

Defining, Measuring, Monitoring, and Managing the Sustainability of Parks for Outdoor Recreation

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EXECUTIVE SUMMARY: Sustainability of parks for outdoor recreation is a long-standing and increasingly urgent issue. Sustainability is an intuitively appealing concept, but it is often seen as so broad that it can be daunting to define and manage in an operational way. The purpose of this paper is to suggest that management-by-objectives frameworks used in contemporary park and outdoor recreation management can be useful in defining, measuring, monitoring, and managing the sustainability of parks for outdoor recreation. The paper presents and describes a generalizable management-by-objectives framework that can be used for this purpose. This framework requires 1) formulating indicators and standards, 2) monitoring indicators, and 3) managing to ensure that standards are maintained. This approach is informed by principles derived from the broad environmental and sustainability literature, including carrying capacity, common property resources, ecosystem management, adaptive management, environmental justice, and ecotourism. Defining, measuring, monitoring, and managing sustainability can be supported by a program of natural and social science research, and this paper offers examples of how research can support formulation of indicators and standards, monitoring and management. Given advances in addressing the sustainability of parks for outdoor recreation—a set of environmental concepts and principles to draw on, an associated management-by-objectives framework, a growing set of research approaches, an array of management practices, and a number of hopeful case studies—application of sustainability to parks and outdoor recreation should move ahead more deliberately.

KEYWORDS: Sustainability, parks, outdoor recreation, management-by-objectives, indicators, and standards

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Contemporary emergence of the concept of “sustainability” can be traced to the 1987 report of the World Commission on Environment and Development, which advanced the principle that managing the environment for the benefits of the present generation should not preclude the ability of future generations to attain needed environmentally related benefits (World Commission on Environment and Development, 1987). Since then, many efforts have been undertaken to define sustainability in a more operational way and to apply it in a number of fields of study and practice. The purpose of this paper is to suggest that the field of parks and outdoor recreation has been a leader in defining and applying the concept of sustainability through development and application of contemporary management-by-objectives frameworks such as Limits of Acceptable Change (LAC) developed by the U.S. Forest Service (Stankey, Cole, Lucas, Peterson, Frissell, & Washburne, 1985) and Visitor Experience and Resource Protection (VERP) developed by the U.S. National Park Service (National Park Service, 1997; Manning, 2001). This paper will 1) illustrate the ways in which these frameworks embody emerging concepts and principles of sustainability and environmental management more broadly, 2) present a generalizable management-by-objectives framework designed to guide management of sustainable outdoor recreation, 3) suggest the ways in which programs of interdisciplinary research can support application of sustainability, and 4) encourage more deliberate and widespread application of this approach to sustainable management of outdoor recreation in parks and related areas.

A number of management-by-objectives frameworks have been developed to guide management of parks and related outdoor recreation areas. While terminology and sequencing of steps may vary among these frameworks, all address sustainability by 1) defining and expressing management objectives in the form of empirical indicators and standards, 2) monitoring indicators, and 3) applying management actions to ensure that standards are maintained (Manning, 2004). Indicators are measurable, manageable variables that are proxies for management objectives, and standards define the minimum acceptable condition of indicators (Manning, 2011). Application of these frameworks helps ensure that the environmental, experiential, and managerial integrity of parks—their sustainability—is maintained. An expanding program of interdisciplinary research is being conducted to support application of these frameworks to diverse units of the U.S. national park and forest systems and other areas inside and outside the U.S. (Manning, 2007).

An example may help illuminate this approach to sustainability. The Wilderness Act of 1964 suggests that areas designated by Congress as part of the National Wilderness Preservation System are to be managed to provide opportunities for “solitude.” Therefore, solitude is an appropriate management objective for most wilderness areas. However,

solitude is a somewhat abstract concept that is difficult to measure directly. Research on wilderness use suggests that the number of visitor groups encountered along trails and at campsites is important to visitors in defining solitude (Manning, 2011). Thus, trail and camp encounters are potentially good indicators because they are measurable, manageable, and serve as a proxy for the management objective of wilderness solitude. Research also suggests that wilderness visitors have standards about how many trail and campsite encounters can be experienced before opportunities for solitude decline to an unacceptable degree (Manning, 2011). For example, a number of studies suggest that wilderness visitors generally find no more than five groups per day encountered along trails to be acceptable and wish to camp out of sight and sound of other groups. Therefore, a maximum of five encounters per day with other groups along trails and no other groups camped within sight or sound may be good standards for defining solitude as a dimension of the sustainability of wilderness areas.

Concepts and Principles of Sustainability

The approach to the sustainability of parks for outdoor recreation outlined above is built on a growing foundation of concepts and principles derived from the broad environmental literature.

Carrying Capacity

The historic concept of “carrying capacity” suggests that there are limits to the use of environmental resources, and this concept has been applied in a number of fields, including wildlife (Leopold, 1933), range (Holechek, Piper, & Herbel, 1998), fisheries (Beverton & Holt, 1957), parks and outdoor recreation (Wagar, 1964; Manning, 2007), and even the ultimate population of Earth (Ehrlich, 1968; Meadows, Randers, & Behrens, 1972; Cohen, 1995). In the field of parks and outdoor recreation, the 1916 Organic Act of the National Park Service (NPS) intimated the issue of carrying capacity (and ultimately, sustainability) in its classic mandate to:

...conserve the scenery and the natural historic objects and the wildlife 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. (39 Stat. 535, 16 U.S.C. 1)

Parks are to be used for outdoor recreation, but the impacts of use must not degrade park resources or experiences to the point that they cannot be enjoyed by future generations. The sustainability of parks for outdoor recreation must recognize these inherent limits (carrying capacities), and these limits are explicitly addressed in management-by-objectives frameworks in the form of standards for park resources and the visitor experience.

The Commons

The concept of “common property resources” or “the commons” has also contributed to understanding and application of sustainability. In a classic paper published in *Science*, Garret Hardin defined the commons as resources that are owned by the public at large, and suggested that these resources are inherently subject to overexploitation because individual users gain the full benefits of their use but suffer only a fraction of the costs (impacts) they impose (Hardin 1968). Hardin explicitly noted national parks such as Yosemite as examples of common property resources:

The National Parks present another instance of the working out of the tragedy of the commons. At present, they are open to all without limit. The parks themselves are limited in extent—there is only one Yosemite Valley—whereas population seems to grow without limit. The values that visitors seek in the parks are steadily eroded. Plainly, we must soon cease to treat the parks as commons or they will be of no value to anyone. (p. 1245)

The remedy to the “tragedy of the commons” was, in Hardin’s words, “mutual coercion, mutually agreed upon”—limits on resource use to which most should agree and to which everyone must abide. Such management actions (e.g., regulation and limitation of use)—designed to maintain environmental and experiential standards—are an explicit component of contemporary management-by-objectives approaches to the sustainability of parks for outdoor recreation.

Ecosystem Management

The concept of “ecosystem management” has also contributed to the contemporary approach to the sustainability of parks for outdoor recreation. Ecosystem management suggests that environmental management must address the integration of ecology and society (Agee & Johnson, 1987; Society of American Foresters, 1993; Grumbine, 1994; Endter-Wada, Blahna, Krannich, & Brunson, 1998). The integrity of important ecological processes must be protected, but environmental resources must ultimately be managed for the benefits of society. Thus, ecosystem management has been defined as “regulating... ecosystem structure and function...to achieve socially desirable conditions” (Agee & Johnson, 1987) and “integrating...ecological relationships within a complex sociopolitical and values framework” (Grumbine, 1994). The contemporary management-by-objectives approach to the sustainability of parks for outdoor recreation, and especially the research that increasingly underlies its application, draws heavily on society—park visitors, residents of surrounding communities, the general public—to help define the management objectives of parks for outdoor recreation and especially their empirical expression in the form of indicators and standards.

Adaptive Management

The contemporary approach to the sustainability of parks for outdoor recreation is also informed by the concept of “adaptive management” (Lee, 1993; Stankey, Clark, & Bormann, 2005; Holling, 1978; Walters, 1986). Environmental management should be conducted within a framework that identifies goals and objectives and works toward these ends through a program of monitoring and management. An important example of this idea is a report by the Ecological Society of America that recommends that environmental management be “driven by explicit goals...and made adaptable by monitoring and research” (Christensen, et al., 1996). This principle is fundamental to the evolving concept of adaptive management, which emphasizes the role of ongoing monitoring and evaluation as a way of informing environmental management. Monitoring is an integral component of the contemporary management-by-objectives approach to the sustainability of parks for outdoor recreation, assessing the degree to which standards for relevant indicators of management objectives have been attained and the effectiveness of management practices in maintaining these standards.

Environmental Justice

Matters of “environmental justice” must also inform sustainability. The report on sustainability prepared by the World Commission on Environment and Development explicitly noted that use and management of natural and environmental resources must be equitable for both moral and pragmatic reasons. Without equitable distribution of environmental benefits, long-term sustainability will ultimately be undermined by political instability. Research over the past several decades has consistently found that racial and ethnic minorities are substantially underrepresented in many types of parks and outdoor recreation areas, especially national parks (Floyd 1999; Solop, Hagen, & Ostergren, 2003). Contemporary management-by-objectives frameworks can help address this issue by crafting management objectives and formulating indicators and standards that are more explicitly inclusive and that result in a more diverse system of parks and outdoor recreation areas designed to meet the needs of an inherently and increasingly diverse society.

Ecotourism

Growing use of parks and protected areas for outdoor recreation—now often called “nature-based tourism” or “ecotourism”—can generate substantial revenues in the form of entrance fees and tourist spending for commercial services. Interest in ecotourism has contributed important ideas about the distribution and use of such revenues and how they should be allocated (Drumm & More, 2005; Drumm, 2003; Lindberg, 1991; Munasinghe & McNeely, 1994; Honey, 2008; Buckley, 2009). Recreational use of parks and protected areas can degrade these sites through trampling of vegetation, soil compaction and erosion, water pollution, and disturbance of wildlife, as well as diminish the quality of the visitor experience through crowding, conflicting uses, and aesthetic implications of resource degradation. Concern for the sustainability of parks and related visitor attractions demands that a portion of the revenues generated by outdoor recreation and ecotourism be reinvested in park protection and management. Similarly, the costs and benefits generated by parks and related areas should be equitably distributed among stakeholders. For example, people who live in and around parks are often subjected to traffic congestion, high prices for housing and consumer goods, and termination of traditional uses of parklands, but may not share in the economic benefits of park-related tourism. Recent texts on ecotourism stress these economic issues. For example, Honey’s (2008) recent text on ecotourism concluded “Effective conservation now includes involving and benefiting the people living nearest the protected areas...and nature tourism has come to mean not just wilderness experiences, but also activities that minimize visitor impact and benefit both protected areas and surrounding human populations” (p. 443). Similarly, Buckley’s (2009) text concluded, “Key economic issues in ecotourism policy include contributions to local communities and to conservation...” (p. 92). Concern for these economic issues should be embedded in sustainable park and outdoor recreation management. Management-by-objectives frameworks include a management dimension in which economic objectives and associated indicators and standards could be developed and applied.

A Management-by-Objectives Framework

As noted above, although a number of management-by-objectives frameworks for parks and outdoor recreation have been developed, the similarities among these frameworks are more striking than their differences (Manning, 2004). Thus, it might be useful to distill and present a generalizable framework that is adaptable to guiding sustainable outdoor recreation in many park and outdoor recreation contexts, including local, regional, national, and even international. The framework shown in Figure 1 and described below borrows and builds on the frameworks found in the professional and scientific literature.

As in all management frameworks, the process begins with an inventory of existing park and outdoor recreation conditions, including resource, social, and managerial (Step 1). This might include gathering baseline information about 1) the extent, location, and

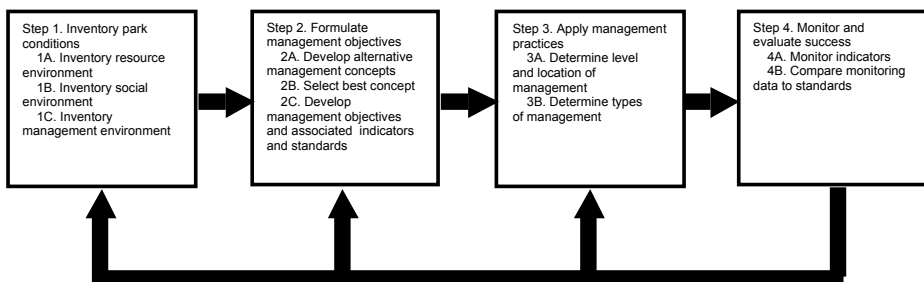


Figure 1. A Management-by-Objectives Framework for Defining, Measuring, Monitoring, and Managing the Sustainability of Parks for Outdoor Recreation.

condition of natural and cultural resources (Substep 1A), 2) the characteristics, needs, and wants of visitors and potential visitors (Substep 1B), and 3) an assessment of management issues and associated potentials and constraints (Substep 1C). The description of current recreation conditions collected in in Step 1 will provide input for Step 2 of the management framework.

Step 2 begins with development of alternative management concepts (Substep 2A). Initial assessment of the inventory data in Step 1 normally suggests general management directions. Legislative or agency policy directives, for example, often describe, at least in a general fashion, the type of recreation experiences to be provided and the degree of emphasis to be placed on maintaining natural and cultural resources. The financial and budgetary resources available for management also can influence management direction; high use levels generally are not feasible without concomitant budgets and personnel to accommodate them. Natural and cultural resource factors also can pose important constraints on general management direction. Unique or fragile resources, for example, suggest relatively low use levels and low-impact activities or very high intensity management. The outdoor recreation experiences desired by the public influence management directions; public preferences should be accommodated to the extent possible, given the constraints of resource and management conditions. Economic considerations may suggest a need for policies and programs to address the financial foundation for park protection and equitable distribution of park and tourism-related costs and benefits.

Normally, there will be several management concepts feasible for an area. This is a reflection of the diversity of resource, social, and management conditions found and the variety of configurations in which they may be arranged. The situation is made even more complex in large areas that might appropriately be divided into two or more use areas or zones, each reflecting a different combination of conditions and providing a different type of recreation opportunity. But to encourage realistic and efficient public input and evaluation, management concepts must be limited to a few that reflect, in the initial judgment of planners and managers, the most realistic and reasonable alternatives.

Selection of the “best” or favored management concept (Substep 2B) involves systematic evaluation of the alternative concepts developed in Substep 2A. Systematically examining and describing the effects of each concept can facilitate this evaluation. Pertinent considerations include 1) the contribution of each concept to diversity in the total outdoor recreation system, 2) potential effects of each concept on visitor use of the area, 3) the resource and social values that are enhanced or diminished by each concept, 4) the management feasibility of accomplishing each concept, and 5) the equitable distribution of costs and benefits.

Development of management objectives and associated indicators and standards for the best or favored management alternative (Substep 2C) can be challenging. The general prescriptions of Substep 2B need to be made more specific so they can guide day-to-day management and be used to evaluate management success or the degree to which outdoor recreation is being managed in a sustainable way. Several factors can help guide this process: 1) the management concepts themselves indicate which elements in the total recreation environment are to be emphasized and may suggest a general range of conditions for these elements, 2) research can indicate which factors of the total recreation environment should be the subject of management objectives, 3) a program of research can help identify potential indicators and standards, 4) if a program of primary research is not possible, the outdoor recreation literature may be suggestive of potential indicators and standards, 5) management objectives should reflect a range of conditions for factors important to visitors to incorporate a desirable element of diversity. At the conclusion of Step 2, explicit management objectives and associated indicators and standards should be formulated.

The process now turns to determining how to get from the current to the desired situation (Step 3). This involves deciding what level and type of management actions are to be applied to the area. Substep 3A determines the level and location of management needed.

This will be determined by the congruence between current conditions as determined in the initial inventory and desired conditions as specified by management objectives. Obviously, the wider the difference between existing and desired conditions, the greater will be the management efforts needed to meet management objectives.

Substep 3B determines the type of management needed. If desired conditions currently are unmet, then some management action is needed. A variety of practices are available for managing outdoor recreation (Cole, Peterson, & Lucas, 1987; Anderson, Lime, & Wang, 1998; Manning, 2011). Examining the range of management alternatives can be helpful in developing an appropriate management program. Indirect management practices (those that do not limit the freedom of choice of visitors) generally should be favored over direct practices where they can be shown to be effective (Manning 2011).

Step 4, monitoring and evaluating success, is a critical but sometimes neglected step in all management frameworks. Once a management program has been developed and implemented, it is necessary to periodically assess whether desired conditions are being achieved and maintained (i.e., whether sustainability has been achieved). In outdoor recreation management, this involves monitoring indicator variables to determine if standards are being met.

Indicators should be monitored periodically (Substep 4A) to determine whether standards are being met. An important issue to be addressed in designing the monitoring program concerns how frequently indicator variables should be measured. There are no precise guidelines for making this determination, as site conditions and budgetary circumstances often will be pivotal considerations. However, several circumstances may dictate more frequent monitoring than normal: 1) when the condition of indicator variables is close to those specified by standards, 2) when rates of environmental, social, or managerial change are thought to be high, 3) when the initial inventory and data base for the area are incomplete or of questionable quality, 4) when the potential effectiveness of management actions is not well known or predictable, and 5) where there have been unanticipated changes to the area such as additional access or changes in adjacent land uses.

Substep 4B involves comparing the conditions found in monitoring to those specified by standards and determining whether success (i.e., sustainability) has been attained and whether changes in management are needed. Quality in outdoor recreation management is most appropriately defined as the degree to which recreation opportunities provide the experiences for which they are designed and managed (Manning, 2011). If monitoring indicates that standards are being met, then no change in management may be needed. However, if monitoring indicates that standards are violated, or are in danger of being violated, then additional management is required.

A final issue involves the cyclic aspects of the management framework described above and illustrated in Figure 1. Under normal circumstances, evaluation of sustainability focuses on Step 3, analyzing what, if any, changes in management are needed to achieve management objectives and meet associated standards. At some point, however, it may be appropriate to reevaluate management objectives and/or indicators and standards. In this case, evaluation focuses on Step 2. Changes in management objectives and associated indicators and standards should only be made consciously and explicitly, following the procedures outlined in Step 2. Evaluations of this scope normally will need to be done only infrequently, perhaps every ten, fifteen, or twenty years. Finally, there will come a time when baseline data for the area are outdated or no longer adequate, and then evaluation must focus on Step 1. An evaluation of this scope, however, likely will be very infrequent, perhaps only every 20 years or so.

Research to Support Application of the Sustainability of Parks for Outdoor Recreation

An expanding body of interdisciplinary research has supported the application of sustainability to parks through management-by-objectives frameworks. This research

has supported all three of the most challenging steps of these frameworks—formulating indicators and standards, monitoring, and management—and has drawn on the environmental concepts and principles outlined earlier.

Indicators and Standards

Research has helped identify indicators and standards for outdoor recreation for many diverse parks and related areas (Manning, 2007; Manning, 2011). Indicators and standards help define and measure the sustainability of parks by offering empirical expressions of management objectives. An early application of this approach employed a program of natural and social science research (e.g., resource inventories, visitor surveys) to identify a suite of indicators at Arches National Park, Utah, including impacts to microbiotic soil crust caused by visitors walking off maintained trails and the number of visitors encountered along trails and at attraction sites (Manning et al., 1996a; Belnap, 1998). Standards of quality for these and other indicators were identified through a survey of visitors that employed normative theory and methods and associated visual simulations to present a range of conditions for selected indicators (Vaske & Whittaker, 2004; Manning & Freimund, 2004). Norms are a long-standing construct in the social sciences addressing social agreement about appropriate behavior, and this has more recently been extended to include measures of acceptable environmental and social conditions in parks and related areas (Shelby & Vaske, 1991; Vaske & Whittaker, 2004; Manning, 2007). Visual simulations of a range of conditions for indicator variables can enhance the ease and accuracy of communication between researchers and respondents (Manning & Freimund, 2004; Manning, 2010). Respondent evaluations of the visual simulations of environmental and experiential conditions at Arches National Park determined the point at which impacts to ecological and social indicators were no longer judged as acceptable. For example, 30 people at one time at Delicate Arch, an iconic park feature, was found to be the threshold of acceptability for crowding (Manning, Lime, & Hof, 1996a).

Research at other national parks has identified a broad range of indicators and standards for issues such as environmental impacts, crowding, and conflict (Manning, 2011). For example, research in Yosemite National Park, California, identified standards for the amount of ground cover vegetation at wilderness campsites (Newman, Manning, Dennis, & McKonly, 2005). Research at Boston Harbor Islands National Recreation Area, Massachusetts, found that the number of encounters with groups while hiking was an important indicator and identified a range of standards for this indicator across several sites (Manning, Leung, & Budruk 2005). A study at Acadia National Park, Maine, found that conflict among hikers and bikers on the carriage roads was an important indicator for both types of visitors and identified standards for such conflict (Manning, Jacobi, Valliere, & Wang, 1998; Jacobi & Manning, 1999). Indicators and standards derived from this type of research are compiled in several sources (Manning, 2007; Manning, 2011; NPS User Capacity, 2011).

This research, and the management-by-objectives frameworks it is designed to support, addresses several of the environmental principles and concepts noted earlier. For example, standards represent the limits on resource use suggested by the concept of carrying capacity. Moreover, these standards are derived by engaging park visitors and other stakeholders in determining the environmental and experiential conditions most appropriate in the context of national parks, and this is in keeping with the integration of environment and society as supported by the concept of ecosystem management.

Research on indicators and standards can also help address the diversity-related objectives of environmental justice and associated issues of economic policy. For example, a recent survey of the general population found significantly different crowding-related standards in national parks for white and black respondents, and this information can be used to plan and manage a spectrum of outdoor recreation opportunities designed to meet the needs of an increasingly diverse society (Stanfield, Manning, Budruk, & Floyd, 2005). Similarly, standards might be developed for the minimum acceptable percentage of park-related revenues that should be reinvested in park protection and management and

that should accrue to local populations, and the minimum percentage of park management costs that should be paid by park visitors.

Monitoring

Management-by-objectives frameworks require a long-term commitment to monitoring. Indicators must be monitored to assess their condition in relation to standards, and monitoring can help determine the success of management actions designed to maintain standards. This approach to management reflects the essence of the concept of adaptive management as described above.

Research has helped develop, apply, and assess a number of monitoring approaches. For example, impacts to vegetation can be monitored using remote sensing (Kim, 2009), visitor use levels can be monitored through a variety of counting techniques (Arnberger, Haider, & Brandenburg, 2005; Cessford & Muhar, 2003; Manning et al., 2006), and visitor conflicts can be monitored through periodic visitor surveys (Manning, Jacobi, & Marion, 2006). Development of computer simulation modeling of recreation use has recently allowed for a more “proactive” form of monitoring (Lawson, Manning, Valliere, & Wang, 2003; Cole, 2005; Gimblett & Skov-Peterson, 2008). For example, a series of simulation models of visitor use levels and patterns at several sites in Yosemite National Park, California, were used to estimate the maximum daily use levels that can be accommodated at these sites without violating previously determined crowding-related standards (Manning, Valliere, Wang, Lawson, & Newman, 2002/2003). Similarly, a simulation model of automobile traffic on the Loop Road at Acadia National Park was used to estimate the maximum number of cars that can be accommodated without violating congestion-related standards (Hallo & Manning, 2009).

Management

The management-by-objectives approach to the sustainability of parks for outdoor recreation requires management actions to ensure that standards are maintained. A substantive body of literature has been developed in the field of parks and outdoor recreation on management approaches (Cole et al., 1987; Anderson et al., 1998; Manning, 2011). For example, a number of management practices are possible, and they can be classified by their strategic purpose and the direct and indirect ways in which they influence visitor behavior (Manning, 1979; Peterson & Lime, 1978). A growing number of studies have tested the efficacy of selected management practices. For example, a recent study at Acadia National Park, Maine, observed visitor behavior in response to several experimental management practices (e.g., visitor education, physical barriers) designed to discourage visitors from walking off designated trails (Park, Manning, Marion, Lawson, & Jacobi, 2008). While most management practices tested were found to be at least somewhat effective, only fencing the margins of trails was found to be effective enough to reduce impacts to surrounding soil and vegetation to a substantive degree.

As with monitoring, simulation modeling can sometimes be used to test the effectiveness of management actions. For example, a simulation model of wilderness camping at Isle Royal National Park, Michigan, was used to test the potential effectiveness of several management practices (e.g., limits on use levels, spatial and temporal redistributions of use, addition of campsites) in reducing crowding at designated campsites (Lawson & Manning, 2003). Spatial and temporal redistributions of use were not found to be effective in reducing campsite crowding, reductions in the number of camping permits was found to be effective but would require very substantial reductions, and requiring visitors to follow a prescribed trip itinerary was found to be very effective.

The management component of contemporary management-by-objectives frameworks reflects elements of several of the environmental principles and concepts described earlier. For example, carrying capacity implies that management actions will be needed if such capacities are exceeded, while the literature on common property resources is more explicit, calling for management in the form of “mutual coercion, mutually agreed upon” (Hardin, 1968). Formulation of standards as part of the first component of management-

by-objectives frameworks, and the normative research that can support such standards, imply some level of “mutual agreement” (or at least majority rule as manifested in the context of a plan for a public park). Management action (especially as manifested in a management practice such as a mandatory permit system) constitutes the “mutual coercion.” Moreover, by definition, management actions constitute the second half of the phrase “adaptive management,” while application of such management actions in response to monitoring data constitute the first half of the phrase. Management can also be shaped in several ways by concerns for environmental justice and related economic issues, including the need for a diverse spectrum of park and outdoor recreation opportunities (Manning, 1985), potential discriminatory effects of some management practices such as fees (Manning, LaPage, Griffall, & Simon, 1996b; Fix & Vaske, 2007; More & Stevens, 2000; Martin, 1999), and the disposition of fee and related revenues to ensure long-term protection of park resources and equitable distribution of the costs and benefits of parks and related areas.

Toward Sustainable Parks for Outdoor Recreation

Sustainability is an intuitively appealing concept, but it is so broad that it can be daunting to define and manage in an operational way. However, in the context of parks and outdoor recreation, sustainability can be addressed through management-by-objectives frameworks as outlined in this paper. Formulation of management objectives and associated indicators and standards offer an empirical definition of the sustainability of parks for outdoor recreation—a quantitative and measurable expression of the environmental, experiential, and managerial conditions that should be maintained for current and future generations. Moreover, the empirical character of indicators and standards facilitates measurement and monitoring of sustainability and guides the application and evaluation of management actions designed to maintain standards for indicator variables and, ultimately, sustainability. This approach to defining, measuring, monitoring, and managing the sustainability of parks for outdoor recreation is iterative and adaptive, requiring a long-term commitment to monitoring, applying and evaluating management actions designed to ensure that standards are maintained, and allowing future generation to reevaluate management objectives and associated indicators and standards when warranted by evolving environmental and social conditions. A program of natural and social science research can help guide and inform this process.

Armed with a set of environmental principles and concepts, an associated management-by-objectives framework, a growing set of supporting research approaches, an array of management practices, and a number of hopeful case studies, engaging the sustainability of parks for outdoor recreation should move ahead aggressively. Of course, applying these management and research approaches will be challenging and sometimes even contentious. But failure to address sustainability will be even more painful in the long run. Do we want to conduct our management of parks and outdoor recreation areas by design or default? As Hardin (1968) wrote, “We can never do nothing.” If we choose not to manage the sustainability of parks, we are implicitly deciding that their current conditions are acceptable and that trends in use and related impacts are not worrisome. We should find comfort and courage in the democratic and civic character of the substance and process outlined in this paper. Management of the sustainability of parks should be based on ecological knowledge and social values and related norms. Engaging the public in decisions about the sustainability of parks builds trust, ownership, and the “social capital” that engenders public enthusiasm and support (Minteer & Manning, 2003; LaChappelle & McCool, 2005; Manning & Ginger, 2007).

Despite advances in theory and related empirical methods, some element of management judgment will remain inescapable in matters of the sustainability of parks for outdoor recreation. However, when this judgment is rendered in the context of a rational and transparent management framework that incorporates concepts and principles drawn from the broad environmental literature, and when it is supported and informed by research and related public involvement, it will lead to a program of management that protects both

the environment and the public good, now and in the future. In the conclusion to his paper, Hardin (1968) wrote, "freedom is the recognition of necessity." In other words, we will be truly free to appreciate parks—now and in the future—only after we have addressed their sustainability. This suggests that it is time to move ahead deliberately on matters of the sustainability of parks for outdoor recreation.

In fact, management of parks and related areas is taking a leadership role in the sustainability of the broader environment, and may have much to offer other fields of study and practice. In a special issue of *Science* in 2003 celebrating the 35th anniversary of publication of Hardin's "The Tragedy of the Commons," Editor-in-Chief Donald Kennedy wrote in his introduction that in the efforts to address management of common property resources, carrying capacity, and sustainability, "there have been some real winners, such as managed preserves that blend conservation objectives with recreational values" (Kennedy, 2003). This is hopeful.

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Methodologies for measuring sustainability and political risks. Summary. 7 Implementing a social, environmental, and economic impact measurement system. Mapping the actions that drive performance. Sustainability performance metrics. Engage with your stakeholders. Measuring reputation. 10 The benefits of sustainability for corporations and society. Make sustainability work. Use the Corporate Sustainability Model to improve performance. Create opportunities for innovation. A last word. Endnotes. Bibliography. Environmental Sustainability Measures for Airports. flights and night-time flights, planning and managing land use, and redistributing noise by managing runways and routes use are some of the mitigative measures employed to meet noise quotas and prescribed limits.20 For the purpose of protecting local communities in the vicinity of airports, curfews and avoidance of immission of noise during night might seem to be some of the most.