Funding Fuels Management in the National Park Service: Costs and Benefits[1]

Stephen J. Botti[2]

Abstract: Despite a quarter of a century of prescribed burning by the National Park Service (NPS) in California, there is reason to believe that the fuels situation is getting worse rather than better. The area burned in the past 10 years has declined by 42 percent compared to the previous 10 years. The total area burned per year from wildfire and prescribed fire is substantially less than that hypothesized in pre-European settlement times. Fuels within these fire adapted vegetation types are increasing and creating conditions conducive to more high-intensity wildfires. The NPS is failing to meet its ecosystem management and hazardous fuel reduction goals and objectives. Obtaining the funding to treat these fuels with prescribed fire has proven difficult. The NPS has developed a project cost analysis system to ensure the effective use of existing fuels management funding and is developing a comprehensive cost/benefit analysis to help demonstrate the wisdom of investing greater resources in prescribed burning and fuels management.

The National Park Service (NPS) has utilized management-ignited prescribed fire (MIPF) in California for 25 years. During the past 20 years, the NPS has prescribed burned 23,187 hectares (57,271 acres) in California parks, or 2.8 percent of the burnable area in those parks (*fig. 1*). For the most part, these fires are ignited either to restore and maintain natural ecosystems or to reduce hazardous fuels. Hazardous fuels are defined as:

> those which, if ignited, threaten public safety, structures, facilities, cultural and natural resources, natural processes, or permit wildfires to spread across administrative boundaries (USDI National Park Service 1990).

In reference to ecosystem management burns, NPS policies state:

> where fire is an essential component of the ecosystem but cannot be allowed to burn as a natural process because of management constraints, fire is used as a tool to accomplish resource management objectives. These objectives include, but are not limited to, replacing natural fire, maintaining historic scenes, reducing hazardous fuels, eliminating exotic/alien species, and preserving endangered species (USDI National Park Service 1990).

Many of these burns are multi-purpose. A burn to reduce hazardous fuels may also produce ecosystem benefits in vegetative communities adapted to natural fire regimes. Conversely, a burn to maintain the natural fire process will prevent unnatural fuels from accumulating and thus avoid the necessity of a burn to reduce hazardous fuels under more difficult burning conditions. For this reason, the NPS funds both types of burns with fire management funds, as part of an integrated land management program. In an era of declining budgets, different components of fire management compete with each other for scarce funds. For this reason, it has become increasingly important to quantify the relative costs and benefits of the three components of NPS wildland fire management: wildfire suppression, prescribed natural fire (PNF) management, and management-ignited prescribed fire (MIPF).

Liabilities and Handicaps in Fuels Management Investments

Most people believe that wildfires should be suppressed regardless of the cost, and this view has been reflected in Congressional funding authorizations for many years. Since society believes that the benefits of protecting lives, property, and resources from wildfires almost always outweigh the costs, Congress has placed no theoretical limit on expenditures for "emergency" wildfire suppression. Even though the appropriation for Department of Interior and related Federal

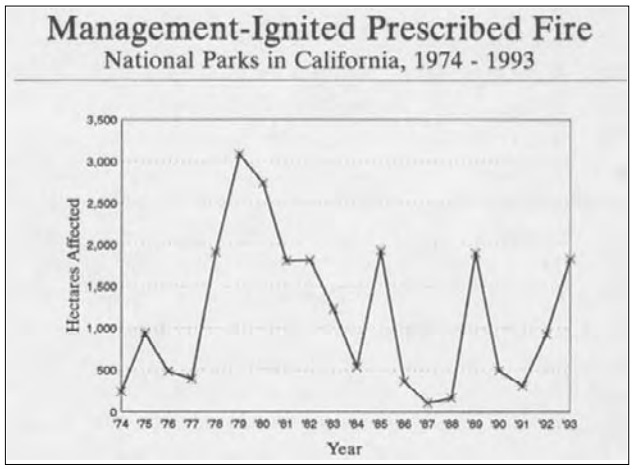

Figure 1–Management-Ignited Prescribed Fire, National Parks in California, 1974-1993.

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[2]Fire Program Planning Manager, USDI National Park Service, National Interagency Fire Center, Branch of Fire and Aviation Management, 3833 Development Ave., Boise, ID 83705.

agencies contains an amount for emergency wildfire suppression, additional funds can be transferred from other appropriations as needed by the Secretary of the Interior. On the other hand, prescribed burning, whether used for ecosystem restoration or as a tool for reducing hazardous fuels, has been faced with a more uncertain funding reality, caused to some degree by ambivalent feelings toward its risks, costs, and benefits. Although prescribed burning has broad support among certain segments of the general population and park visitors, it has rarely been viewed as equally essential to wildfire suppression. The ecosystem benefits are somewhat esoteric to most people and the long-term reduction in wildfire threat may not be immediately apparent to the public or park managers. Some people oppose the program because smoke can affect neighboring communities and park visitors, or because of fear that prescribed fires will escape.

The prescribed fire program is complicated by inherent risk of fire escape and associated liability issues. Even if wildfire suppression efforts fail to save resources and property, there is a general reluctance among the public and the fire management community to criticize suppression organizations and personnel who risk their lives fighting wildfire. The huge government expenditures for wildfire suppression also rarely receive close scrutiny or critical analysis. This same generosity is seldom extended to prescribed burning efforts, however. If prescribed burns escape or smoke impacts become intolerable, reputations can be tarnished quickly, and careers adversely affected. This is one reason that evaluations of the costs and benefits of wildfire suppression and fuels management are not conducted on a level playing field. Prescribed burning and fuels management are planned investments that may not yield rewards for many years. They are not emergency actions. Like most investments in the future, investing in prescribed burning requires discipline, a willingness to take risks, and a long-term perspective.

Status of Current NPS Fuels Management

The Department of the Interior and the National Park Service have invested far more in suppressing destructive wildfires than in managing the fuels that produce destructive wildfires. In fiscal year 1994, the Department budgeted $221.5 million for suppression and suppression preparedness compared to only $12 million for prescribed fire and fuels management. In California last year, the NPS spent $3 million to suppress wildfires on 329 hectares (813 acres) compared to $237,000 to prescribe burn 2,040 hectares (5,039 acres). The relative costs for wildland fire management are $9,115 per hectare ($3,690 per acre) for wildfire suppression compared to $116 per hectare ($47 per acre) for prescribed burning. The total suppression cost was actually considerably higher than NPS finance records indicate because the NPS does not track the costs of firefighting resources contributed by other federal agencies to suppress wildfires on NPS lands. Although the investment in suppression response may look out-of-proportion to that in prescribed fire, a true evaluation of these numbers is not straightforward. It is to be expected that the cost of mobilizing large numbers of suppression resources for an unscheduled incident would be much greater than the cost of staffing a planned and controlled prescribed burn. What is not clear is whether an increased investment in prescribed burning and fuels management would produce a much greater corresponding reduction in suppression costs. Other, more subtle benefits of prescribed burning, such as the decreased probability of catastrophic wildfire threatening resources at risk, remain to be quantified. Managers intuitively believe that these benefits must exist or they would not take the risks, but the lack of data or effective cost/benefit models for prescribed burning diminishes our ability to present a convincing case for increased support.

Are we achieving our fuels and ecosystem management goals with the present level of program funding and accomplishment? The same question can be asked another way. What are the costs of not burning or of not burning enough? To answer this question we must document both the increased costs of wildfire suppression and real property losses, which can be quantified economically, and the intangible costs of natural and cultural resource losses. As stewards of taxpayer dollars, we must also ask, "Is the current prescribed burning program cost effective, or would a greater investment in prescribed burning be more cost effective?"

Before answering these questions, it may be helpful to evaluate the total influence of wildland fire within two representative California National Parks. Wildfires, management-ignited prescribed fires, and prescribed natural fires all contribute to the fuels balance and vegetative community structure in Yosemite, Sequoia and Kings Canyon National Parks. These Parks provide good examples to study because of their long history of prescribed fire management.

The past 20 years of combined wildfire, PNF, and MIPF data from Yosemite reveal that the total area burned is only 36 percent of that hypothesized under natural fire regimes, while at Sequoia and Kings Canyon it is only 22 percent (*figs. 2* and *3*). The hypothesized pristine average annual fire occurrence target is extrapolated from current knowledge of fire return intervals within the vegetative communities in both parks (Caprio and Swetman, in press, Kilgore 1973, Kilgore 1981, Kilgore and Taylor 1979, Parsons 1976, Show and Kotok 1924, Swetnam 1993, USDI National Park Service 1987, Wagener 1961). The continued existence of this gap between pristine and modern fire regimes in vegetative communities adapted to or even dependent upon recurring fires is causing the NPS to drift farther away from its twin goals of protecting people and property and preserving natural ecosystems. As a result of this gap, hazardous fuels are continuing to increase, increasing the costs and difficulty of future prescribed burning projects, along with the cost and destructive power of future wildfires. Analyzing the cost of this gap should be a major focus of future research. The NPS needs to know whether closing that gap would be a cost-effective fire management strategy. At present, parks are

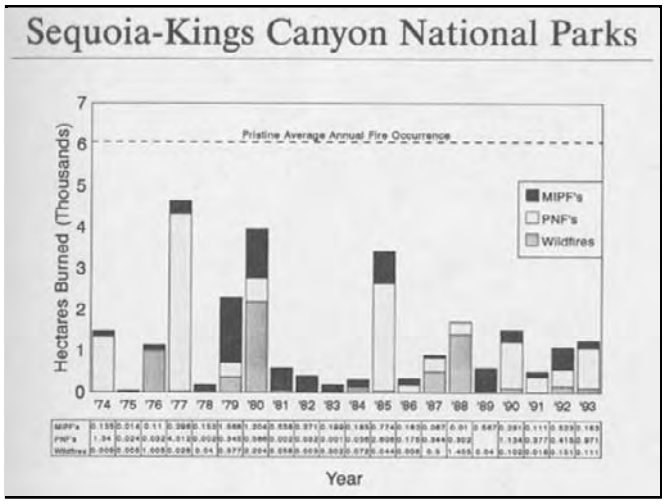

Figure 2–Wildland Fire Occurrence, 1974-1993, Sequoia-Kings Canyon National Parks

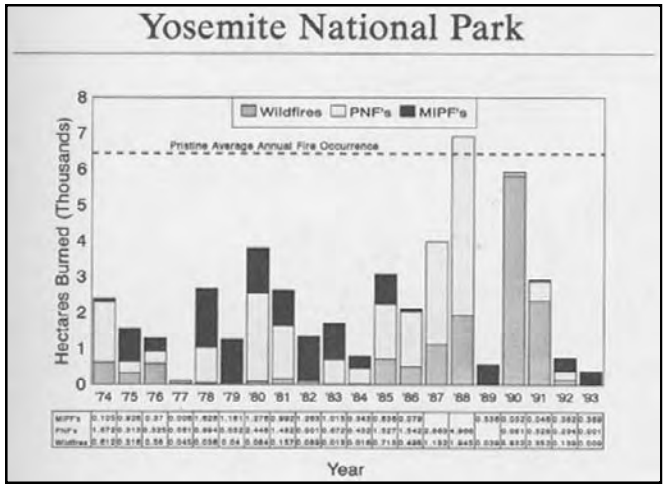

Figure 3–Wildland Fire Occurrence, 1974-1993, Yosemite National Park

proposing to burn less area than is required to close the gap, the NPS is funding less than the parks are proposing, and the parks are carrying out only about half of the projects that are funded.

Fuels Management Analysis Programs

The NPS has never been able to fund all of the fuels management work requested by parks each year. In 1994 the NPS was able to fund only 41 percent of hazard fuel reduction projects requested by parks. In order to allocate scarce funds to the highest priority and most cost-effective projects, the NPS developed three project analysis programs. In the first, parks define projects through an on-line computer program. Projects from all parks are compiled in a central database and assigned priority points by the computer on the basis of fuel type, fire behavior, values at risk, and legislative and administrative mandates and complexity. This program also contains a cost spreadsheet that displays costs stratified by four cost categories and four phases of project development and execution (*figs.4* and *5*). This program produces reports that list all fuels and ecosystem maintenance prescribed burning projects in priority order along with the requested budget for each project. Using these reports, the national fire program manager can easily allocate funds to the highest priority projects according to the funds available in each year.

Under the second program, parks can group projects into multi-project and multi-year plans. This planning tool allows fire managers at the park to define, and those at the regional and national levels to understand, a park's long-term strategy for fuels management and ecosystem management prescribed burning. Multi-year plans that are approved at the regional and national levels receive priority for funding in future years. This planning strategy encourages parks to develop comprehensive fuels management plans and to receive assurance of year-to-year funding continuity for well-designed programs. It also helps fire budget managers to allocate scarce funds to those programs which will achieve the most effective long-term results.

While these programs allow managers in the regional and national fire offices to allocate funds to the highest priority projects, they fail to address the issue of whether the funding requests for high-priority projects are reasonable. Funding itself is not a priority ranking factor and thus must be considered separately. Projects of equal size in similar fuel types with equal values at risk and equal complexity sometimes vary dramatically in cost per hectare. Projects vary from $1.20 to $42,000 per hectare, making it difficult to decide what is reasonable without more detailed knowledge of the factors causing the variation. Some cost variation between projects is to be expected because of size, fuel model, complexity, and other factors, but managers need to quantify how much variation is acceptable for various types of projects.

In order to solve this problem, the NPS contracted with the Department of Forest Sciences at Colorado State University for the development of a cost analysis system (Omi and others 1992). They evaluated all project criteria through a regression analysis to determine which ones contributed most to cost variability, and used the results to develop cost target zones for projects. The regression equation captured 91 percent of the cost variation for hazard fuel reduction projects and 82 percent of the variation for ecosystem maintenance burns. The variables include criteria such as project size, NPS region, fuel model, type of treatment, natural resource values at risk, and the risk of fire escape. The findings were incorporated into a PC-based computer

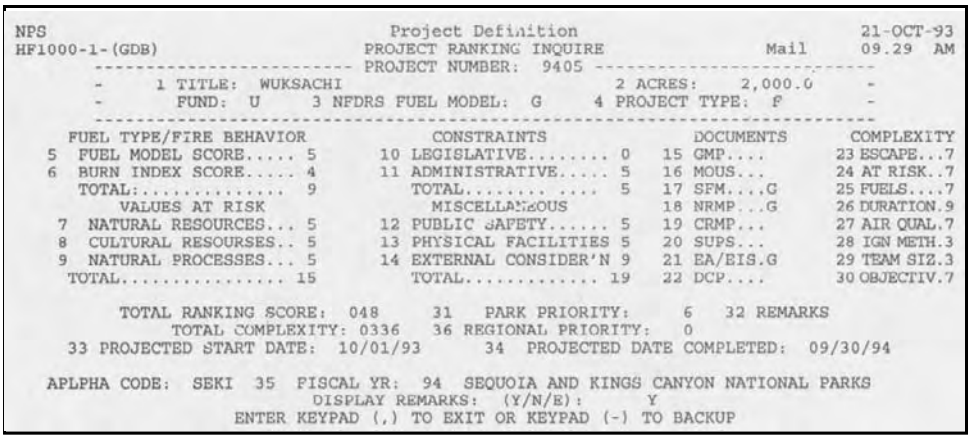

Figure 4–National Park Service Hazard Fuel Project Ranking Program

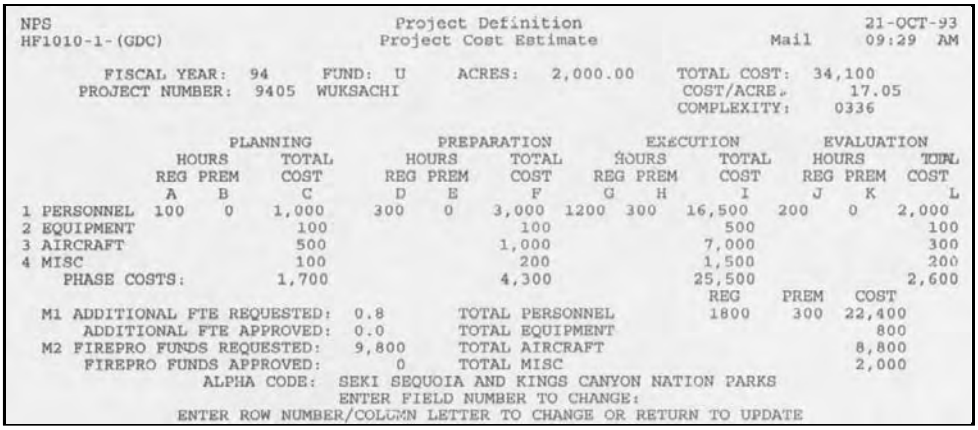

Figure 5–National Park Service Hazard Fuel Project Cost Estimate Program

program used to screen all NPS fuels management and ecosystem maintenance projects.

This screening program is just one tool for deciding whether to fund a project. Projects falling within the 95 percent confidence range for costs of similar projects are considered to be reasonable from a cost standpoint, but may still be rejected on the basis of ranking score, regional office recommendation, a park's track record for project accomplishment, or for other reasons. Projects rejected by the screening program can still be funded if a park can justify why the costs are unusually high.

The existence of the screening program has forced parks to improve their estimates of project costs and to become more cost efficient in order to stay within the target ranges. Since the target ranges are unknown to parks, they cannot manipulate the system by either reducing their estimates to just inside the upper end of the range or allowing costs for an otherwise inexpensive project to escalate to the upper end of a range.

Although these three analysis programs provide useful tools for screening and ranking fuels management projects, they do not provide a quantitative evaluation of programmatic fuels management costs and benefits. A fourth analysis tool is being developed to model the effectiveness of incremental increases in prescribed burn funding in protecting resources at risk, reducing suppression costs, and restoring natural ecosystems. The model will identify the value of resources protected, the long-term costs of the various alternative fuels treatment programs, and the cost of projected suppression response under various treatment scenarios.

By simulating wildfire suppression scenarios under a variety of fuels treatment strategies, managers will be able

to determine which strategy will be most effective in achieving the desired reduction in risk to resources and real property. First managers will establish wildfire risk reduction and ecosystem protection targets. For example, managers may be willing to accept a 5 percent probability that wildfires will destroy a value at risk. By modeling fire spread and suppression response under alternative fuels treatment methods, managers will be able to determine which method will produce a fuels complex in which there is only a 5 percent probability that a wildfire will exceed suppression capabilities and destroy resources at risk. The prescribed burning projects necessary to achieve the target fuel complex will be defined under a preferred alternative for the fire management program. Subsequently, budget targets for park, regional, and national hazard fuels treatment can be determined by aggregating the projects identified in the preferred alternatives for all programs. The simulation will also display probable net savings in fire management costs by comparing wildfire suppression expenditures to hazard fuels treatment costs under various treatment alternatives.

Although the simulation and cost analysis have yet to be designed, some of the possible tools they will utilize may include:

• Data that monitor fire effects, indicating the changes in the fuels complex and vegetative community structure from prescribed burns under varying prescriptions. These data can be used to identify the prescription needed to achieve ecosystem management objectives and to provide fuel inputs for a large fire growth model.

• Existing data in the current NPS fire program analysis software that assess the degree of wildfire risk to natural and cultural resources and real property in hazard fuel reduction units.

• Data on wildfires originating inside and adjacent to National Parks that could burn through hazardous fuels and destroy values at risk inside a park.

• Programs to simulate the spread of wildfires under a variety of hazard fuel treatments utilizing geographic information systems and large fire growth models. These programs will display the likelihood that such fires can be successfully suppressed with the current levels of suppression resources.

• Databases on resources outside parks at risk from wildfires originating inside parks. The decreased risk to these resources from fuels management programs will need to be considered in the comparison of total benefits to costs.

Conclusion

The completion of all four phases of the NPS management-ignited prescribed fire analysis system will provide managers with powerful tools for identifying optimum program funding needs, formulating and defending a fire management budget request that reflects those needs, and allocating scarce funds to the highest priority needs. Although there is ample scientific work identifying the benefits of prescribed burning within fire adapted ecosystems, further work is needed to monitor fire effects and model how well the current and projected burning programs will achieve goals and objectives. The comprehensive fuels management analysis system being developed by the NPS will help quantify the relative costs and benefits of wildfire suppression and prescribed fire management programs. This will help define true prescribed fire program needs, and ensure the most efficient use of scarce taxpayer dollars.

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