



Figure 1. National Park System areas in the northeastern United States —a region where suppression of all fires remains the dominant fire management policy.

Prescribed Burning Opportunities in National Parks of the Northeastern United States

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The purpose of this paper is to review and describe the opportunities for implementing prescribed fire programs in national parks of the northeastern United States, a region where suppression of all fires remains the dominant fire management policy (Fig. 1).

Wildfires have been an important component of terrestrial ecosystems for at least the past half billion years (Komarek, 1973). Fire alters both the physical and chemical characteristics of soils in which plants must live and the structure and composition of vegetation. As vegetation changes, so does the habitat for a variety of animal species. The National Park Service (NPS) historically viewed fire as a destructive force, but in recent years has reevaluated its position in light of new ecological evidence that suggests that some of our most valued vegetation types and wildlife species depend upon the rejuvenating effects of wildfires (Leopold et al., 1963). Early policies that called for the complete suppression of all fires have been replaced, in some instances, by management plans that call for allowing some natural (i.e., lightning-caused) fires to burn within predetermined geographic and climatic constraints. These "unscheduled" (after Fischer, 1985) ignitions may be complemented by "scheduled" ignitions—fires that are set by resource managers to accomplish specific management objectives such as hazard fuel reduction, vegetation manipulation, or wildlife habitat maintenance. Prescribed natural fire programs, where unscheduled lightning ignitions are monitored but not necessarily suppressed,

have been implemented in several western parks including Yellowstone, Yosemite, and Sequoia-Kings Canyon. Prescribed fire with scheduled ignitions has been employed in the ponderosa pine-white fir forests of Crater Lake National Park to encourage the regeneration of pine and to reduce the accumulation of fuel that could lead to uncontrollable wildfires. Fires are ignited at Redwood National Park to retard the encroachment of Douglas-fir (*Pseudotsuga menziesii*) into redwood stands and at Everglades National Park and Big Cypress National Preserve to reduce the incidence of unscheduled human ignitions (i.e., malicious or accidental wildfires).

The parks of the Northeastern U.S. are, for a variety of cultural and ecological reasons, among the last to consider the use of prescribed fire as a management tool. Natural fires are rare in the region, and fires have historically occurred at long intervals and have been catastrophic in nature. This has led to a perception on the part of the public that all wildland fires are destructive. Little research has been conducted to examine the natural role of fire in ecosystems of the Northeast. Instead, ecologists speak of a "shifting mosaic steady state" (Bormann and Likens, 1979) in which classical concepts of succession and climax are more applicable than modern disturbance theory.

Resource managers in the Northeast have little experience fighting fires, and equipment is often outdated and of little use in prescribed fire situations. Thus, it is not surprising that managers have been reluctant to employ

controlled burns for management purposes.

Even in the larger western parks, however, where the natural role of fire is well understood, prescribed fire programs have been slow to develop. Rocky Mountain National Park, for example, was the first NPS unit to prepare and implement a fire management plan. The plan designated a natural fire zone where lightning-caused fires were allowed to burn. Problems with fire containment and public opposition to what was perceived to be a "let-burn" policy led to a temporary suspension of the plan, however (Axtell, 1986). Other parks, especially those in the Northeast, lack information necessary to reintroduce fire as a natural process. At parks with high visitor use and/or in densely populated areas, public safety will always be a concern.

The Present Situation

Prescribed Natural Fires

It is unlikely that natural fire programs ever will be implemented in the Northeast. Research conducted at Cape Cod National Seashore (Patterson et al., 1985) suggests that lightning fires were probably uncommon prior to European settlement. Fires were common in some areas (Patterson and Backman, 1988), but most were probably caused by Indians (Patterson and Sassaman, 1987). The NPS has generally been reluctant to use scheduled ignitions to duplicate the effects of Indian burning, but, in the Northeast a lack of burning during the twentieth century has led to dangerous accumulations of fuels. At

Acadia National Park on the Maine coast, fires have occurred at long intervals and have been catastrophic in nature (Patterson et al., 1983b). Although fuel accumulations in some areas of the Park are of concern, a reintroduction of natural fire is in our opinion both impractical and undesirable. Only five of 218 fires occurring at Acadia since 1937 have been caused by lightning, and none of these burned more than 0.1 hectare. Acadia is a relatively small park, with the largest unit only 12,000 hectares. Boundaries are complex, and this complicates the task of protecting adjacent properties. The cool, wet, coastal climate is rarely conducive to burning, but during droughts like the one that preceded the great Bar Harbor Fire of 1947, fire hazard in the Park's spruce forests can be extreme. A strong bias toward fire suppression on the part of the public and park managers argues against the implementation of a natural fire program. The same situation applies in other parks in the Northeast.

Prescribed Fire with Scheduled Ignitions

We do not advocate the implementation of a natural fire program in the Northeast, but it is recognized that there are some instances where prescribed fires with scheduled ignitions are appropriate. Prescribed fires are currently employed on a limited basis. They could be used to meet several objectives for a variety of purposes. A burning program was initiated in 1983, and most fires to date have been conducted for research and training purposes. Only at Saratoga National

Historical Park has a prescribed burning program been implemented for management purposes.

Saratoga National Historical Park

Saratoga National Historical Park in Stillwater, New York was established in 1948 to preserve and commemorate the site of the Battles of Saratoga, pivotal encounters between British and American troops in the early days of the Revolutionary War. The Battle took place in September and October, 1777 on land that had been partially cleared by settlers during the preceding two-to-three decades. Troops cleared additional land, and today nearly 300 of the Park's 1130 hectares are designated for maintenance as open areas. Elm-ash-maple, oak, and white pine forests comprise the natural vegetation of the area, which occupies bluffs and high land overlooking the western banks of the Hudson River north of Albany. In the absence of human intervention, fields are invaded by shrubs and trees, and park personnel have historically either mowed fields or leased them to farmers for cultivation. The decline in the local agricultural economy, the rising cost of mowing (estimated to be \$82.50 per hectare in 1986), and the hazards associated with operating heavy machinery on the steep slopes along the river prompted park officials to request assistance in evaluating the potential of prescribed fire as a means of maintaining open space within the Park.

An initial review of fire reports and historic accounts of the settling of the area indicated that natural and human ignitions have

been rare during the twentieth century, but that fire was probably used by European settlers, and before them, Indians, to clear land. We know little about presettlement Indian burning practices, but early explorers reported at least local use of fire by Indians in east-coast forests (Russell, 1983). Burning for land clearing was a common practice among settlers during the eighteenth and nineteenth centuries [see Dickens (1867) for an interesting account of the destruction caused by these fires].

The Park, with the assistance of fire personnel at the regional office in Boston and students and scientists at the University of Massachusetts' Cooperative Park Studies Unit, conducted initial research burns during Spring 1985. Objectives included evaluation of the effectiveness of fire in retarding shrub and tree development in open fields and shrub lands, and the development and assessment of site-specific fuel models and burn prescriptions. In a joint study with wildlife biologists from New York's College of Environmental Sciences and Forestry at Syracuse, we evaluated interactions between treatments such as prescribed burning and mowing and browsing by deer, populations of which are reaching nuisance levels in and around the Park. Research burns continued during the Fall 1985 and Spring 1986. Early indications suggested that prescribed fire can be employed safely and effectively to maintain open fields. Burning is most effective when conducted before green-up in the spring (generally during April and early May). With favorable winds (8-25 kph), humidity between 20 and 40 percent, and clear

skies, fields can be burned within 24 hours after light to moderate rain. Thus the hazard of fires spreading into surrounding woodlands, which remain damp for several days, is reduced. Spring burns appear to be more effective than fall burns in killing shrubs and tree saplings, because some herbs remain green into late fall, and the presence of these live fuels reduces the intensity of fall burns.

The first few burns at Saratoga pointed out one of the problems associated with developing a prescribed burning program in a region where prescribed fire is not employed and where the incidence of wildfires is low. The Park is critically short of trained fire personnel. At any one time the Park can count on no more than a few trained personnel from among its own staff. The regional office has supplemented the Park crew with personnel from other parks in the region. Although this provides valuable fire experience to those who participate, the logistics of filling crews given the fickle nature of New England's weather and the fact that the best burning season occurs before most parks add seasonal rangers restrict the opportunities for burning.

The initial program at Saratoga was small, with 6-to-8 hectares burned during each of the two years prior to 1986. The Park has since developed a fire management plan that calls for an expansion of the program to 20-to-30 hectares burned per year. Research will continue to determine long-term impacts of burning on the structure and composition of park vegetation. Early results suggest that fields can be burned at three-to-

five year intervals, but additional monitoring will be required.

Fire Island National Seashore

The first prescribed fires in the North Atlantic Region were conducted at Fire Island National Seashore during June and July of 1983 and 1984. Small (0.05 ha) plots were established in a stand of huckleberry (*Gaylussacia bacata*) near Watch Hill on Fire Island. The objectives of the burn were to evaluate the fire suppression capability of Seashore personnel and equipment and to obtain information on fire behavior in huckleberry, which was reported to have flammable leaves. It was found that the only fire equipment available for fighting wildland fires was that kept at a local marina for extinguishing fires on pleasure craft. The high-volume, low-pressure portable pumps that were used were unsuitable for wildland fire suppression, and after the first burn it was recommended that the Seashore obtain high-pressure/low-volume equipment. It was also found that fires in huckleberry can produce flame lengths of 3-to-4 meters above canopies that are no more than a meter high within a few hours after light rain. Seashore personnel with experience fighting fires in southern California likened fire behavior in huckleberry to that in chaparral, and these initial research burns at Fire Island lead to the development of a major study to evaluate ways of reducing fire hazard where huckleberry is an important component of the vegetation.

Cape Cod National Seashore

Cape Cod National Seashore contains more than 3,387 hectares of mixed oak and/or pitch pine forests, most of which contain dense stands of huckleberry in the understory. Live fuel loadings of stems less than 1.5 meters in height average 9 to 13.5 tons per hectare with values as high as 31.5 tons per hectare in some stands (Patterson et al., 1983a). These dense shrub stands act as ladders up which flames climb to the canopy and thus contribute to the severe hazard of crown fires in stands that contain abundant pitch pine (*Pinus rigida*). Cape Cod National Seashore averaged more than 10 wildfires per year during the period 1974-1983. All were ignited by humans. Although most fires were small and none exceeded 12 hectares in size, fires of several hundred hectares have burned elsewhere on Cape Cod during the past 30 years. With more than 500 private tracts as inholdings and more than 6 million visitors per year at Cape Cod National Seashore, the threat of destructive wildfires is large. Recognizing the contribution of flammable shrub understories to the overall fire potential, Seashore personnel requested assistance in evaluating both fire behavior under varying fuel and weather conditions and the potential of various treatments for reducing fuel loading. In 1985 a study was initiated in which 48 0.04-hectare plots are treated by mowing or prescribed burns during either the dormant or the growing season and at intervals of from one-to-four years. The first 12 plots were burned during April and May 1986; with an additional 12 plots burned

during July. Preliminary results after four years of burning show that both dormant and growing season burns can be conducted without seriously damaging overstory pine and oak. Soil moisture conditions must be monitored carefully during summer months, however, so that burns can be scheduled at times when tree root systems will not be damaged. Mortality of huckleberry stems approaches 100 percent, even when burns are conducted during the summer within two days following rain. We have found that by the judicious application of back and strip-head fires we can control fire behavior and avoid overstory fire damage during the summer. Early work by Buell and Cantlon (1953) suggests that repeated dormant season burns reduce the proportion of huckleberry relative to blueberry (*Vaccinium* spp.) in New Jersey pine-oak forests. If treatments can decrease the present 3 to 1 proportion of huckleberry to blueberry in Cape Cod forests, the hazard of wildfires could be significantly reduced, because blueberry leaves are not flammable when green. This research, although in its early stages, should, over the next five years, provide NPS with valuable information on fire behavior and fuel-hazard reduction techniques.

Future Prospects

An expansion of prescribed burning programs in northeastern national parks, beyond those described above, seems unlikely in the near future. Prescribed fire with scheduled ignitions might be employed at Acadia National Park to reduce fuel hazard and increase the proportion of less

flammable deciduous trees. Park personnel are reluctant to consider burning given the lack of information on fire behavior in mature and over-mature spruce forests, however. Additional trained personnel would be required before the Park would consider even small research burns. Burning might be employed more widely at Cape Cod, but state regulations restrict open burning to the period January 15 to May 1 and during the hours of 10:00am and 4:00pm. Thus management burns would have to be small and located in areas where smoke would not impact the public. At least in the near future, there is little likelihood that burning will be employed on more than a few hectares annually. At both Acadia and Cape Cod it is unlikely that prescribed burning will be employed on large acreages. A large, catastrophic wildfire at either unit could increase interest in the use of prescribed fire for fuel-hazard reduction, however. In the absence of such a catastrophe, fire can be expected to be employed primarily for maintaining open fields at Saratoga and, perhaps, vistas at some of the smaller parks.

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Potpourri

Some Notes from the 1988 Tucson Conference

The following note from Lenard Brown, Regional Historian, Southeast Region, contains an idea worthy of further exploration:

".....Prior to traveling to Tucson for the November meeting, four of the representatives from the Southeast Region agreed to take notes on the sessions attended. The plan was to assemble the notes with some minimal editing and distribute the information to the parks in the Southeast Region who have significant numbers of cultural resources. At the suggestion of John Peine of Great Smoky Mountains—copy of memo enclosed—I am sending you a copy of our efforts.

"I do not necessarily agree with John's suggestion that this process be formalized for the sixth conference for two reasons. First, of the three dozen copies distributed in February, John has been the only one to comment or acknowledge receipt. Everyone suffers from some degree of information overload. Second, formalizing the process may eliminate the values that Peine

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