RATIONALIZING MANAGEMENT OF NATURAL AREAS IN NATIONAL PARKS

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Policies that direct environmental management must be dynamic. As knowledge accumulates and new models replace older ones, goals that once made sense are seen in new light to be irrelevant, self-contradictory, or inappropriate. Policy dynamics reflects changes in societal values, changes in models of the natural world, and interactions of those elements. It has now been 20 years since the Leopold Committee presented its report to Secretary of the Interior Udall (Leopold et al. 1963) and provided park resource managers with an integrated and coherent basis for the stewardship of national park natural [and now wilderness] areas. The impetus for calling the committee was recent removal by National Park Service staff of more than 4,000 elk from Yellowstone National Park by shooting, and controversy over both whether it was proper to kill native animals in national parks, and who should do the killing. Leopold and his fellow scientists did not dispute that periodic removal of native ungulates from national parks was an appropriate management tool: "Good park management requires that ungulate populations be reduced to the level that the range will carry in good health..." They supported the Park Service action.

Nearly 20 years later, after exhaustive field study and a review of historical material, Houston (1982) largely refuted both the empirical basis and the conceptual framework of the Leopold Committee's findings on Yellowstone's Northern Elk Herd. Not only did Houston find little basis for the claim that elk range was overgrazed and the herd itself above carrying capacity, but he suggested that the Park Service had been implicitly managing for the kind of ecological "scene"--that is, ecosystem structural elements, process elements, and their interactions--that it found appealing: lush vegetation, fat elk, and unburned forests. As if recognizing that his paradigm shift, resulting from a new ecological model and altered philosophical viewpoint, may be repeated in the future, Houston called for "experimental management," in which hypotheses may be generated and tested in a monitored and sometimes experimentally manipulated environment within the national parks.

This evolution of natural models, societal values, and their interactions produces a dynamic role for national parks and consequently the policies that guide them. It's been going on since the Yellowstone Act of 1872 created "a public park or pleasuring ground for the benefit and enjoyment of the people" in which "the natural curiosities or wonders" were to be maintained "in their natural condition." By 1916, when Congress created the National Park Service through additional legislation, more visionary language directed the new agency "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in

such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (National Parks Act of 1916). Although the large western parks operated much like autonomous fiefdoms until quite recently, general phases in the management of natural resources may be demarcated for the Service as a whole.

Era of Spectacles

The first generation of national parks was selected around scenery and spectacles: geysers, waterfalls, big trees, volcanoes, deep canyons. Protection of these objects and their immediate environment, protection of visitors, and protection of visitors' enjoyment of the scenery was Park Service policy taken directly from the 1916 law. The management of national parks for protection of natural features and the pleasure of visitors--and the not-incidental desire of the Park Service to attract more visitors and establish a constituency (Ise 1961)--led to tourist accommodations directly abutting those same features, and the creation of new amusements such as bear feeding stations and the famous Yosemite firefall. To protect living scenery, forest insects and diseases were dealt with by pesticides and prophylactic cutting, without regard to whether the phenomena were natural, exotic, or aggravated by human presence (Ise 1961). Management of wildlife was largely an ad hoc affair. Although traditional Park Service policy long has been "to permit each species of wildlife to carry on its struggle for existence without artificial help" (Ise 1961:454), individual superintendents regularly ordered reductions of hooved animals when they were believed to be overstocked or damaging vegetation.

Thanks to work by scientists such as Adolph Murie and George Wright, destruction of predators, as a means of increasing ungulates or because their activities were offensive to some, was gradually abandoned in the 1930s (Wright et al. 1933). By the end of the decade, internal documents (Dixon 1940) and popular articles (Finley and Finley 1940) were questioning the Park Service habit of feeding bears and then killing them when they became nuisances. Fire was strenuously excluded from national parks. In most cases it was the Forest Service that made the plans and conducted firefighting; Park Service firefighting did not come into its own until the 1930s (Pyne 1982). The contribution that fire suppression in some areas makes as its own long-term threat to safety and the scenic resource was not appreciated until well after World War II. Despite valuable advice from people both within and outside the agency, the National Park Service lacked any resource policy of substance and the professional scientists and resource managers necessary to give it substance.

Era of Resource Management

National park resource management entered a new age when the Leopold Committee filed its report entitled "Wildlife Management in the National Parks" (Leopold et al. 1963). The committee far exceeded its formal directive, and produced a document that

spoke to the broad issue of goals and policies for natural resource management in national park natural areas. Its very words have been appended to policy documents and repeated as litany:

> *As a primary goal, we would recommend that the biotic associations within each park be maintained, or where necessary recreated, as nearly as possible in the condition that prevailed when the area was first visited by the white man. A national park should represent a vignette of primitive America (Leopold et al. 1963:32).*

With this goal clearly and formally stated, the committee said that means to achieve it could include reintroduction of extirpated species; control or elimination of exotics; and population management where natural controls or park size and necessary habitat components were inadequate. While time and patience might restore climax communities disrupted by fire, logging, or other disturbances, the loss of serial and other fire-dependent communities could only be restored by reintroduction of fire. For the Sierra Nevada of California, the report specifically recommended controlled burning as the only method with extensive application for reducing "a dog-hair thicket of young pines, white fire, incense cedar, and mature brush--a direct function of overprotection from natural ground fires."

The committee restated views enunciated in 1962 at the First World Conference on National Parks; there it had been suggested that park management served a homeostatic function, substituting artificial controls for natural ecologic factors that had been lost on account of inadequate park size, extirpation, or human activities over time. The Leopold Report stressed management of a *scene,* and defined that target scene explicitly as the moment when European man first laid eyes on it. "A reasonable illusion of primitive America could be recreated, using the utmost in skill, judgment, and ecologic sensitivity."

Possibly the most far-reaching recommendation of the Leopold Committee was development of a professional cadre of scientists and resource management specialists within the National Park Service:

> *Active management aimed at restoration of natural communities of plants and animals demands skills and knowledge not now in existence. A greatly expanded research program, oriented to management needs, must be developed within the National Park Service itself. Both research and the application of management methods should be in the hands of skilled park personnel (Leopold et al. 1963:43).*

The Leopold Report at last provided a unifying rationale for management of natural or wilderness areas in national parks. It called for the acquisition of scientific information so that the "vignette of primitive America" could be determined and the tools best suited to restore it applied. It repeatedly specified

controlled burning as a preferred tool for manipulating pyrophytic vegetation because of its low cost and similarity to the effects of wildfire.

Fire Management in National Parks

The Park Service had two distinct reasons for introducing prescribed fire into its natural areas. The first was that nearly a century of fire suppression presumably had altered pristine plant communities. The second was that buildup of both living and dead fuels constituted a threat of unnaturally hot and dangerous wildfire that imperiled park resources, people, and surrounding lands. These threats and their solution through prescribed fire rapidly became incorporated into management documents (e.g., van Wagtendonk 1974, Sequoia and Kings Canyon National Parks 1979). Fires produced by natural ignition sources also were permitted to burn with increasing frequency, but only insofar as they were "in prescription"--usually referring to their safety and potential for containment--and furthered management objectives. As natural areas were modified by prescribed fire, managers felt, the reduced fuel loadings would permit larger proportions of the parks to be included in "natural fire zones."

Present Management Policies of the National Park Service (1978) emphasize control of all fires--regardless of ignition source--in natural/wilderness areas, and state: "The fire management program of all parks must be designed around park objectives." Continuing:

> *In natural systems this may include the need for some areas to proceed through succession toward climax while others are set back by fire. Natural zones should represent the full spectrum of the parks' dynamic natural vegetation patterns (IV-13).*

That is, in Leopoldian fashion, fires are to be managed for objectives. Although present policy provides some examples of possible objectives, it leaves final determination to the local manager.

One interesting facet of national park fire management is the role of Indian burning and its simulation. Evidence continues to accumulate that throughout much of the world, aboriginal man greatly influenced vegetation by burning (Pyne 1982). This appears to be true for California, including the Sierra Nevada (Lewis 1973). When Kilgore and Taylor (1979) reconstructed the fire history of a sequoia-mixed conifer forest, they found a fire frequency substantially greater than one that could be generated by contemporary natural ignition rates, and concluded that Indians were responsible for a large but undetermined proportion of the fire scars on that site. Partly because it is now difficult to distinguish the historic effects of aboriginal burning from those of lightning ignitions, and partly because the Leopold Report specifically referred to "the condition that prevailed when the area was first visited by the white man"--from which one may infer that Indians were to be included in the landscape--

managers in the Sierra Nevada parks have been inclined to merge both ignition sources and their ecologic effects when calculating "natural" vegetation patterns and developing prescribed burning plans. Similar Indian burning effects and similar management conclusions have been drawn for other areas, such as the northern Rocky Mountains (Barrett and Arno 1982). Concern for whether or not Indian burning practices should be simulated is not trivial. It has been suggested that the increased frequency of fires in the Sierra Nevada induced by Indians reduced average intensity, altering forest structure and permitting the famed giant sequoias to reach great size and age instead of burning up in hot fires.

Under the Leopold approach, resource managers in a number of western parks with significant natural or wilderness areas have explored as a first-step objective the restoration of vegetation structure to what it was in pre-settlement times, generally defined as approximately a century ago (and, not incidentally, when photographers began to record scenery in the West). In most cases that structure has been estimated from a combination of present stand structure, fire scars and other physical evidence, historic records, and inferences drawn from vegetation elsewhere. All of these techniques, save rare instances where actual reports of Indian burning practices are available, lump ignition sources for past fires. A combination of mechanical manipulation and prescribed fire has then been applied. Although not always explicitly stated, program objectives for the first round of burning generally include (1) restoration of the pre-settlement scene, either (a) as a vignette of primitive America, or (b) as the best approximation of what the present vegetation would have looked like had it not been disturbed by Europeans; (2) protection of visitors, structures, featured resources, and designated scenery; and (3) prevention, as an outcome of ignition from any source, of uncontrolled wildfire that could burn areas within or outside park boundaries in an unacceptable fashion. The rationale for this approach is extensively developed in Parsons (1981).

As techniques for burning have developed to the point where first-round fire management programs can be implemented successfully, managers have been confronted with the dilemma of where to proceed next. In natural areas, one is left with the alternatives of either ceasing prescribed burning and permitting natural ignitions to provide the sole source of fire, or to supplement/supplant natural ignitions indefinitely with prescribed fires whose parameters would be determined by available information on pre-settlement fire behavior, present and historic vegetation structure, or both. In practice, the first alternative is unlikely ever to be implemented strictly: protection of various resources and conflicting fire policies on adjoining lands will require prescribed fire for reasons other than ecological objectives. The second alternative is obligatory if Indian burning was a significant factor in creating the pre-settlement scene and objectives are described in terms of structural outcomes.

The Ambiguities of Present Policy

Taken literally, present policy calls for naturalness to be accomplished via anthropogenic means. The section entitled "Regulation of Wildlife Populations" mandates that "regulation of native animal populations in natural zones shall be permitted to occur by natural means to the greatest extent possible" (IV-9). Management "will strive to maintain the natural abundance, behavior, diversity, and ecological integrity" of these animals (IV-6), a significant advance in sophistication over the policies of 1970, in which "health of the species, the native environment, and the scenic landscape..." are included. But even current policy, by failing to declare when intervention is appropriate and when it is not, leaves those decisions up to the local manager.

The regular usage of "may" rather than "shall," and phrases like "where possible," leave management policy open to the kinds of creative interpretation best exemplified by Bonnicksen and Stone (1982) in their policy analysis of vegetation management in US national parks. Although their analysis is grievously flawed by selective use of now-outdated and antiquated Park Service and Interior policy documents, they offer a subtle and sophisticated elucidation of some of the inherent contradictions in what they call "structural maintenance objectives," and point out the interdependence of structure and process.

Ecological reserve: a proposed rationalizing principle for natural areas in national parks. I propose that the *principal aim of National Park Service resource management in natural areas is the unimpeded interaction of native ecosystem processes and structural elements.* Both structural elements (including plants and animals, soil and parent material, water and air), and system processes (such as photosynthesis, wildfire, and erosion), are protected, as are interactions among them. While park policy historically has variously compelled, encouraged, and permitted intervention in ecosystems in order to enhance or inhibit different physical elements such as scenery or wildlife by influencing processes such as wildfire, predation, or erosion, the changing role of national parks and more sophisticated ecological understanding has reduced the perceived need for intervention to an extremely limited set of cases. These are:

1. To reverse or mitigate anthropogenic factors where knowledge and tools exist to do so. Such factors may include loss of native species or introduction of exotics; alterations in vegetation caused by burning, fire suppression, logging, and so on; and physical alterations of the landscape.

2. To protect a featured resource. Policy makers and managers may elect to place protection of a particular system element, such as endangered species, a valued spectacle, or an historic scene, above protection of wild ecosystem interactions where the latter threaten the former.

3. To protect human life and property. Wildfire and large predators, for example, may be controlled or ex-

cluded from a zone that is dedicated to intensive visitation or development, or that borders land dedicated to conflicting uses.

As other wild ecosystems are compromised by a variety of human activities such as mining, grazing, logging, and recreation, what are left become increasingly valuable as living laboratories of natural ecological processes. The function they serve, as controls in a world in which human influence is virtually omnipresent, varies inversely in value with the degree to which they are disturbed. This newly emphasized function of natural areas in national parks is explicity recognized by the dedication of many parks as International Biosphere Reserves under UNESCO's Man and the Biosphere Program. There are two other classes of natural areas with potential as reserves for ecological study: wilderness lands managed by the Forest Service and the Bureau of Land Management, and Research Natural Areas managed by a variety of government and university units. Unfortunately most wilderness areas outside national parks are compromised by grazing and hunting, and research natural areas are, for the most part, too small to study as ecosystems. That leaves natural and wilderness areas in national parks.

At the present time, the Park Service emphasizes the management of wilderness for its aesthetic and spiritual value; scientific research is tolerated--if not exactly welcomed--"which require(s) such areas for their accomplishment, and which will not adversely modify either the physical or biological resources and processes of the ecosystems, nor intrude upon or otherwise degrade the aesthetic values and recreational enjoyment of wilderness environments." Recognition of the scientific values of nonmanipulated natural or wilderness areas introduces some conflicts with recreation. Human visitation, which is already acknowledged to compromise wilderness value when it reaches certain levels, may significantly compromise scientific value at yet lower levels. Collection of scientific information often includes setting up scientific equipment, destructive sampling of resources, and other visual or acoustic blights on an otherwise unmarred landscape. The proposed ecological reserve principle places scientific studies meeting yet-to-be established criteria for significance above recreation in priority.

The Leopold approach of scene management is incompatible with management for unimpeded natural processes. By designating a particular set of conditions a "reasonable illusion of primitive America" and calling upon both natural and artificial processes to achieve it, new anthropogenic artifacts--however subtle or artfully imitative of uncontrolled outcomes--are introduced into the system and compromise any study of natural processes. The ecological reserve management strategy recognizes, as does present policy, that parks are ecologic islands and cannot be managed as limitless wilderness. It still requires the reversal or mitigation of anthropogenic effects when the knowledge and skills are available to do so. But by abandoning the notion of an end product, natural processes and structural elements are

permitted to interact freely within previously stated constraints that must be made explicit for each management plan. This new perspective recognizes that ecosystem processes and ecosystem structural elements are both real properties, that they are interdependent, and that both are deserving of protection in the wild state and are valid and meaningful objects of study. In their critique of policy, Bonnicksen and Stone (1982:101) miss this point entirely; they argue instead that "The purpose of national parks is not to preserve fires. Rather fire is a tool that is used to produce some desired state in the condition of an ecosystem."

The ecological reserve approach to resource management obviates some difficulties in present policy, and introduces a few of its own. Cycles and trends in climate, erosion, and plant succession no longer pose as management concerns; they can be studied rather than confronted. Wildlife population phenomena such as epizootics, irruptions, and collapses are transformed from problems to phenomena not generally available for study elsewhere; they remain of particular interest to the local manager who must determine if they are anthropogenically induced. Simulation of aboriginal burning is rendered moot, because such a simulation would freeze a moment in Indian cultural evolution, climate, and biotic relations for all time. Had they been free to follow their own cultural destiny, Indians presumably would not have pursued deer, collected acorns, and ignited fires in perpetuity.

A serious difficulty in this strategy is that knowledge of anthropogenic factors to be corrected is poor. Lacking data on long-term lightning ignition and spread patterns, one cannot compensate for loss of fires previously invading from beyond park boundaries. When ungulate populations explode and collapse, is it from loss of predators or habitat beyond park boundaries, or a natural phenomenon? Acquisition of that kind of information can be obtained only by scientific study of the phenomena in a locale where management intervention will not interrupt it. The study of wildfire pattern and process is a legitimate scientific topic. Where else could it be studied but where it is permitted to burn? Thus, the generation of new knowledge by research in completely wild systems also serves to protect them by detecting anthropogenic artifacts.

This management proposal for natural areas is nothing more than a small extension of the policy evolution process that has been taking place for decades. Houston's (1982) comments on Yellowstone elk reflect the same train of thought, as does Yellowstone National Park's recent decision not to intervene when bighorn sheep were severly afflicted by conjunctivitis. If there is a "new" idea here, it is simply that the last vestiges of scene management be purged from policy, and that exceptions to the basic resource management goal [for natural and wilderness areas] of unimpeded interaction of native ecosystem processes and structural elements be explicitly stated and justified for each resource management plan.

In a world in which subtle and insidious forces--radiation, acid rain and air pollution, the "greenhouse effect," deforestation and desertification--threaten habitability of the globe for many organisms including human beings, we urgently require sites where what remains of natural ecosystem functioning may be studied, and where baseline values for system elements and their interactions can be established and monitored indefinitely. For many systems in this country only national parks are sufficiently large and undisturbed to serve the purpose. It behooves the National Park Service not only to recognize but to embrace this new role.

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