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Thomas M. Bonnicksen
Office for Strategic Studies in Resource Policy, Taxas A&M University, COllege Station

RESTORING BIODIVERSITY IN PARK AND WILDERNESS AREAS: AN ASSESSMENT OF THE YELLOWSTONE WILDFIRES

Thomas M. Bonnicksen
Office for Strategic Studies in Resource Policy, Texas A&M University,
College Station, Texas

ABSTRACT: Scientific management is essential for restoring biodiversity in park and wilderness areas. A fundamental requirement of scientific management is quantitative or measurable standards for judging success. A qualitative goal is also needed to guide action prior to setting quantitative standards. Quantitative standards are a measurable but necessarily imperfect representation of the goal. Goals and standards are the two most important parts of the general procedure that is followed in scientific management. The Yellowstone wildfires of 1988 illustrate the problems that occur when theology replaces science as a means for restoring biodiversity in park and wilderness areas.

INTRODUCTION

The mammoth wildfires that scorched nearly half of Yellowstone National Park during the summer of 1988 were caused by a lack of restoration goals and objectives, a century of fuel accumulation due to fire suppression, and an anti-scientific management philosophy that dominates the thinking of some administrators in the U.S. National Park Service. Why did the Park Service allow these fires to burn in a drought, especially after a century of neglect had created a dangerous wildfire hazard? The answer can be found in a memo written by Mr. Howard T. Nichols, a Park Service Environmental Specialist sent to help in the command center during the Yellowstone wildfires, in which he stated that members of the Yellowstone staff knew "that 1988 was a very dry year" yet they "were determined to maintain the Park's natural fire regime." Underlying the determination of Park Service employees to maintain their perception of a "natural fire regime" is a belief in the wisdom of "nature," or "dehumanized wildness," and a rejection of scientific management.

THEOLOGICAL VS. SCIENTIFIC MANAGEMENT

Many people in the Park Service and supporting organizations regard park and wilderness areas as sanctuaries in which "Mother Nature" resides and rules. In their view, humans must display the same kind of reverence for "Mother Nature" when entering a park as they would show for God in a church. That reverence extends to an illusion that "Mother Nature" is managing these areas, not humans. Therefore, "letting nature take its course" is the only acceptable management strategy. This is "theological management" not scientific management.

Theology is a body of doctrines, opinions or beliefs asserted *a priori*, or without proof, that guide the behavior of a group. For example, the overarching philosophy that guides park policy is that "nature knows best." Such a doctrine of "dehumanized wildness" leads inevitably to the belief that park and wilderness areas are sacred spaces that must be left alone. Using science to

manage such places is unacceptable in principle because it is the equivalent of playing God. Exceptions are made, of course, but intervention is generally rationalized as mitigating human influences.

Unlike theology, science is a body of knowledge arrived at by ordered thinking, observation, experimentation and verification. Although a scientist may hold religious beliefs, science itself must be free of dogma. Science deals with advancing knowledge about the laws that govern the behavior of the physical world and putting that knowledge to work to improve the human condition. For example, if only a fraction of the $120 million used to fight the Yellowstone wildfires had been spent on scientific management over the past fifty years, the number, size and destructiveness of the wildfires could have been substantially reduced.

The philosophy that "nature knows best," which is theological management, is founded on two false premises. The first is that national park and wilderness areas were pristine or untouched by humans when they were set aside. By the time European explorers arrived, much of the vegetation and wildlife in park and wilderness areas was profoundly altered due to thousands of years of Indian use. The area now called Yellowstone National Park, for example, was occupied or visited by Indian people dating back to the arrival of Paleo-Indian or "Clovis" people between 7,500 and 11,500 years ago (Janetski, 1987). Indian occupation extended through the prehistoric period and later included such familiar Indian people of the historic period as the Blackfeet, Crow and Shoshone-Bannock (Janetski, 1987). The Indians were finally extirpated from Yellowstone in 1878.

The biotic communities that we valued enough to set aside as park and wilderness areas were largely created by Indian people to serve their needs. The doctrine of "dehumanized wildness" denies this widespread and important role of Indians in managing vegetation and wildlife, and increasing biodiversity.

The second false premise is that national parks like Yellowstone are large enough to contain large-scale forces like catastrophic wildfires without threatening people and property. As early as 1962, a committee of fifteen members representing eight nations stated in their report on the "Management of National Parks and Equivalent Reserves" that "Few of the world's parks are large enough to be in fact self-regulatory ecological units; rather, most are ecological islands subject to direct or indirect modification by activities and conditions in the surrounding areas" (Leopold et al., 1963).

The removal of Indian people, the suppression of fire, and a century of modifications and external influences have profoundly altered the biotic communities in national parks. Consequently, these areas no longer contain the naturally diverse conditions that existed when they were first observed by European visitors. As the Secretary of Interior's Advisory Board on Wildlife Management, chaired by Dr. A. Starker Leopold, stated in its 1963 report ". . . biotic associations in many of our national parks are artifacts, pure and simple. They represent a complex ecological history but they do not necessarily represent primitive America" (Leopold et al., 1963).

Dr. Leopold elaborated on this point in the last letter that he wrote on the subject before his death, in which he stated that "Our parks are too small in area to relegate to the forces of nature that shaped a continent" (Leopold, 1983). Dr. Leopold then gave examples of park deterioration that included the loss of ancient aspen forests and associated wildlife in Yellowstone due to the overpopulation of elk, and he concluded by saying that "Management issues of this kind involve judgement followed by action. They are not resolved simply by 'allowing natural ecosystem processes to operate'" (Leopold, 1983).

The Canadian Park Service has accepted the role of people in nature and moved forward to embrace scientific management while the U.S.

National Park Service has moved backward by taking refuge in theology. Unlike the U.S. Park Service's decision to let Yellowstone burn, the Canadian Park Service is using prescribed fires based on scientific research to return the forests to a more natural condition. Cliff White, the Canadian fire management coordinator, stated that Canadians cannot accept the notion about fire that "as long as lightning started it, it's God's way." "We can't use that here," he said, "because God's way is too rough" (see Kunzig, 1989).

Park managers in Canada follow a logical step-by-step management process that involves documenting historic conditions; specifying goals for restoring vegetation and fire based on those conditions; specifying measurable objectives for assessing success or failure; intervening as necessary to achieve those objectives; monitoring their success; and revising their plans to incorporate new knowledge or to correct errors. In other words, managers in the Canadian Park Service use scientific management. They are professionals who are comfortable with giving scientific reasons for their actions and standing by the consequences. They are also willing to change management practices as knowledge advances.

While the Canadian Park Service is using scientific management, the U.S. Park Service is relying on theological management in many national parks. The implicit goal of theological management is to leave park and wilderness areas untouched by humans. Success is measured by the degree to which human influences have been eliminated from the parks. The irony of theological fire management is that park managers are dictating the future condition of national parks by trying to eliminate their own influence. They are imposing their own human biases on the meaning and purpose of parks while simultaneously denying their dominant role in nature.

THEOLOGICAL MANAGEMENT AND SCIENTIFIC BIAS

Theology prevents the U.S. Park Service from changing, and forces Park Service administrators to continually use new arguments to defend old doctrines. Inevitably, adherence to the philosophy of "letting nature take its course" compromises the objectivity of science. Those who subscribe to this philosophy reject in advance any knowledge, proposed research or insights that question existing policy. Thus the Park Service often spends precious resources to hire sympathetic scientists to conduct research that is designed to fend off criticism rather than to answer questions that are designed to improve management practices.

One of the most troubling examples of possible bias is the repeated use of a statement by the Park Service that large-scale fires only occurred in Yellowstone every 200 to 400 years. In fact, this alleged 200-400 year fire cycle is the single most important defense used by the Park Service to justify the 1988 wildfires as a natural event. Evidence for this fire cycle, however, comes from a single study (Romme and Despain, 1989), and the analysis of the data in that study is seriously flawed.

Romme and Despain (1989) conducted their study on a 320,000 acre area of the subalpine plateaus and mountains in Yellowstone National Park. This is precisely the environment in which they claim Indian burning was minimal and fire suppression was only effective for the past 30 years. Therefore, they conclude that fuels have not accumulated due to the effects of fire suppression and the elimination of Indian burning. They argue that this means the conditions that led to the wildfires of 1988 were natural, including fuels and weather. Therefore, the fires were also natural.

Romme and Despain (1989) documented the percent of the study area that was burned during fifty year periods between 1690 and 1988. Using these data, and the presumption that fuel

conditions were natural, they state that "Our conclusion is that the fires of 1988 were more or less a natural event in the ecological history of Yellowstone Park, a perturbation such as might occur every 200 or 300 years." As Figure 1 shows, their selection of fifty year periods for the display of their data does give the false appearance of a 300 year interval between large scale fires. Both their conclusion, and the method they selected to display the data from which their conclusion was derived, are convenient because they support existing Park Service fire policy. Unfortunately, their analysis is deceptive and wrong!

As Figure 2 shows, breaking Romme and Despain's (1989) data into smaller ten year periods changes the picture substantially. The period from 1690 to 1740 was characterized by fires in every decade while the period from 1940 to 1988 was nearly free of fires except for the massive wildfire of 1988 (Figure 2). Thus any conclusion about these two periods that is based on the assumption that they are similar is invalid. Consequently, Romme and Despain's (1989) own published data contradicts their conclusion and shows that the wildfires of 1988 were unprecedented in the period studied.

Romme and Despain (1989) also argue that the elimination of Indians in 1878, and the implementation of a fire suppression policy in 1886, had no effect on fuels in Yellowstone National Park. Again, their own data contradict their statement as can be clearly seen in Figure 3. The long period of frequent fires ended almost abruptly between 1878 and 1886, with the exception of only one decade prior to 1988. This means that available fuels did accumulate in Yellowstone for over a century. These fuels were critical to the size and severity of the 1988 wildfires.

Finally, as Figure 4 shows, there is a dramatic difference between the "Indian and lightning fire period" in Yellowstone (1690 to 1886) and the "fire suppression and let burn period" (1886 to 1988). This difference distinguishes the historic natural fire cycle in Yellowstone from the unnatural fire cycle that was created by the intervention of European settlers. The historically unprecedented 1988 wildfires in Yellowstone are a conspicuous example of the potential magnitude of future fires that will occur as part of this unnatural fire cycle.

RESTORING BIODIVERSITY

The U.S. National Park Act of 1916, as well as acts establishing individual park units, stress "naturalness" as a primary goal for the creation and management of national parks. The U.S. Wilderness Act of 1964 also uses the preservation of "natural conditions" as one of the goals for wilderness (Bonnicksen and Stone, 1985). The problem is that "natural" is not defined, so restoration ecologists have no clear goal for guiding restoration projects (Kilgore, 1984). Ambiguous terms like "natural" require further clarification before they can serve as goals for restoration ecology.

There are three broad categories of restoration goals: structural, functional, and holistic (Bonnicksen, 1988a, 1990). Structural goals concentrate on the elements or parts of biotic communities, such as species composition and the arrangement of those species in space. Functional goals do not include the structure of biotic communities because function, such as wildfire and plant succession, are more important. Holistic goals are comprised of both the structural and functional attributes of biotic communities. Therefore, both attributes of biotic communities are considered equally important as standards for measuring the success of holistic goals.

Biodiversity is a structural goal because it focuses on the number and kinds of "things" in a particular area. The arrangement of "things" in horizontal and vertical space, and time, may also be essential attributes of biodiversity. The number of different species or within-species

genetic variations are examples of measurable attributes of biotic communities that can be used as standards of authenticity for the historical period. Similarly, knowing the relative proportions of aggregations in vegetation mosaics and their seral stages is often essential for achieving this restoration goal. The relative size of plant and animal populations, or aggregations, may also be important in restoring biodiversity. A restoration ecologist could also use one of several diversity indexes to measure evenness in the distribution among species and aggregations. Statistical pattern analysis of aggregations may also be important, especially measures of randomness, clumping, or uniformity, and the intensity and grain of the patterns. Measures of the insularity of communities may also be critical to sustainable management of biodiversity.

The biodiversity goal is consistent with the definition of naturalness provided by the 1963 recommendations of both the Leopold Committee and the National Academy of Sciences Advisory Committee to the National Park Service on Research. The Leopold Committee suggested that "the goal of managing the national parks and monuments should be to preserve, or where necessary to recreate, the ecologic scene as viewed by the first European visitors" (Leopold et al., 1963). The committee tempered its recommendation, however, by stating that "if the goal cannot be achieved it can be approached. A reasonable illusion of primitive America could be recreated" (Leopold et al., 1963). Similarly, when referring to this recommendation, the National Academy of Sciences report cautioned that "the ideal, though admirable, may not be fully attainable; yet it is desirable to move in that direction" (National Academy of Sciences 1963). These recommendations were also adopted by Secretary Udall and incorporated into the administrative policies of the Park Service (U.S. National Park Service, 1968). This definition of naturalness includes biodiversity but it is also more comprehensive because ecological processes are an important part of "a vignette of primitive America."

Restoring biodiversity in a park or wilderness area where naturalness is the primary goal requires not only a quantitative description of biodiversity, which serves as a standard for restoration, but also a description of the disturbance history and ecological processes that led to, and sustain biodiversity. The disturbance history of a biotic community should be assessed in a systematic manner that considers the agent of disturbance; that is, whether or not that disturbance was caused by human or non-human forces, or an interaction between both forces. The types of disturbances that affect particular biotic communities must also be determined, as well as the scale, frequency, intensity, and impact of the disturbances.

It is also important to know the agent responsible for the disturbance history of a community. For example, the historic biodiversity of Yellowstone National Park cannot be restored by chance lightning fires. Indian fires interacted with lightning fires to maintain vegetation in a mosaic pattern that supported a diverse and abundant variety of wildlife and plant species. Today many lightning fires do not burn in a natural manner because they no longer interact with the effects of Indian fires. The vegetation mosaic that resulted from the interaction of Indian-set fires and lightning fires sustained a high level of biodiversity in Yellowstone. The unnaturally large scale of the 1988 wildfires has substantially reduced that biodiversity in many areas of the park.

Elimination of Indians as a source of fires has resulted in succession toward more shade tolerant tree species, thickening understory vegetation, heavier fuel accumulations, and a concomitant increase in the potential for more catastrophic wildfires. Lightning fires cannot be allowed to burn in these forests (Bonnicksen, 1989a, 1989b). Therefore, if the agent of disturbance is gone then the effects of the disturbance must be simulated. In the case of Yellowstone, this means that prescribed burning to simulate Indian fires will be an essential and continuing part of scientific management.

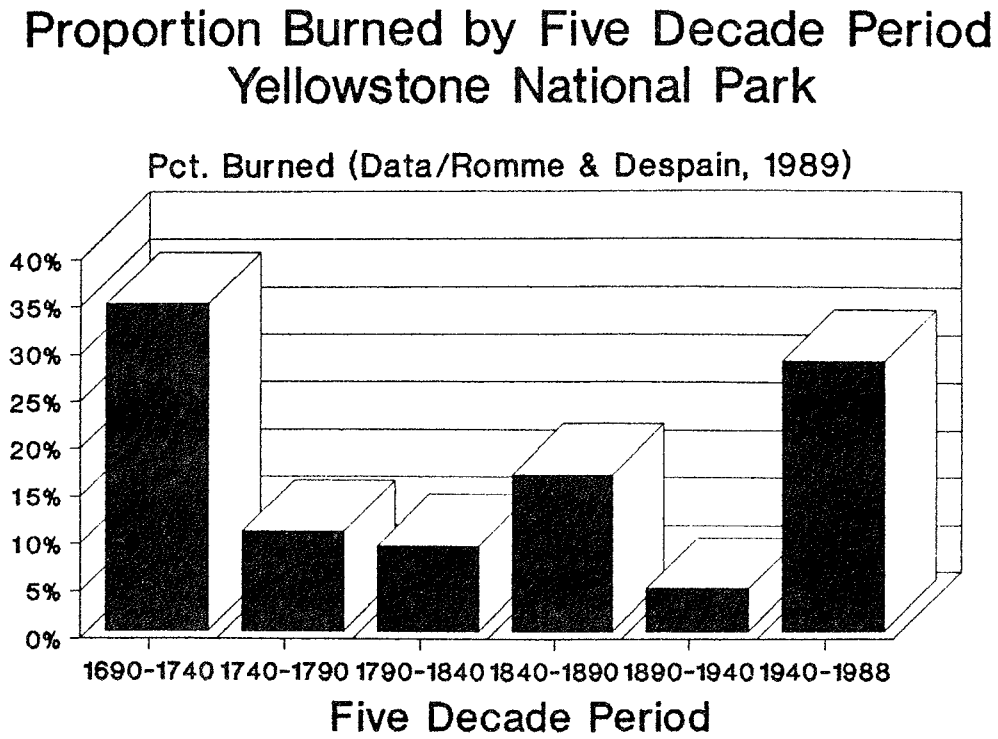

FIGURE 1

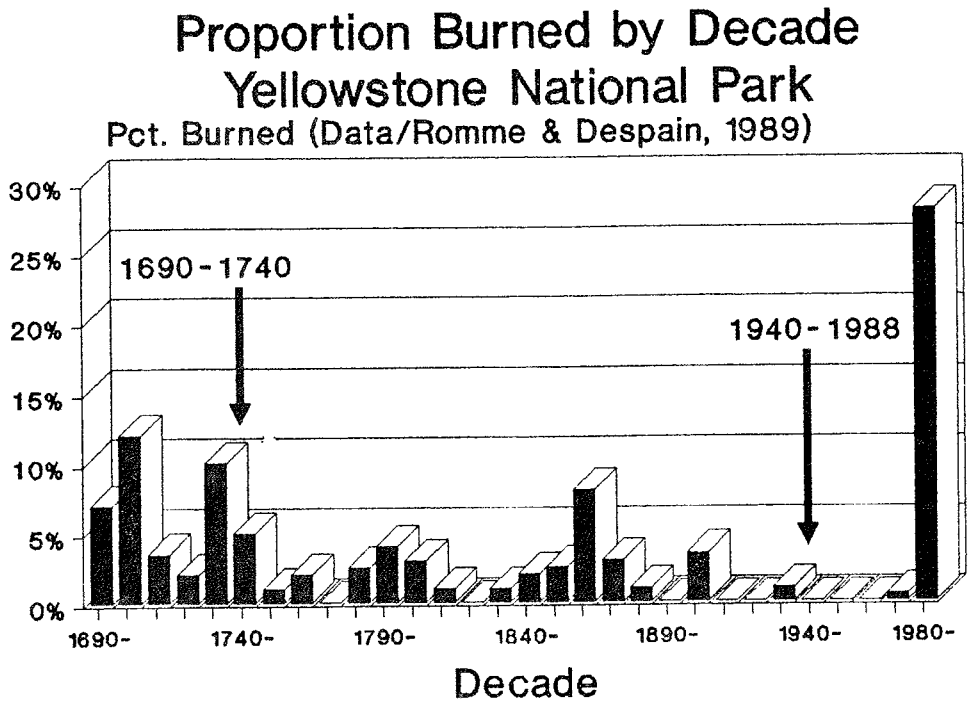

FIGURE 2

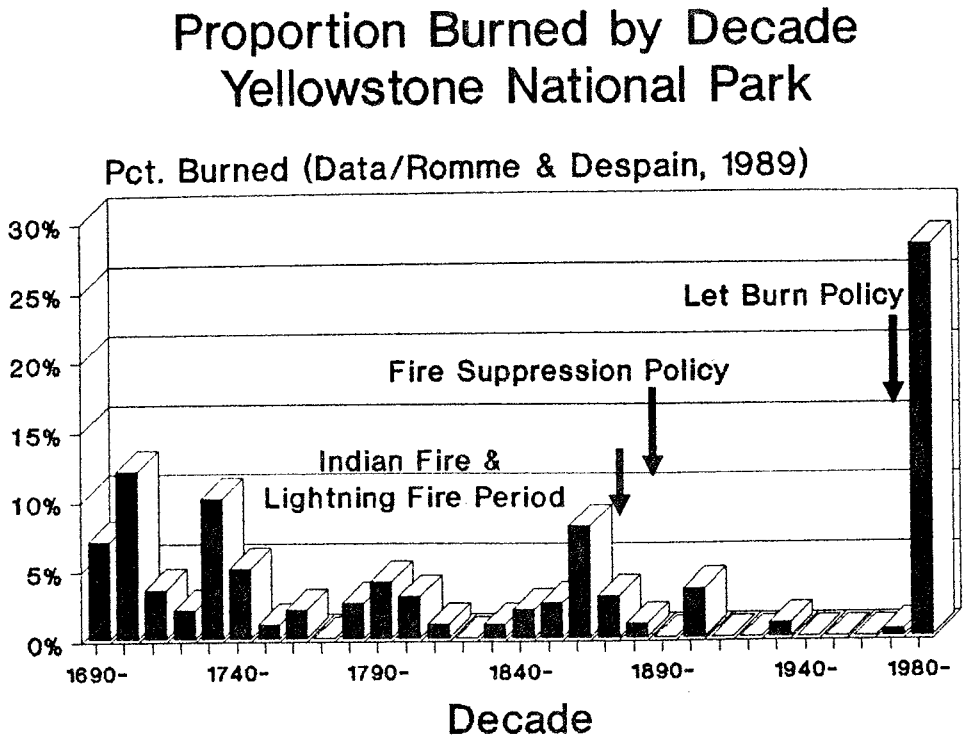

FIGURE 3

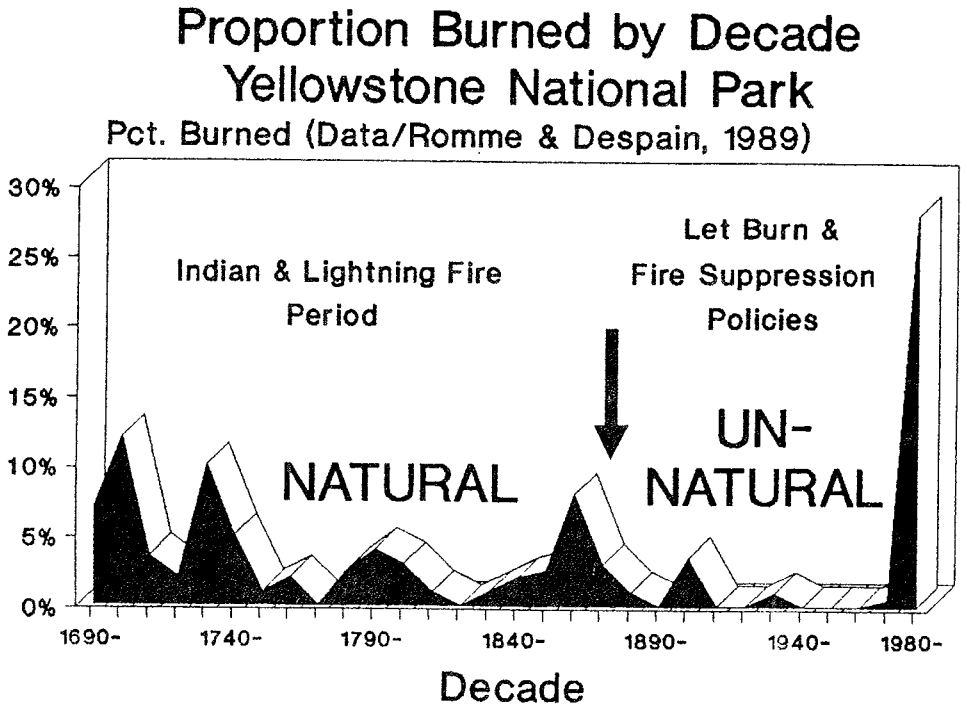

FIGURE 4

CONCLUSION

The Yellowstone wildfires of 1988 have stimulated a long overdue discussion among resource professionals and the public about the objectives and management of our national park and wilderness areas. Understanding the two management philosophies that underlie our choice for the future--theology and science--is an essential part of that discussion. The selection of theology as our guiding philosophy takes away the option of making further choices. Eliminating the influence of humans is all that is required to insure the success of theological management.

In contrast, the selection of science as our guiding philosophy requires humans to play an active role in managing the environment. In my opinion, scientific management will insure that our national parks continue to serve their original purpose of providing for "the enjoyment of the people," and preserving naturalness as stated in legislation and the inscription on the stone gate to Yellowstone National Park. Theological management will only satisfy the religious needs of a small but influential group. In either case, the choice that is made today will have irreversible consequences for the future of our national park and wilderness areas.

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