FIRE MANAGEMENT & RESEARCH HISTORY OF THE NATIONAL PARK SERVICE OUTISDE OF ALASKA

Fire played an important role in the creation and maintenance of most national park ecosystems before they were legislatively established as national parks. However, fire suppression was the dominant policy at the time of the enabling legislation of the National Park Service in 1916 up until the mid-1960's (Agee, 1974). The suppression policy began as a means of reducing damaging human imputs, based on the idea that fire was an unnatural presence in the forests. By stressing the protection of objects rather than processes within ecosystems, total fire exclusion was easily justified.

This justification remained unchallenged in national parks until the research of Dr. William Robertson in Everglades National Park. Robertson's research in the early 1950's established the role of fire in subclimax pine forests (Kilgore, 1976), and in 1958 prescribed burning was begun to control hardwood invasion. While the principles behind burning in the southeastern United States were well established, their application to park ecosystems was an important first step for the National Park Service.

The single most significant report on fire management was produced by Secretary of the Interior Udall's Advisory Board on Wildlife Management in 1963. This report (Leopold _et al_., 1963) identified changes in flora and fauna in national parks due to protection from natural factors, including fire, and recommended biotic management that would allow, as feasible, fires, floods, and other natural forces to preserve natural ecosystems.

The acceptance of this report soon affected administrative policies. In 1968, National Park Service policy officially recognized the natural role of fire and authorized its presence under predetermined conditions. Naturally-occurring fires were allowed and prescribed fires were approved as substitutes for natural fire. In 1975 and again in 1978 this policy was slightly amended but the principle of recognizing the natural role of fire remains the cornerstone of fire management policy.

Research was instrumental in the Everglades program and has been an important initial element of fire management in every park with a successful integrated fire management plan. The list, while not all-inclusive, is nevertheless impressive: Sequoia-Kings Canyon (Biswell et al., 1966, Hartesveldt et al., 1964, Kilgore, 1971, Kilgore and Briggs, 1972); Yosemite (van Wagtendonk, 1972); Pinnacles (Agee and Biswell, 1978); Crater Lake (Zobel and McNeil 1976, Zobel and Zeigler, 1978); Yellowstone (Taylor, 1969; Sellers and Despain, 1976); Grand Teton (Loope and Wood, 1976); Glacier (Kessell, 1976); Wind Cove (Lovaas, 1976); and, of course, Everglades (Robertson, 1962).

The fire management leadership role played by the National Park Service has been the result of effective management-oriented research and closely coordinated application by park managers. However, progress has not been made in a vacuum. Interaction with other Federal agencies, State agencies, local agencies, and the public has helped both research and management progress. This interaction has been in the form of basic research in similar areas that can be applied in parks, development of universally accepted systems such as the National Fire-Danger Rating System, park research being conducted by other-agency personnel, and cooperative management programs. Future progress in fire management and research is highly dependent on continuing interaction by the National Park Service with its interested cooperators.

PAST AND EXISTING NATIONAL PARK SERVICE FIRE RESEARCH IN ALASKA

Up until 1978, there were five national park system areas in Alaska: Mount McKinley National Park (1917), Glacier Bay National Monument (1925), Katmai National Monument (1918), Sitka National Historic Park (1910), and Klondike Gold Rush National Historic Site (1976). None of these areas have extensive fire histories; the vegetation is coastal and/or high elevation for the most part. Fire research has, not unexpectedly, been a low priority research topic in all of these areas. As far as can be determined, there has been no fire research specifically targeted for any of the above mentioned parks.

In the 1971 symposium Fire in the Northern Environment, two papers were presented on Alaska's national parks. One dealt with general National Park Service fire policy (Prasil, 1971) and the other was a survey-level assessment of tourism-smoke interactions (Miller, 1971). The Katmai draft natural resources management plan (1976) recognized the need for a fire history study of the monument, but this study has not been funded. A compilation of fire history at Mount McKinley was completed in 1976 by Buskirk.

In short, there has been little need until now for a fire research program for Alaska's parks. The opportunities that were once the domain of other agencies, however, will be presented to the National Park Service after passage of the d-2 legislation.

REVIEW OF PAST ALASKA FIRE RESEARCH

As with all scientific disciplines over the last 30 years, there has been a tremendous increase in fire research information, and Alaskan fire research is no exception. However, the information for Alaska is still of manageable proportions due to the geographical and financial isolation of that portion of the United States. A fire ecology research review for Alaska has the further advantage of two excellent ecological reviews almost 20 years apart which together compile much of the available information in a comprehensive and comprehendable manner (Lutz, 1956, Viereck, 1973). Lutz's paper contains 165 references, only five of which are dated past 1950. Viereck's paper contains 113 references, only three of which are dated prior to 1950. Taken together, they form a rather complete chronological review of interior Alaska fire ecology up until the early 1970's.

The boreal forest of North America is a region in which forest fires have been common and widespread, probably as far back as such forests have existed. Lutz (1959) reviewed available historic evidence concerning aboriginal man and white man as causes of fire and showed both were a source of fires. While he acknowledged lightning to be one cause of fire, Lutz believed man to be even a more prolific source. However, he presented no firm evidence to support this inference.

Available evidence indicated to Lutz (1953) that about 400,000 hectares (1 million acres) of interior Alaska burned annually from 1898 to 1940. Barney (1971b) suggested that a higher figure of 600,000 to 1,000,000 hectares (1.5-2.5 million acres) probably burned each year over the same period. The vegetation types affected as a percentage of the total burn over this period were estimated by Barney (1971a) to be: conifer 35.9; conifer-broadleaf, 15.0; broadleaf, 1.8; tundra, 42.7; and other types, 4.6. Treeless vegetation accounts for almost half of the total estimated burned acreage.

Since 1940, better fire statistics are available for both interior and coastal Alaska. Man-caused fires account for 70 percent of all fire starts, but because such fires are clustered around easily accessible terrain, they account for only 22 percent of acreage burned. The remaining 78 percent of the annual burned acreage is accounted for by lightning fires. Although the interior Alaska fire season is generally April 1 - September 30, May, June, and July are the major fire months, with highest temperatures, lightning activity level, and hours of daylight, and low precipitation and humidity (Barney, 1969).

Most of the available literature on ecological effects of fires in Alaska concentrates on the taiga. There is little information on coastal fires, although some information does exist for southern forests of similar structure outside of Alaska. There is also little information available on tundra fires, even though this type accounts for a large proportion of burned acreage. As is typical of much of the fire literature, most papers do not attempt to quantify the characteristics of the fire or fires which affected the study area. A recent paper by Barney et al. (1978) comparing actual to fuel model prediction rates of spread in Alaska fuels is one type of fire characterization that will be needed in future ecological studies to understand biological effects.

It is beyond the scope of this review to summarize in depth the available information on fire effects on vegetation, animals, soils, water, and air. A general review of ecological effects of forest fires is provided by Ahlgren and Ahlgren (1960) and another more recent review tied more specifically to fire management alternatives is provided by Agee (1974). However, both of these papers draw from a much larger literature than that applicable to Alaska; the reader is referred to Lutz (1956) and Viereck (1973) for more specific reviews.

There are several symposia and bibliographies that focus on the boreal environment, and much ~~more~~ of the information may be useful for Alaskan situations. In 1969, a bibliography, Fire in Far Northern Regions, was compiled by Larson (1969), and contains 198 references. In 1971, the symposium Fire in the Northern Environment was convened to examine the ramifications of wildfire, its control and role in the subarctic (Slaughter *et al.*, 1971). Several other symposia concentrating on other aspects of Alaskan and/or boreal environments may have useful information as well: BLM's 1976 Surface ~~Surface~~ Protection Seminar, the National Academy of Sciences' PERMAFROST: The North American Contribution to the Second International Conference, and the 1975 Circumpolar Conference on Northern Ecology which was held in Ottawa.

We still have a relatively elementary understanding of those ecosystems where fire studies have concentrated. As Viereck (1973) noted, Lutz's 1956 paper "Ecological effects of forest fires in the interior of Alaska" has been much used and quoted as a "bible" but in some respects it may have discouraged further work. Renewed interest in fire effects has outlined some further complexities and two examples are illustrative.

Lutz (1956) diagrammed changes in forest type following fire as shown in Figure 1A. Viereck (1973) modified Lutz' diagram as shown in Figure 1B, reordering the sequence to some degree and indicating a more complex interrelationship between the taiga communities identified. An intensive study of the black spruce ecosystem is now underway by Van Cleve and others (1976) at the University of Alaska, which will provide a much better picture of black spruce dynamics. Fire studies in the same area by BLM and the Forest Service should provide additional understanding of black spruce ecosystems and provide a model for other fire-ecosystem studies in Alaska.

A second example of increasing complexity in fire effects is the fire-caribou relationship. There is general agreement that fire destroys lichen forage, which may take many decades to recover (Leopold and Darling, 1953, Lutz, 1956). However, some current thought is that caribou may not be so dependent on lichen for winter food, and that fires in the northern boreal forest are not necessarily detrimental to caribou populations (see reviews by Viereck, 1973 and Kelleyhouse, 1978), as was once assumed to be the case. Research is continuing on this controversial topic, and its complexity is compounded by herd declines due to hunting and natural mortality (Alaska Dept. Fish and Game, 1976).

Socioeconomic impacts of fire management have been mentioned in several studies but rarely quantified. Dollar figures of recreational costs due to two wildfires are mentioned by Hakala et al. (1971), but unquantified recreational benefits are mentioned in the same paper. At Mount McKinley, smoke from extensive interior fires in 1969 was expected to decrease recreational activity, although visitation actually increased (Miller, 1971). This was thought to be the result of an inelastic response: visitors had come from far away with little schedule flexibility or advance information.

Landscape and scenic effects of fires due to the subjective nature of judgments that must be made. Although fire is responsible for much of the landscape diversity and pattern in interior Alaska, recently burned landscapes are not pleasing to some people. Crushing of standing snags has improved the appearance of burns to some observers (Hakala et al., 1971), while to others the mechanically treated landscape is less pleasing to the eye than untreated burned areas.

The direct economic impacts of forest fires (such as structure loss or commercial forest loss) are like to be less important than more indirect impacts, such as firefighting income to local communities or lack of visibility grounding air traffic of all sorts. In areas where economic activity has traditionally been low, such impacts can have significant effects on local economies.

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