

Dr. Biswell's Influence on the Development of Prescribed Burning in California¹

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Abstract: Prescribed burning in California has evolved from the original practices of the Native Americans, through years of experimentation and controversy, to finally become an accepted ecosystem management activity. When Dr. Harold Biswell arrived in California, he began research on improving game range by using prescribed fires and on understory burning in ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) stands. Through a series of field days that included demonstration burns, Dr. Biswell was able to educate and inform both the public and professional foresters about the benefits of prescribed fires. These field days became the basis for several university extension courses and were influential in changing the prescribed fire policies of numerous agencies. As the problem of urban encroachment into wildlands continues, the need for safe and effective prescribed burns will increase. Dr. Biswell's sound research, presentation of the facts, and patience with people and fire should guide us in the application of fire in wildland ecosystems.

Although many people have contributed to the development of prescribed burning in California, Dr. Harold H. Biswell was a major influence on the acceptance and application of fire in wildland ecosystems. Acceptance did not come easily. A history of abuse of fire and the perception that California's climate and topography precluded the use of fire galvanized objections to prescribed burning. By using his thorough research, enthusiastic teaching, and field demonstrations, Dr. Biswell was able to gain the respect of public and professional audiences alike. As a result of his untiring efforts, agencies began to change their policies to include the use of fires. His ideas became even more relevant as urban development thrust its way into wildland ecosystems.

History of Prescribed Burning in California

Native Americans were the first practitioners of prescribed burning for managing vegetation. When European Americans settled the coastal and foothill areas of California, indiscriminate burning occurred. In response to the destruction perceived to be a result of burning, some attempted to exclude all fires from the landscape. A few land owners began to use light burning to counter the effects of fire

suppression on fuel accumulations. A program to improve forage for livestock by burning ranch lands was active in the 1940's and 1950's, but gradually declined as concern about the liability for escapes increased. Understory burning, particularly in ponderosa pine, did not become common until the late 1950's and continues today.

Burning by Native Americans

Native Americans have resided in the Sierra Nevada for at least 3,000 years (Reily 1987). Evidence of their use of fire has been found in some of the oldest deposits of cultural material. Fire was used to clear undergrowth, ease food gathering and hunting, and favor vegetation used for specific purposes (Reynolds 1959, Wickstrom 1987). Ethnographic studies have shown that the primary use of fire by Native Americans in the Sierra Nevada was to manage plants for basketry materials (Anderson 1993). In addition to fires set by humans, lightning ignitions ensured that fire was pervasive on the landscape when European Americans arrived in California.

Light Burning

European settlers used fire indiscriminately to clear areas for farming, ranching, and mining. The impacts of such burning was not a concern because vegetation was thought of as a nuisance rather than a resource. By the beginning of the century, timber became more important and attempts were made to suppress fires (Clar 1959). Some landowners felt that excluding all fires from the land was not beneficial in the long run and that light burning could be used to reduce fuel hazards (Hoxie 1910). Forestry professionals claimed that any fire in the forest was bad and that public and private lands should be managed under a policy of systematic fire protection (DuBois 1914). White (1920) countered with a critique of the fire protectionist policy. The controversy did not subside until USDA Forest Service researchers concluded that light burning was ineffective, impractical, and economically indefensible (Show and Kotok 1924). Fire protection became institutionalized in California in 1924 when the State Board of Forestry adopted the policy of fire exclusion (Pyne 1982).

Ranch and Game Range Burning

In the early 1940's, ranchers and hunters became concerned that rangelands used by livestock and wildlife had declined in value because of increasing brush density (Biswell

¹An abbreviated version of this paper was presented at the Biswell Symposium: Fire Issues and Solutions in Urban and Wildland Ecosystems, February 15-17, 1994, Walnut Creek, California.

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1989). In addition to reduced grazing capacities, the accumulation of brush posed a hazard, especially for arson fires. The California Division of Forestry (which later became the Department of Forestry and Fire Protection) recognized these problems and in 1945 began to issue burning permits to landowners. For the first time in two decades, the use of fire was officially sanctioned by a government agency.

When Dr. Biswell arrived in California in 1947, he began working with ranchers on their burning operations, and he conducted research on improving game range by using prescribed fires in chaparral. His first efforts were at Teaford Forest in the Sierra Nevada foothills in Madera County. There he worked with ranchers and farm advisors to develop techniques for using fire to kill some of the woody vegetation and then replace it with grasses to increase the grazing capacity for livestock (Biswell 1963, 1967). Range improvement burning reached its peak in 1955 when over 200,000 acres were burned (Biswell 1989). As more homes were built on adjacent wildlands, range improvement burning declined primarily because landowners were held liable for any damage from escaped fires.

Ranchers and public agencies tried to improve wildlife habitat using type conversion burns. Extensive areas on the Mendocino National Forest and on lands administered by the Bureau of Land Management were burned (Burma 1967, Doman 1967). Dr. Biswell's research was conducted in chamise (*Adenostoma fasciculatum* H. & A.) chaparral in Lake County in conjunction with the California Department of Fish and Game (Biswell 1954, 1961). Prescribed burns were used to create openings in the brush for deer, to encourage sprouting, and to favor herbaceous species. This resulted in a three- to four-fold increase in deer populations in the burned areas. Like range improvement, burning for wildlife habitat declined because of the economic costs and the liability for escapes.

Understory Burning in Ponderosa Pine

Although light burning in the forest had been practiced for many years before 1924, State and Federal policies required strict suppression and precluded using fire for forest management purposes. Prescribed fires were acceptable for grass and brush lands but not in the pine forests (Biswell 1989). Based on his experience in the southeast, Dr. Biswell felt that prescribed burns could reduce fuel hazards in pine stands so that wildfires would be less destructive and easier to control.

In 1951, Dr. Biswell started research on understory burning in ponderosa pine stands at Teaford Forest and at Hoberg's Resort in Lake County. The purpose of this burning was to improve timber production by controlling brush in the understory, reducing fire hazards, and thinning. Burn plots at Hoberg's showed that the number of manzanita (*Arctostaphylos viscida* Parry) seedlings in second-growth ponderosa pine stands can be substantially reduced and that

pine seedlings may appear in abundance (Biswell and Schultz 1958). Additional studies showed that prescribed fire could be used to reduce fuel hazards (Biswell 1959, 1960; Biswell and Schultz 1956; Sweeney and Biswell 1961).

One of the most dramatic results of Dr. Biswell's research at Hoberg's occurred when a wildfire burned into an area previously prescribed burned and was easily controlled (Biswell 1963). In the treated area scarcely any needles on the trees were scorched, while outside of it a majority of the trees were killed. Thinning stands of ponderosa pine diminished debris accumulation for at least 20 years, and when accompanied with fertilization, increased growth by 134 percent (Agee and Biswell 1970a, b).

Burning in Giant Sequoia and Mixed Conifer Forests

In 1965, Dr. Biswell started his research on fuel reduction and stand modification in giant sequoia (*Sequoiadendron giganteum* [Lindl.] Buchholz) and mixed conifer stands at Whitaker's Forest near Sequoia and Kings Canyon National Parks. There, he and his students started a series of studies that would contribute greatly to the refinement of the science of prescribed burning. Litter production studies set the stage for recognizing that different species had varying fuel characteristics that would affect fire behavior (Agee and others 1978, Biswell and others 1966). Costs for cutting, piling, and broadcast burning giant sequoia stands to reduce fire hazards ranged from \$115 to \$146 per acre (Biswell and others 1968). Giant sequoia seedling survival was studied on burned and unburned areas that had been manipulated by Agee and Biswell (1969). They found 100 percent mortality of giant sequoia seedlings on the unburned plot, while 96 out of 1,253 survived on the burned plot.

Adjacent to Whitaker's Forest, in the Redwood Mountain Grove of Kings Canyon National Park, Hartesvelt and Harvey (1967) started another study on giant sequoia regeneration after fire. Harvey and others (1980) synthesized what was known about giant sequoia ecology in a single volume.

Graduate students took the opportunity to learn from Dr. Biswell's experience and wisdom. Bruce Kilgore (1968), a student of Dr. Starker Leopold, studied the breeding bird populations in managed and unmanaged stands of giant sequoia at Whitaker's Forest. Jim Agee (1968, 1973) did his masters degree work on fuel conditions at Whitaker's and his doctorate on the effects of prescribed fires on forest floor properties. My work (van Wagtenonk 1972, 1974) on fire and fuel relationships was conducted in Yosemite National Park because of insufficient ponderosa pine stands at Whitaker's and because the Forest Service was not amenable to burning on its land.

Field Days and Extension Courses

Beginning with the work at Hoberg's, Dr. Biswell conducted field days to discuss prescribed burning and to demonstrate its use with a small fire. These early demonstrations were controversial because many people were still uncomfortable with the idea of burning (Biswell 1989). The field days were very educational, however, and numerous resource professionals and members of the public were enlightened about the use of fire.

My first exposure to prescribed fire was at a field day sponsored by Dr. Biswell at Whitaker's Forest. In attendance were Dr. Leopold, other prominent scientists, several representatives from the USDI National Park Service and the USDA Forest Service, and other interested people. Lively discussions occurred that planted the seed for policy changes that were yet to come. On the last field day at Whitaker's Forest in 1973, 175 people attended. If the field days had continued, Dr. Biswell felt that the attendance might have soared to over 250 people (Biswell 1989).

After Dr. Biswell retired in 1973, he taught a class on fire ecology at the University of California at Davis for 2 years. For the next 8 years he taught four university extension classes. Fire ecology of forests was the subject at Yosemite National Park, while the course at Mt. Diablo State Park covered chaparral fire ecology. Classes were held on giant sequoia fire ecology at Calaveras State Park and fire ecology basics in San Diego County. These courses attracted many students, agency workers, and the general public. The mix of participants ensured that there was a good exchange of information and a healthy reexamination of attitudes about fire. Although retired, Dr. Biswell was requested by students to be on their dissertation committees as an emeritus professor. Under his guidance, Ron Wakimoto (1978) completed his doctorate on the effects of fires in chaparral in San Diego County.

Prescribed Burning Policies

Dr. Biswell's influence on agency policies and attitudes about prescribed fire have been both subtle and profound. The National Park Service and the California Department of Parks and Recreation have sought his advice and counsel and have altered their policies as a result. Less direct, but just as important, has been his influence on the Forest Service and the California Department of Forestry and Fire Protection.

National Park Service

Although experimental burning had started in Everglades National Park in 1951 (Robinson 1962), National Park Service policy did not include the use of fire at that time. Impetus for a change came from university researchers in California. In 1962, the Secretary of the Interior asked Dr. Leopold to head a committee to examine wildlife management concerns in the National Parks. The committee did not confine its report to wildlife, but rather recommended that parks be

managed as complete ecosystems that include fire (Leopold and others 1963). The close association with Dr. Biswell and attendance at his field days undoubtedly influenced Dr. Leopold. The report was incorporated into National Park Service policy in 1968.

Sequoia and Kings Canyon National Parks started a fire management program in 1968 that included environmental restoration burns, prescribed natural fires, and research (Kilgore 1971, Kilgore and Briggs 1972, Parsons 1976). Yosemite's prescribed burning program followed in 1970 and its prescribed natural fire program in 1972 (van Wagtenonk 1978). Dr. Biswell and his former students played pivotal roles in these programs in both parks.

Similar to the conditions at Hoberg's Resort, wildfires have burned into park areas that have been previously burned by prescribed fires. When the Pierce fire crowned uphill into the Redwood Mountain Grove in Kings Canyon, it dropped to the ground in an area that had been burned five years before (Stephenson and others 1991). The eventual control of the A-Rock fire in Yosemite in 1990 was attributed, in part, to the prescribed burns in the area that had greatly reduced fuels in the understory (Clark 1990).

California Department of Parks and Recreation

Many California State Park rangers and managers have attended Dr. Biswell's classes and field days. Their experience formed the basis for programs to restore fire to the State Parks. In 1975, fire was carefully applied in Calaveras Big Trees State Park to allow the ecosystems to operate as naturally as possible (Biswell 1989). By 1982, prescribed burning programs were started in several other parks including Mt. Diablo, Cuyamaca Rancho, Big Basin Redwoods, and Montana de Oro.

Rangers are required to take intensive courses in fire ecology and have supervised field experience before they are certified to burn. Dr. Biswell and some of his former students have taught in these classes.

California Department of Forestry and Fire Protection (CDF)

The CDF was involved in the range burning program in the 1950's, but soon emphasized the protection function of fire management. Over the intervening years, many personnel from the agency have attended field days and special "show me" trips conducted by Dr. Biswell. At one of these field days, he recalled a CDF ranger stating, "In the fifties we were all making fun of Harold and fighting him. Now, 30 years later, we are all working for him" (Biswell 1989).

The single biggest impediment to burning on private lands was removed when Senate Bill 1704 was enacted in 1981. This bill authorized a vegetation management program for brush-covered lands and the CDF to contract with private landowners to burn on their properties. The liability issue was dealt with by requiring insurance and escrow accounts as well as state assumption of responsibility for the operation.

Forest Service

From its inception in 1905, the Forest Service had a strict policy of fire exclusion. In 1943, an exception to the policy was allowed on National Forest lands in the longleaf pine (*Pinus palustris* Mill.) and slash pine (*Pinus elliottii* Engelm) types, where private owners had burned for decades and Forest Service research had shown beneficial effects (Schiff 1962). Dr. Biswell conducted some of the early research while employed by the Forest Service at the Southeastern Forest Experiment Station. In 1941, he started his work on the integration of prescribed burning, timber production, and livestock grazing (Biswell 1958).

The Forest Service began to examine its fire exclusion policy in the early 1970's. A retreat for regional fire control officers in 1974 brought together experts from outside the Service to share their expertise. Interestingly, Dr. Biswell was not invited to attend, but several of his former students gave presentations. It was not until 1978 that the national policy changed to encompass total fire management including prevention, suppression, and use. Some of the people who were instrumental in these changes had first been exposed to the idea of prescribed burning through Dr. Biswell's writings or by attendance at one of his field days.

The Future

In the years to come, Dr. Biswell's influence will continue to be felt throughout the fire community. In particular, as the problem of urban encroachment into wildlands continues, the need for safe and effective prescribed burns will increase. His intuitive knowledge of wildland fuels led him to recognize the real threat of the recent fires in Oakland and Berkeley. Research into the weather conditions leading up to the conflagration that destroyed 625 homes in Berkeley in 1923 convinced him that, if fuels were not treated, such an event could recur (Biswell 1989). And in 1970 it did, when 37 homes were destroyed in the Berkeley and Oakland hills. Research on fuel hazards guided by him showed that the potential for even more destructive fires was present (Agee and others 1973). The 1991 Tunnel fire in Oakland and Berkeley underscored his alarm.

When Dr. Biswell first started his research on fire in California, Dean Walter Mulford of the University of California at Berkeley's School of Forestry advised him to "develop sound research, let the chips fall where they may, and not argue with people but rather listen to them and present the facts" (Biswell 1989). We would do well to follow that same advice. His research and, in particular, his patience with people and fire should guide us in the future application of fire in wildland ecosystems.

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