Introduction

Protected area managers have three responsibilities that direct the stewardship of the special places under their care. First, managers protect the attributes, uses and values that were identified in the enabling legislation or decree that established the protection of the area. Second, managers provide for the highest quality of opportunity for recreational, historical, educational and spiritual uses permitted or authorized in the area. Finally, managers interact with communities adjacent to or within the protected to accommodate their interests, including those that are political, economic and cultural in character.

These three responsibilities constitute management for the public interest. The three together are not necessarily compatible all the time; in fact collisions in these responsibilities typify the daily course of events for protected area managers. For example, as managers seek to sustain the values for which a protected area was established, they may negatively impact the access recreationists have to the area, and may adversely affect the economy of local communities. Discovering and sustaining this public interest is not just solely the job of protected area managers. Seeking the public interest has long been defined as the domain of scientists and experts, in order to neutralize political influences. However, visitor management is more than a scientific problem that is only subject to technical inquiry; it is also within the realm of enlightened citizenry, deliberative study, and public debate. Such citizenry helps managers identify special values, establish standards of acceptable impact, identify the social acceptability of proposed actions, and ensure accountability for protection—responsibilities that are inherently political in character.

Meeting these responsibilities is difficult in even the technical arena. Often the legislatures, parliaments and governments designating these areas have little notion of the paradoxes, issues and questions that are engendered through protected area status; and if so, many times leave the resolution of these to managers who are habitually overworked and underpaid with multiple and competing demands for their attention, yet driven by a strong professional ethic of land stewardship. Further complicating the difficult task of meeting these responsibilities in many protected areas, such as those in the UK, Greece and many other countries, is the presence of substantial private lands and communities within the exterior boundaries. In these situations, the objectives of individual private landowners may not be congruent with those of the protected area managing agency. Land may be developed in ways that intrude upon

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and are incompatible with the overriding purpose of the park. Ecosystem processes disregard political boundaries; and often, such boundaries do not reflect bioregional realities, but the realities of political processes and compromises; comprises required to gain the consent of those affected.

Management of visitors often requires controlling access to a protected area, a formidable challenge, if not impossible task in the multiple ownership situations typically found in protected areas. And, the presence of communities within or adjacent to the protected area frequently leads to strong economic interests in its management, particularly for tourism but also for access to resource commodities.

While in some countries administrative policies have been developed to the extent that incompatible and conflicting uses on private lands within a protected area can be regulated or controlled, in many other countries, protected area managers are often left with few tools, other than altruistic arguments, to convince land owners of the need to apply development judiciously and sensitively. In many cases, private land owner decisions are not subject to the same public scrutiny and stakeholder involvement that confront national park administrations. In such situations, the challenges of sustaining protected area values may be overwhelming. Nevertheless, managers of protected areas retain a responsibility to involve communities, use best practices, and have decisions informed by science. And, because of the contentious environment often characterizing protected areas with interior private lands, established principles frequently provide a defensible framework to buttress management plans against political criticism and legal attack.

In this paper, I provide first a short set of propositions upon which management of protected areas rests that reflect this reality. I then turn to a group of principles that have been derived from the scientific and technical literature that provide the framework within which visitors and their consequent biophysical and social impacts can be effectively addressed. These principles are applicable to a wide variety of protected area situations. While a brief statement is made describing each of these principles, more comprehensive treatment is given the principle that most directly deals with the notion of a carrying capacity. Finally, because of the need to establish some type of strategic decision-making regime, I suggest a set of criteria that can be used to assess the suitability of a proposed regime. The reader is also referred to Eagles, McCool and Haynes (2002) for further detail on best practice guidelines.

**Three Guiding Propositions**

Protected areas are generally designated, established, and preserved to ensure that the special values within them are sustained. Simply gazetting them does not ensure the sustainability of a park (and the values it contains), for most are confronted with a variety of forces, uses and conditions that threaten the integrity of the special values contained within them. A large part of a protected area manager’s job is to deal with the challenges, dilemmas and paradoxes that arise out of these threats. Such management rests upon three major propositions that serve as the foundation for protected area planning and management, and determined by eleven principles derived out of the scientific literature dealing with visitors in parks and wilderness.

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2 These principles were also articulated in Borrie, McCool and Stankey (1998)
Proposition 1: The natural and cultural heritage protected by the enabling legislation forms the basis for all other values and uses of the park.

The natural and cultural heritage of an area protected by legislation is often unique, irreplaceable and of immeasurable value. The particular attributes that are protected become the basis for uses of the park—such as recreation (as in the case of scuba diving in marine parks), learning (understanding biodiversity and ecological processes), appreciation (viewing and comprehending a magnificent natural environment or ancient monument), meditation (understanding the spiritual basis of one’s religion) or even patriotic inspiration (such as viewing a monument to a past historic figure). Without these attributes being sustainably protected, their long-term socially significant benefits are reduced or even lost.

This array of social values is itself not necessarily internally consistent. Managing for them may involve understanding that some are more important than others, establishing limits to impacts and uses, and identifying the tradeoffs that are inevitably involved in management (Cole and Stankey 1998). Management is rarely unconstrained, and often inherits conflicting mandates and expectations. Argument about the relative priority of one goal versus another typifies the social discourse of management. An example is the US National Park Service Organic Act mandate to protect the scenery and to provide for the enjoyment of future generations. Clearly, this mandate is problematic from a decision perspective in that no clear, unambiguous choice is apparently available for most situations.

Proposition 2: Recreational, learning and appreciative activities are dependent on maintenance of the conditions set forth in the enabling legislation, yet provide substantial monetary and social benefits to participants, the local community and the Park administration.

While the recreational and other uses sustained within protected areas are significant to visitors, such value is founded on the intrinsic values identified in the enabling legislation. Because people find these values important for one reason or another, they spend scarce time visiting the protected area. As they visit, they purchase goods and services, not only in the park from concessionaires, but in nearby communities, and in communities along travel routes. This spending can be substantial, providing economic opportunity, labor income and tax revenue to these communities, many of which are small, rural in character, and with economies that are undergoing transition away from traditional resource commodities. Thus, decisions about visitor management have distributive consequences that lie outside the protected area; these consequences must be acknowledged and accounted for in management.

Proposition 3: Parks and protected areas exist within a larger social and environmental context that requires active community involvement and understanding.

Protected areas are not isolated entities; they are inextricably linked to the larger environmental and social context. Natural processes occurring outside the area have influences within boundaries; processes inside the area often affect conditions outside it, as when a naturally occurring fire escapes a park boundary and endangers lives and
private property. Likewise, it would be difficult to justify a management plan that did not acknowledge, for example, the influence of external transportation infrastructure on internal circulation patterns. A park superintendent who marginalizes (inadvertently or otherwise) the political, economic, subsistence or cultural interests of a local community is in for a difficult time.

**Principles**

**Principle 1: Appropriate Management Depends Upon Objectives**

A clear and consistent theme expressed throughout the literature of visitor management in protected areas has been the need for explicitly stated objectives (Brown, McCool and Manfredo 1987; Lime and Stankey 1971; Manning 1999). Objectives provide definitive statements of the products or outcomes of recreation or protected area management. Objectives, either as formal statements of legislative or administrative policy or as explicit assertions in a management plan, identify the appropriateness of management actions or indicate acceptable resource and social conditions. Formally stated objectives allow protected area managers to determine how successful management actions may have been in resolving problems, addressing management issues and sustaining recreation, heritage or biodiversity values. Manning (1999) argues that management objectives provide an answer to the question of how much change is acceptable by deciding what types of recreation experience a particular recreation area should provide, the feel of naturalness of environmental conditions, the kind of experience offered, and the intensity of management practices. While clearly the context for the above concerned management of recreational uses, other uses and values would benefit from clearly established objectives. Unfortunately, writing managerially useful objectives is not easy; while people tend to agree about general values and concepts of protected areas, specific and explicit objectives are likely to evoke considerable disagreement about what is to be accomplished or produced at a recreation site or protected area. It should be noted that the process of establishing objectives is an intrinsically political one, and therefore methods that include interaction with those affected will help develop objectives upon which a consensus can be developed. The mechanisms of public inclusion at this stage of protected area planning and others are critical to not only establishing the legitimacy of the planning effort but also in creating opportunities for the affected publics to develop ownership in the process.

**Principle 2: Diversity in Resource and Social Conditions in Protected Areas Is Inevitable and May be Desirable**

Resource and social conditions within any relatively large protected area are not likely to be uniform. Impacts, use levels, and expectations of appropriate conditions tend to vary (for example, see Martin, McCool and Lucas 1989 concerning variability in acceptable campsite impact conditions in the periphery vs. the center of a protected area). Topography, vegetation and access influence use densities and level of impact. Visitor use is frequently unevenly distributed. This diversity of conditions is inevitable, and sometimes desirable. For example, in large terrestrial protected areas, it generally would not be desirable to have developments spread evenly across the area, leaving no place untouched. The interior areas of protected areas often display
fewer human-induced impacts than the periphery. Managers can identify this diversity and then make decisions on its desirability, thus separating technical decisions from subjective, value-based judgments. Finally, Haas and others (1987) argue that managing for diversity explicitly through some type of zoning process is more likely to lead to preservation of protected area values than existing implicit or de facto zoning. Such zoning, when accompanied by companion indicators, standards and management action, serves to limit the spread of human induced impacts.

Principle 3: *Management is Directed at Influencing Human-Induced Change*

Many protected areas have been established to preserve not only unique and valuable natural features and conditions, but natural processes as well. In other situations, such as the in the UK, national parks have been established to maintain particular cultural landscapes. In parks that protect natural or cultural heritage, managers are deeply concerned about the human-induced changes that affect heritage values contained within them. The overall purpose of management is generally oriented toward limiting and managing these human-induced changes. Such human-induced changes may lead to conditions that visitors or managers may feel are unacceptable or inappropriate; in many cases, such changes come from the visitors themselves. Management then concerns itself with determining what actions will be effective in influencing the amount, type and location of these changes in addition to determining how much change is acceptable.

Principle 4: *Impacts on Resource and Social Conditions Are Inevitable Consequences of Human Use*

A variety of research has shown that relatively small amounts of recreational use lead to disproportionately large biophysical impacts (Cole 1987; Leung and Marion 2000). This is shown schematically in Figure 1. Once a decision to allow any level of recreation in a protected area is made, the consequence will be that some level of impact will occur. Management thus is directed primarily not at preventing degradation, but rather managing the impacts of visitors. Thus, the principal question that managers must ask is “how much impact is acceptable in this area?” Once this question has been addressed, managers must then deal with the appropriateness of various techniques or actions to manage to this level of impact. In a similar way, social impacts often occur with relatively small amounts of use. For example, a few people behaving in a rowdy manner may impact another visitor’s experience far more than many people being quieter. This principal extends to types of visitors as well. Lucas, (1964) for example, found that canoeists in Minnesota’s Boundary Waters Canoe Area USA were more sensitive to encountering motorboaters than larger numbers of canoeists.

This principle most directly deals with the notion of a recreation or tourism carrying capacity. While carrying capacity in this context has many definitions\(^3\), it centers on the idea that a protected area can accommodate only so many visitors without unacceptably impacting the values for which the area was established. The definition of carrying capacity in these terms—which has historically driven a great deal of

\(^3\) Recent examples include, Butler (1996); Saveriades (2000) and De Ruyck, Soares and McLachlan (1997).
research attempting to establish empirical linkages between use levels and social and biophysical conditions—leads one to the conclusion that with the application of enough science, the site’s carrying capacity can be revealed.

A number of concerns have been articulated about this narrow, scientifically based approach to managing visitors and therefore optimizing the public interest (McCool and Lime 2002). Here, however, I wish to elaborate more on the viability of this particular theory in identifying the public interest.

Underlying many approaches to carrying capacity has been the implicit notion that with enough science, a neutral, value free inquiry can discover the “capacity” to a protected area that uniquely prescribes the optimal level of public benefits flowing from it. Such faith in science as an arbiter of the public interest derives from Progressive Era management philosophy in the US. During this era, it was felt that the public interest is best uncovered and served by technically trained bureaucrats. By relying on experts, the influence of narrowly focused interest groups is removed from policy formulation, and thus broader public interest is maintained.

In this sense, public policy is defined as a technical rather than a political problem. Thus, public policy such as establishing a carrying capacity is a matter of efficiency and optimizing the benefit flow to a particular group. But establishing a carrying capacity holds significant distributional consequences. For example, if the number of visitors wanting to enter a protected area is above the designated capacity, how do managers determine who gets to enter? Each possible technique (e.g., queue, lottery, reservations, price, merit, etc.) discriminates (Stankey and Baden 1977) against a particular type of visitor (e.g., those who can not wait for a queue). In the Grand Canyon National Park of the US, the queue for those wanting a private permit to float on the Colorado River through the park is approximately 20 years long, indicating that anyone over about 55 years of age applying for a permit will be unable to receive one, given the current life expectancy in the US.

More fundamentally, however, a carrying capacity (if it could be determined) is determined by what managerial objective has been selected. Selecting an objective for a park (recognizing what objective is chosen is greatly influenced by enabling legislation or decree) is itself a political act for it reflects the values for which the area was established. Objectives are not something that can be uncovered through the application of science. Thus, the application of management based on a carrying capacity alone cannot reflect the underlying public interest in a protected area.

This brief critique is not meant to suggest that science has no role in visitor management nor should one infer that the author has little concern for the impacts that could be caused by poor visitor management. Science has important roles—for example, in determining the consequences of alternative management actions. But the application of science alone is unlikely to reveal the public interest.

See for example Williams and Matheny (1995) for a both a description of the dominance of what they call the managerial language in public policy and for a critique of its limited capacity to deal with many public issues.
Principle 5: *Impacts May be Temporally or Spatially Discontinuous*

Impacts from visitor use or management activities may occur offsite and may not be visible until later. For example, a management strategy eliminating camping around a lake may simply transfer impacts to other, potentially, more sensitive areas. Inefficient water treatment may result in pollution of water downstream from the outlet. And, impacts, such as dying vegetation, may not be visible until long after recreationists leave the site. Such tendencies make understanding and managing impacts significantly more difficult, demand substantial knowledge about use-impact relationships at different scales, and require managers to carefully design appropriate monitoring strategies.

Principle 6: *Many Variables Influence the Use/Impact Relationship*

While the level of recreational use is an important consideration in managing protected areas, a variety of other variables affect the use/impact relationship. For example, it has long been known that behavior of recreationists influences the amount of impact they cause. In marine settings, treading water with flippers in shallow areas may stir up sand that may impact coral. In terrestrial settings, hiking on sensitive soils during the wet season leads to greater level of impact than hiking in the dry season. Other variables that affect the relationship between use and impact include travel method, group size, season of use, and a variety of geological, physiographic, soil and vegetation characteristics. Similarly, there may be coral settings that are more or less sensitive to recreational use. What this principle means is that the standard errors around lines depicting use/impact relationships will be extremely large because of these other factors and that attempts to control human-induced impacts solely through use limits or carrying capacities may fail. Education and information programs and regulations aimed at changing visitor behavior may be more effective.

Principle 7: *Many Management Problems Are Not Use Density Dependent*

Management problems that relate to the number of people using an area tend to be those that have relatively simple technological solutions, such as sewage, water supply and parking. Even for some of these, however, the intensity of the problem may not be linearly related to amount of use. For example, per capita consumption of water for sewage disposal may be reduced by using toilets with low water requirements. The lack of a precise linear relationship between use and biophysical impact implies that management problems are not density dependent. Similar conclusions can be made with respect to social conditions. For many visitors to backcountry areas of national protected areas, solitude is not a significant or salient motivation (Stankey and McCool 1984). Thus, controlling use levels to optimize opportunities for solitude would be inappropriate.

Principle 8: *Limiting Use is Only One of Many Management Options*

One of the problems with the carrying capacity approach is its emphasis on controlling or limiting the number of visitors as a key to limiting impacts (Stankey and McCool 1991). Because carrying capacity carries with it the question “how many is too many?” it tends to view imposition of use limits as an end in itself. A use limit
policy is only one of a number of potential management actions that are available to address visitor impacts, yet is one of the most intrusive actions that managers could deploy. Use limit policies have historically carried with them a host of additional problems, such as choosing appropriate allocation and rationing techniques. These techniques have been among the most controversial actions protected area managers in the United States have ever taken (McCool and Ashor 1984).

Principle 9: Monitoring is Essential to Professional Management

Monitoring, in an informal sense, has historically been a component of the protected area manager’s job. Monitoring is defined as the periodic and systematic measurement of key indicators of biophysical and social conditions. It performs two major functions. First, it allows managers to maintain a formal record of biophysical and social conditions over time. In serving this function, data points can inform managers of changes in these conditions rather than relying solely on informal perceptions of changes that might have occurred. This is particularly important in situations where managers change frequently or where effects are slow to develop. Second, it helps assess the effectiveness of management actions. Thus, monitoring helps managers understand, in a relatively objective way, if the action addressed the problem.


Many decisions confronting protected area managers are simply technical in nature, such as the number of toilets in a campground, the location of a trail, or the design of a visitor center. However, many others, including decisions to limit use (and how), reflect judgments about values—such as objectives for an area, spacing between campsites, types of facilities, or the kind of recreation opportunities to be provided. It is important in decision-making that means and ends not get confused. Decision processes should separate questions of “what is” from “what should be”. For example, identifying the range of diversity in resource or social conditions that exists within a protected area is a different task from determining the preferred range of diversity. Existing conditions may influence preferred conditions, but the tasks of identifying an existing range and the prescribed range should be kept separate.

Principle 11: Deliberation and Consensus Among Affected Publics about Proposed Actions is Needed for Successful Implementation of Protected Area Management Strategies

Managing visitor impacts in national protected areas occurs within a context of increasing public concern about both environmental quality and participation in government decision-making. In the US, the First Amendment to the Constitution guarantees that citizens have the right to petition the government for grievances. While in the US this requirement is a legal one, there are other compelling reasons for public deliberation and consensus around policy. Increasing political polarization and conflict over natural resources indicates that successful decisions--ones that can be

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5 See Krumpe and McCool (1998) for a discussion of the key decisions in protected area management requiring value judgments.
implemented—require not only a systematic and technical problem-solving process but also one that incorporates public participation as well. Within the highly charged social and political contexts that protected area management frequently occur, technical planning processes tend to create more in the way of disagreement than agreement because proposed actions may adversely affect some well-defined value expressed by a group within the public. Some actions, such as research and use limit policies may privilege certain groups (such as participants in a survey—non-participants will include people who do not visit an area because its management policies do not create the recreational setting they seek) and marginalize others (McCool and Cole 2001). Thus, there are significant, and often unplanned, distributive effects of use limits and carrying capacities.

The legal power to plan and implement, in the politicized situations confronting many protected area managers, is separated from the power to implement. Individual interest groups have “veto” power over proposed actions. As Friedmann (1993) argues, planning is a political process and must proceed specifically with this acknowledgment. Thus, a consensus (“grudging agreement”) is needed for protected area agency to implement. A consensus requires that six conditions be met: (1) agreement on the definition of the problem; (2) agreement that the problem can be resolved through public involvement; (3) knowledge is distributed equally among participants; (4) participants will be willing to “live with the results”; (4) the process includes all affected interests; (6) and the agency has been given permission to act (McCool, Guthrie and Kapler-Smith 2000).

Criteria for a Management/Planning Decision-making framework

Protected areas must be actively, even aggressively managed because a variety of uses and forces may threaten the integrity of the values for which they are established. The above principles provide an intellectual foundation for this task. They have formed the basis for visitor management in mountainous protected areas, marine parks, national parks, outdoor recreation areas and multiple-use areas. Yet, without some type of explicit management strategy, they can be applied haphazardly, and such application may counter their effectiveness.

Accepting the need for management, how should the threats, issues and challenges to protected area values be addressed? Managers have several alternatives. These include an “ad hoc” approach or one based upon an explicit, systematic decision-making framework. Ad hoc approaches have typified recreation and protected area planning for many decades. They generally involve incremental decisions made without reference to long term goals and deal with the “art of the possible”. Such ad hoc approaches however, often lead to a number of unanticipated consequences, loss of opportunities, or problem displacement rather than problem resolution. For example, limiting use in one park, may displace visitor use (and consequent impact problems) to another. Incremental decisions (with a focus of what can be done) may lead over time to significant setting changes.

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6 I have not included the alternative of “Do nothing”. The strategy of making no decisions, ignoring problems or consciously avoiding difficult decisions and situations is one alternative some have chosen to pursue, although few would publicly admitting doing so.
In response to many protected area problems and the lack of efficacy of ad hoc approaches, a number of decision-making frameworks have been established, such as the Limits of Acceptable Change, Visitor Experience and Resource Protection, Tourism Optimization and Management Model, and Visitor Impact Management\(^7\). What is important here is that managers need a decision-making process to replace ad hoc approaches, but it may be felt that the above systems are not appropriate for a particular situation. While designing a new system requires considerable thought, time and energy, it may be necessary.

What criteria would typify such systems? First, the system should be rational and systematic. By this I mean the framework must make sense to managers and affected publics; the flow of activity from one step to another—sequencing—should make sense as the dependencies may be very clear. For example, inventory is often the first step in planning, but if it is, managers are confronted with the question of what to inventory. Inventory then may be placed later in the management system so that the important issues and questions are addressed. Second, the process should make important decision steps and value judgments explicit. Value judgments typify many visitor management questions; the value systems involved should be revealed to the public so that particular beliefs and values are not inadvertently marginalized. By making the process explicit, the process and its outcomes become defensible.

Third, we would expect that the management system be adaptable to the variety of protected area planning contexts and situations. It should not be overly dependent on specific laws and regulations, yet should address their intent. The rationale for each element of a decision-making framework should be clearly understood so it can be modified to fit local conditions. Fourth, the system is process oriented rather than output oriented. The system institutionalizes a particular way of making decisions not necessarily of providing answers. The visitor management systems above force managers and affected publics to go through specific steps, but do not determine, for example, if education or regulation is the most effective solution to a problem in all situations. Process-orientation also means that the system provides managers with a consistent methodology for approaching unexpected problems.

A fifth characteristic is that the system is built upon a foundation of science and other appropriate knowledge. The system ensures that decisions are informed, but not dictated, by science. Sixth, the system requires managers and publics to articulate the specific goals and objectives needed to choose among alternatives and select the most equitable, effective and efficient actions. This means that affected publics are involved in all phases of the process, including framing of the problem, design of the “solution”, long-term monitoring and evaluation. In this sense, learning becomes an important feature of decision-making, and is distributed not just to the public, but with the public and managers acting in concert. And, seventh, the system has political viability. I noted earlier that protected areas and visitor management frequently occur within politicized settings. In those settings, establishing and maintaining the legitimacy of decision-making processes and retaining (or where necessary, re-establishing trust) is essential to successful planning. The system must therefore be thoroughly transparent, public and explicit.

\(^7\) See Nilsen and Grant (1998) for a summary of each of these approaches to visitor management.
**Conclusion**

There can be no question that the process of managing visitor impacts is among the most challenging jobs in conservation. Managers are confronted with the task of maximizing the public interest through meeting three responsibilities: that of protecting established values, managing visitors’ recreational opportunities and interacting with nearby communities. These responsibilities are inherently political in nature, though to carry them out competently a firm foundation in the science of visitor management and other areas is needed.

The principles discussed here provide a foundation for applying a systematic decision making process, that when coupled with adequate and appropriate public involvement can lead to successful visitor management in protected areas. In mixed land ownership situations, where identifying and sustaining the public interest is often contentious, they provide a defensible foundation for decision-making.
Figure 1. The above figure demonstrates three potential relationships between use levels and amount of resulting biophysical and social impact. Curve C represents a situation where the level of impact increases relatively gradually to a particular region of the curve and then begins to accelerate rapidly. If this relationship was to hold, landscapes could be characterized as containing an intrinsic carrying capacity. Management would only have to uncover this region of the curve (through accepted research protocols) and then limit use accordingly. Curve B represents a situation where impacts are a linear function of use level. In this situation as use increases impacts increase in some linear proportion. Management strives to develop the coefficient linking use and impact (again through research). While impacts can be predicted in a relatively straightforward way, management is left with the problem of determining an acceptable level of impact, unlike Curve C. Curve A represents a situation where impacts increase rapidly with small amounts of use, and then the rate of increase decreases as use level rises. In this situation, there is also no intrinsic landscape carrying capacity. Settings characterized by even moderate levels of use would have to experience significant reductions in order to reduce impacts. In many cases, such reductions would still have little effect on the level of impact.

Research in both biophysical and social impacts indicates that Curve A represents the nature of the relationship between use and impact. This curve carries at least two implications: (1) limiting use will likely be ineffective in controlling impacts except for very low levels of use; and (2) since use is not strongly related to impact over most of the range of the curve, other techniques will need to be implemented. A third implication is that since there is no carrying capacity, managers must determine how much impact is acceptable. Judgments of acceptability are ultimately value statements, which can incorporate science, but science itself cannot identify the level of acceptability.
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