to the burning program in the redwood (Sequoia sempervirens) forests of the Santa Cruz Mountains (Greelee 1985). In this latter instance Greelee burned on level ground when there was no breeze, which resulted in scorch up to 90 feet. Biswell (1986) burned on sloping ground in the same area and produced no significant scorch due to better disbursement of heat in the crowns, He noted that tree limbs greater than 6 inches in diameter were undamaged and sprouted after burning, greatly reducing adverse visual impacts from prescribed fire.

Taylor and Daniel (1985) have demonstrated that the change in appearance of trees and forest stands following prescribed burning results in decreased scenic quality ratings and reduced recreational acceptability. Their study showed a decreased preference and lower scenic rating among forest visitors, even after receiving information on the beneficial effects of fire on the forest. Hammett (1979) documented a high correlation between familiarity and visual preference. Unfamiliarity with charred trees and fire-killed regeneration on the part of the 20th century public probably has contributed to dissatisfaction with the results of prescribed burning. Martin (1986) has suggested that if we could take a survey of Native Americans who lived in the giant sequoia-mixed conifer forest prior to 1865, we would find a high degree of acceptance of trees with charred bark. However, we are not dealing with a public composed of pre-20th century Native Americans. Our public has not had a familiarity with bark charred trees in our National Parks. Whether we can or should educate the public to accept charred trees is a difficult question to answer. Zajonc (1980) has offered persuasive evidence that our judgements about preferences may be fairly independent of the cognitive process. He suggests that feelings often dominate the cognitive process when it comes to our preferences.

> "Even the most convincing arguments on the merits of spinach won't reduce a child's aversion to this vegetable" (Zajonc 1980 p. 172).

SOLVING THE PROBLEM

Alternatives to reduce negative impacts while creating positive impacts from prescribed burning are needed. Pre-fire site preparation can reduce bark char on specimen trees, and post-fire felling, stacking, and burning of fire-killed understory trees and other charred materials can significantly reduce negatively perceived visual impacts of prescribed burning.

Early work by Biswell and others (1968) at Whitaker's Forest, and Biswell (1986) and Walford (1986) at Calaveras Big Trees State Park demonstrates what prescribed burning can be used in the giant sequoia-mixed conifer forest in ways that minimize the negative visual impacts often associated with it. These procedures involve the removal of litter and heavy fuels from the base of trees before burning.

At Calaveras, litter was raked back 2 or 3 feet from the base of each large giant sequoia, and heavy fuels were thrown or moved to the side or above each tree to a distance of 10 to 15 feet. Following the fires, dead trees within the stands were felled, as were some living intermediate sized trees within 6 feet of giant sequoias.

At Whitaker's Forest, understory white fire and incense cedar under 11 feet tall were also cut, piled, and burned prior to the broadcast burning of the forest floor. At Calaveras Big Trees State Park's South Grove, local areas of fire-killed white fire and incense cedar and other charred materials were cleared after the prescribed burns. Biswell noted that in neither case were understory trees felled and not preburned prior to broadcast burning. He feared that the additional fuels on the ground would

make too much fire and produce visually unacceptable impacts.

These site-preparation and post-fire activities are labor intensive. In the late 1960's, Biswell spent $243 per acre on preparation and post fire hand work, using inexpensive convict labor. He estimates that the same work today might cost upwards of $1000. Expenditures amounting to $550 per acre were required at Calaveras in 1981. This seemingly expensive site preparation work practically eliminated the charring of the tree bark and the residual charred visual artifacts of the prescribed burning.

The removal of understory white fire and incense cedar additionally restored visual penetration into the forest, recreating the essential character of the open, park-like forest. In doing this understory vista clearing, Biswell (1986) and Walford (1986) were guided by the late landscape architecture professor, Leland Vaughn from U.C. Berkeley, who identified the importance of retaining clusters of understory regeneration to frame vistas and create a sense of sequencing in views as seen from trails. In broadcast burning, clusters of young trees are naturally retained in openings where fuels are insufficient to consume them. Another potentially positive visual impact of prescribed fire can be the fresh exposure of old firescars, scenic curiosities of great interest to the public. At Whitaker's Forest on an 80 acre plot, Biswell studied the firescars on 50 sequoias between 8 and 16 feet d.b.h. No two were alike. Scorch and char, being natural, should not be eliminated as visual elements. They should, however, not be greatly increased in extent as a result of prescribed fires, particularly restoration fires.

CONCLUSIONS

The recent history of prescribed burning in the sequoia-mixed conifer forest type provides a basis for some conclusions about the probable future involvement of visual criteria in managed fires. These conclusions are based in part on the findings of the Christensen Panel which investigated the prescribed burning program in Sequoia, Kings Canyon and Yosemite National Parks and the response of the National Park Service to the report. In short, the panel found a need to recognize the negative visual impact of charred bark and the positive role landscape architects could play in planning prescribed burns.

The major recommendations of the panel's report (Christensen and others 1987) are as follows:

1. Prescribed burns planned for areas managed as natural ecosystems should be classed as:
   a. Restoration fires--fires to manipulate fuel conditions judged to be "unnatural."
   b. Simulated natural fires--fires intended to maintain the natural fire regime.
2. Showcase areas should be expanded in areas where scene management is of primary concern.
3. Reevaluate the policy of using natural fire return intervals based only on lightning caused fire. The National Park Service should consider the fire return interval during the Native American period in the adoption of a fire return interval to be used in prescribed fire management.
4. Landscape architects should be consulted in the development of burn plans.
Aesthetic concerns should be addressed in selecting from among ecologically acceptable alternatives.
5. A formal external review program should be initiated to review fire management plans.

Specific suggestions for modification of existing burn plans were as follows:

1. Judicious preburn cutting of live trees to minimize bark char and crown scorch.
2. Removal of heavy fuels from the base of all large trees in restoration areas.
3. Use of single-burning front, rather than multiple-spot ignition, in simulated natural fires.
4. Manipulation of debris following burning if prescribed burning has exacerbrated [sic] heavy dead fuel conditions. Additional local burning is advised to achieve fuel reduction objectives.

The recommendatins [sic] represent the kinds of changes in existing prescribed burning programs that are designed to reduce fuel loading or to reintroduce fire into National Parks, which we think are necessary to minimize the negative visual impacts of prescribed burning. We believe it will be imperative that resource agencies wanting to use prescribed burning as a management technique in the 21st century recognize the potential negative visual impacts. Public concern over the impact of prescribed burning on air quality has led to the intervention of air pollution control officials in the selection of climatic conditions when burning will be allowed. We believe that similar intervention will occur unless foresters and park managers address the negative visual impacts that are occurring as a result of current prescribed burning techniques.

The National Park Service has endorsed the recommendations of the Panel. The fire management staff, augmented by a landscape architect, is revising the burn plan for the Keyhole and Tharps burns scheduled for 1987. The recommendations to reduce bark char, scorch height, and to take advantage of scene-management opportunities on restoration fires as proposed in the Panel Report have been adopted. An additional impact of the report has been the base funding of the Sequoias prescribed burning program at $80,000. The response of the National Park Service is an example of the response other agencies will need to adopt in dealing with the potential negative visual impacts of prescribed burning in the next century.

Back to the future, our preferred future, by the year 2000 we could have a management ethic in which informed scenic and recreational considerations influence wildland fires as part of a multidisciplinary planning program. This might include interpretation programs that aim to remake the public's preferences, presenting dazzling images of carbon etching to use an unloaded term for char. More potentially influential, however, will be changes to prescribed fire programs resulting from the involvement of individuals professionally trained and competent to identify and communicate alternatives based on intuitive judgements. Such people, landscape architects and planners who specialize in guiding work that heightens environmental sensory perceptions and in utilizing behavioral studies related to recreational areas could lead to strengthening the visitor's visual image of unique scenic elements resulting from prescription fire. In addition to greater visual penetration, there is the potential actually to improve scenic opportunities through experimental sequencing such as Biswell (1986) and Walford (1986) employed at Calaveras, setting the visitor up for a thrill.

In conclusion, we paraphrase that enduring Talleyrand (Bartlett 1980) quotation that "War is much too serious a matter to be entrusted to the military," by proposing that scenic integrity in the giant sequoia-mixed conifer forest is too serious a matter to be left up to the resource scientists. Rather, design consciousness, developed through multidisciplinary involvement and utilizing ecologically acceptable alternatives within the scope of vibrant process management, could be the key to retaining public support for prescribed burning.

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