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Conserving the natural integrity of mountain parks: Lessons from Glacier National Park, Montana

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Abstract. Glacier National Park represents one of the oldest and most pristine of the mountain parks in the western United States. For many decades following its establishment in 1910, enabling legislation, economic conditions, boundary configuration, geographic location, management procedures, environmental legislation, and public interest contributed to the successful conservation of natural biological diversity within the park. More recently, peripheral development, ecological isolation, landscape fragmentation, and special designations pose risks and establish values that require incorporation into a new management paradigm based on a regional ecosystem model. The prospect of global climate change adds the dimension of permanent environmental change to the increasing complexity of park conservation.

Key-words: Biodiversity, legislation, ecosystem, climate, history, ideology

Introduction

The concept of national parks originated more than a century ago in mountain landscapes of the western United States. The early years were characterized by large parcels of scenic public lands being established by legal statute as pleasuring grounds for adventuresome travelers. With public use, the many additional values of national parks were recognized, a federal management agency established, and a system of parks created throughout the United States. As the system of protected natural areas expanded, the attributes and success of the original mountain parks frequently led to their use as models for the establishment and management of new parks throughout the world.

Glacier National Park (GNP) in northwestern Montana represents one of the oldest and most pristine of the original western parks. The park is managed as a natural area – ecosystem processes rather than human intervention dominate the landscape. This paper reviews park history and describes parkland features as a basis for identifying and discussing attributes of importance to the conservation of mountain ecosystems. Natural resources information was located through an interactive computer program that listed 2510 data sources for the park and adjoining lands. Synthesis and interpretation reflect the viewpoint of an author with nearly 25 years of resident research experience in GNP.

Historical perspective

In 1897, a large block of public land in northwestern Montana, including a parcel purchased from the Blackfeet Indians, was designated by Presidential Executive Order as Lewis and Clark Forest Reserve. GNP was created from these lands through legislation enacted by the United States Congress in 1910. Language in the legislation established the park as „... a public park or pleasure ground for the benefit and enjoyment of the people of the United States ... in a state of nature so far as is consistent with the purpose of this act, and for the care and protection of the fish and game within the boundaries thereof." The legal process of forming a national park continued in 1911 when the State of Montana ceded exclusive legal jurisdiction to the federal government and was completed in 1914 when cession was accepted through federal legislation.

The park ideology embodied a cultural reaction to environmental circumstances at the beginning of the twentieth century (Sheire 1970). Sheire further proposed that images created by the ideology defined four levels of human relationships to nature. As *wilderness*, the park portrayed the environment of the western pioneers. As a *playground*, a sense of freedom and a source of health was provided. As a *laboratory*, the park was intellectually perceived according to the disciplines of the natural sciences. And as a *symbol*, the park represented national character, purpose, and taste in environment. Sheire concluded – „In preserving nature, the nation improved the quality of its civilization."

The park encompasses 410,201 ha of a cordillera that extends the latitudinal length of western North America. Boundaries remain essentially as described in the original legislation; 128 ha were added and 9 ha deleted from the southern boundary in 1978. There were proposals and debates concerning the boundary prior to creation

of the park – protection of lowland wildlife habitats was an issue. As a result, the northwestern boundary is more ecologically sound than originally proposed. In contrast, the eastern boundary excludes important wildlife habitats and is further compromised by two water reclamation projects that were allowed by the legislation that created the park.

The international boundary between the United States and Canada is shared with Waterton Lakes National Park (WLNP) in southeastern Alberta. WLNP was originally established in 1895 as Kootenay Lakes Forest Park; conversion to its current status as a national park occurred in 1911. In 1932, federal legislation in both countries designated the parks as an International Peace Park to commemorate mutual friendship and goodwill. Further recognition was granted by the United Nations Educational, Scientific, and Cultural Organization in 1976 (GNP) and 1979 (WLNP) by designating the parks as Biosphere Reserves under the Man and Biosphere program. Neither special designation altered the management authority of the parks but there is growing evidence that the biosphere reserve program helped to move the earlier symbolic status of the international park toward a broader ecological relationship. The partnership now routinely includes mutual development of strategies to address potential impacts of peripheral activities and developments.

Federal land management legislation has added new dimensions to the administration of GNP. For example, the North and Middle Forks of the Flathead River, which form the western park boundary, have been designated as wild and scenic under the Wild and Scenic Rivers Act of 1974. The designation does not change or replace current management authority but it does require a cooperative effort with the U. S. Forest Service to conserve the ecologic integrity of river corridors adjacent to the park boundary. Three areas comprising 95 percent of the park have also been nominated for wilderness status under the Wilderness Act of 1964. While no congressional action has been taken, the areas are managed in accordance with the principles expressed in the Act.

In contrast to special designations, environmental and cultural legislation added important new responsibilities to the management of GNP. The most prominent of these relatively new initiatives were the National Historic Preservation Act of 1966, National Environmental Policy Act of 1969, Clean Air Act of 1970, Clean Water Act of 1972, and Endangered Species Act of 1973. Their enactment and subsequent amendments introduced important modifications to the exclusive jurisdiction formerly enjoyed by the park. No longer was park management in full control of its actions and activities. These laws fostered the beginnings of an important change for GNP, one that for the first time granted local, state, and federal interests legal access to the park management process.

Landscape features

The park landscape was created by an overthrust fault of ancient sedimentary substrates. Glaciers and streams have eroded the sedimentary strata in a dendritic pattern that radiates from a central axis of ridges and peaks. Terrain is precipitous with elevations ranging from 948 m and 1,367 m along the western and eastern boundaries, respectively, to 3,190 m near the central hydrologic divide. Glacial moraines dominate the topography in parts of the park and are especially prominent in the northwest. Soils have developed directly on bedrock or on deposits shaped by glacial, colluvial, or fluvial activity.

Topographic features and geographic location create conditions for a climate that is influenced by weather systems of two principal origins. Western slopes are dominated by a maritime system that moderates temperatures and is the principal source of parkwide precipitation. To the east, continental air masses modify the maritime influence to create more variable conditions, especially in winter. Winds are generally from the west or southwest; cloud cover extensive during late fall, winter, and early spring.

Topography also contributes to a complex pattern of precipitation and temperature (Finklin 1986). Precipitation generally increases with increasing elevation; normal annual precipitation ranges from about 59 cm on the park periphery to 250 cm or more in the central highlands. Temperatures tend to decrease with increasing elevation although inversions are common. January is the coldest month with mean temperatures ranging from -7° to -13°C; July the warmest with means of 8° to 17°C.

Precipitation contributes to a hydrologic system that forms headwaters for three continental drainages. Winter snowfall is sufficient to maintain active glaciers and extensive snowfields that help to sustain streamflow throughout the year. Glaciers have created small cirque lakes near the headwaters of many streams; large deep lakes at lower elevation reflect the advance of large cordilleran glaciers during the late Pleistocene. There are currently about 50 active glaciers in the park, several of which may be remnants of the Wisconsin period (Carrara 1989). The remainder appear to be products of a cooler climate that reached its peak during the nineteenth century.

The park is part of a larger landscape mosaic that includes public, tribal, and private lands. To the south, west, and north, extensive national or provincial forests are managed for multiple resource values or are formally designated as wilderness. To the east, prairie foothills are included in the Blackfeet Indian Reservation. Private holdings occur on the periphery or along lowland travel corridors within the region. With the exception of corporate holdings by the forest products industry, most private lands are occupied by a dispersed resident population.

In 1892, completion of a transcontinental railroad along the southern park boundary opened the region to

settlement and economic development. Forest management, livestock grazing and farming became traditional regional economic activities; fossil fuel development and recreation increased in importance during recent decades. GNP is a major contributor to the area economy with nearly 2 million visits now being recorded each year. The park is nearing its capacity for recreation and tourism during the summer vacation months.

Biological diversity

The park landscape is occupied by biotic communities that represent a transition from the northern to the central Rocky Mountains. Alpine tundra, talus, and outcrops occur at elevations above about 2,000 m throughout the central highlands. Lower slopes and valleys are dominated by extensive coniferous forests; fire and snowslides create a mosaic of younger communities within these forests. Grasslands, meadows, and deciduous forests are restricted to lower elevations with suitable soil conditions. Headwater streams and glacial lakes are numerous; productivity generally low.

In 1988, a new model to inventory and monitor physical and biological resources was proposed for GNP. As part of the process, information and data resulting from park research were assembled, classified, and stored in a network computer file that essentially represented a natural resources database. In turn, the new database provided a foundation for evaluating lists of vascular plant, amphibian, reptile, fish, bird, and mammal species that had been created in less than formal fashion during earlier years. With the addition of important biogeographic attributes, the species inventories were revised and also stored as a computer database. The inventory has not been fully verified but it does provide a cursory view of biological diversity as expressed by species richness.

Taxonomic Group	Number of Species			
	Native	Invaders	Missing	Total
Vascular Plants	1091	124	0	1215
Fish	20	7	0	27
Amphibians	6	0	1	6
Reptiles	4	0	0	4
Birds	259	6	0	265
Mammals	61	1	2	62
Total	1440	138	3	1578

Table 1. Species richness of six taxonomic groups in Glacier National Park, Montana.

At least 1,578 vascular plant and vertebrate species were recent inhabitants of GNP (Table 1). Of these, 1,440 (91%) represented native flora and fauna and 138 (9%) were relatively recent invaders of park habitats. Only three species were known to be missing although the continued presence of several plant species was questionable. By nearly any measure, these data reveal an increase in biological diversity without an attendant loss of native park species. However, one should recognize that most inventory systems emphasize the discovery of new species; procedures for documenting the loss of species are inherently more complex.

There were important differences in the diversity characteristics of the six taxonomic categories. Vascular plants were the most numerous and included by far the largest number of new invaders (11%). And while there were fewer fish than plants, a greater proportion (35%) were new additions to the park biota. In contrast, the few amphibian and reptile species that inhabited the park were all native to the area. Birds and mammals were intermediate in their position; numbers of invaders in these categories were surprisingly low (2% and 2%, respectively).

The high colonization rate for vascular plants reflected their ability to establish populations in habitats created by human activity. In most cases, regional agricultural practices introduced new species or created suitable environments for weedy invaders; roads, trails, and other disturbances then fostered access to the park. In a few cases, alien plants were introduced directly into the park by early homesteaders or administrators. Coniferous forests and alpine tundra appear to resist invasion by weedy pioneers so that the distribution and impact of new plants has been restricted largely to low elevation developments and grasslands.

In contrast to plants, fish were purposefully introduced into park and regional waters to satisfy recreational demands. Once present, the network of lakes and streams provided natural pathways for dispersing to other suitable habitats within the system. Many park lakes and streams are now inhabited by one or more alien fish species; their presence has imperiled native Cutthroat Trout (*Salmo clarki lewisi*) through 84% of their original range within the park (Marnell 1988). At the same time, concern for the genetic contamination of cutthroat trout was lessened by research that revealed the importance of local adaptation (Marnell *et al* 1987). Where fish were introduced to formerly barren lakes, their presence likely impacts the diversity of resident invertebrates.

The natural diversity of amphibians, reptiles, birds, and mammals has probably changed little during the history of GNP. For those few species that did arrive, park habitats and resident communities were apparently not conducive to population establishment. The two native mammals missing from the park were included in the inventory on the basis of implied historical distribution; additional mammalian residents are being discovered at the rate of about one species per new field study. Visibility and interest in birds were the apparent cause of a growing species list but a possibility remains that

broader trends in distributional patterns have also occurred in North America.

A paucity of information precluded the inclusion of invertebrates, pathogens, and other forms of life in this quantitative analysis of biological diversity. However, it is known that changes have occured within these categories; insects have been introduced to control noxious weeds and pathogens from domestic livestock suspected of infecting native wildlife. In one especially notable case, purposeful introduction of Opposum Shrimp (*Mysis relicta*) to waters near the park resulted in dramatic ecosystem response throughout an entire drainage, including GNP (Spencer *et al* 1991).

Significant attributes

From the standpoint of biological diversity, species that were judged from their distributional histories to be invaders have generally not replaced natural communities in GNP. This condition appears to be largely attributable to the history, physiography, and management of the park. At least seven attributes have contributed to successful conservation of biological diversity.

1. *Enabling Legislation.* The federal legislation that established the park contained language that provided the philosophical and legal foundations for managing the park as protected sanctuary. Philosophically, the language provided a specific goal while allowing for the evolution of management during the ensuing years. Legally, acquisition of exclusive jurisdiction was especially significant since it essentially eliminated the ambiguity and confusion that frequently accompany more complex jurisdictional formats.

2. *Economics.* The park was established prior to a demand for exploitation of its natural resources. The area had been searched for minerals and fossil fuels but few deposits of commercial value were discovered and there seemed to be little immediate need for the extensive forests of the region. However, the potential for recreation was recognized and a unique alliance formed between conservationists and railroad executives. Together, they supported establishment and development of the park in a manner that would serve both interests well into the future.

3. *Boundary.* The size of the park was determined by boundary location rather than a concious effort to include as much land as possible. Although wildlife winter habitats were an important local consideration, it appears that the primary goal was to embrace a natural topographic unit of scenic mountains. Regardless of intent, the result was a national park of sufficient size to protect the biological diversity that was largely intact when the park was established.

4. *Location.* The park is strategically positioned along a continuum of mountainous terrain, portions of which are also protected as wilderness and parks. Ecologically, the result has been a relatively open system that fosters free movement of component species. Under these conditions, ecosystem processes have been able to compensate for local disturbance and insular problems have been slow to develop.

Human demographics represents a second important aspect of location. The park is located a considerable distance from major metropolitan centers, an attribute that was especially effective in limiting the effects of intense visitation during the early years. More recently, automobile travel and leisure time prompted more distant travel and the park became an attractive destination for large numbers of people during the three summer months. However, topography and climate continue to complement the remote setting during the remainder of the year and help to restrict access to the park interior. The implication of this travel pattern is that many species and their habitats have been protected from disturbance during the critical winter months.

5. *Management.* Protection of natural resources from human influence represents the fundamental element of park conservation. Initially, the need to protect wildlife from illegal killing provided the rationale for a resident park staff. But as the number of visitors increased, programs to prevent damage to vegetation and other resources were also implemented. Ironically, developments that were originally constructed to promote park use became the means by which burgeoning visitation was subsequently managed. Public information emerged as the vehicle that fostered the success of visitor control programs.

In contrast to the distinctive program of protection, conservation of natural resources was often influenced by philosophies, concepts, and techniques developed by other agencies. The result was an evolution of programs that included activities such as sport fishing, wildlife feeding, predator control, population culling, fish stocking, and chemical treatments. With the accumulation of ecological knowledge, many were abandoned or replaced by strategies that emphasize the role and value of natural processes in park management. The transition enhanced the identity of GNP as a unique form of public land management.

6. *Environmental Legislation.* Recent environmental legislation strengthened the opportunity and potential for conserving the natural integrity of GNP. Those responsible for surrounding landscapes were, for the first time, required by a variety of laws to include consideration of park goals and resources in their plans and activities. For example, park air quality is now legally protected from external activities that threaten significant degradation. Of course,

the new laws also require more rigorous management within the park, including the avoidance of activities that violate air, water, and other ecological standards established for adjacent lands.

7. *Public Interest.* A broad base of public interest in GNP developed during the past two decades. It emerged from a concern for environmental quality and the role played by the park in contributing to the perpetuation of natural values. New laws provided the legal access for public involvement in the management process; television, newspapers, and other communications media carried local park issues to a national audience. The park has benefitted from public interest but at the same time, its new role as partner in regional and national conservation efforts has added complexity to the management process.

It is important to note that each attribute acting alone held only marginal potential for assuring the conservation of natural conditions. For example, a large park with inappropriate boundaries or in a more accessible location would likely have experienced greater change than that documented for GNP. However, the scenario was synergistic over time and thus largely responsible for the natural scene currently portrayed within the park.

New challenges

There is evidence to suggest that the attributes which helped to protect GNP in the past may not be sufficient to assure a similar degree of protection in the future. An expanding human population is the principal contributor to new social and ecological issues that will likely impact park resources.

The emergence of the national park concept in the late nineteenth century reflected a growing need for some form of cultural identity in the United States (Runte 1979). The first parks were therefore symbolic expressions of the value placed on scenic landscapes by society. Interest in the concept grew rapidly, additional benefits and values were recognized, and the system of national parks continued to expand throughout the twentieth century. However, the nature of parks designated within the system also changed to reflect the wishes and meet the needs of an increasingly urban society. The result was a complex mixture of 357 national parks, recreation areas, historic sites, seashores, and other protected areas at the beginning of 1991 (Mackintosh 1991).

While changing cultural values had their greatest impact on the compostion of the national park system, individual units have also been influenced by a political process founded on the importance of values. Since the potential for additional expansion of the system has dwindled, it seems likely that existing units will face even more pressure to satisfy new expectations. As one example, demand for guide services, photographic expeditions, bicycle facilities, and winter access has increased in GNP as visitors explore new challenges during their leisure time. Economic marketing by a variety of interest groups helped to create change of this nature – it is not unreasonable to expect additional changes to be motivated by economic factors.

In addition to economics, changing social values also occur in response to the intellectual transformation that humans are experiencing as they move toward an urban society. The trend is driven by information and reflected in attitudes, expectations, and behavior of those with an interest in the national parks. Where satisfaction is not achieved, a variety of processes is used by the public to cause changes in park management. The conservation of Grizzly Bears (*Ursus arctos*) illustrates the complex nature of changing social values in GNP.

In 1967, two campers were killed by grizzlies in separate wilderness incidents in GNP. An intense public response caused a change in management; a balanced program of control for both bears and humans was implemented. As concern for the viability of bear populations continued to grow, management shifted toward even greater control of park visitors. Coincidentally, conflicts with humans accelerated and the resulting public debate continued to bring visibility to the issue. With enhanced public awareness, grizzlies acquired symbolic status and thus became important to economic interests within and near the park. In little more than two decades, changing values for a single species influenced not only the demography of park visitors, but the entire land management scheme surrounding the park (Sax and Keiter 1988).

From an ecological perspective, patterns of human development surrounding the park continue to have important implications for management. Settlement and development of private lands are of particular interest since control through planning has only marginal public support. Access to the energy and timber resources of public forests is also an issue – new roads foster expanded use by others as well. In theory, peripheral development is causing the park to gradually assume the characteristics of an ecological island. In reality, current impacts tend to be speculative and have yet to be measured with any degree of certainty.

For park wildlife, peripheral development reduces habitat and increases the potential for harvest of species with large home ranges. Abundant species of high cultural value are of the least concern – cooperative management will likely assure their viability well into the future. However, those with lower or conflicting values may become increasingly dependent upon park habitats for survival. Unfortunately, evidence suggests that the park may not be large enough to sustain isolated populations of species such as Grizzly Bear or Wolverine (*Gulo gulo*).

In contrast to the potential effects of isolation on native wildlife, peripheral development has enhanced the opportunity for pioneering species to colonize the park.

Vascular plants have been especially successful invaders; vehicular traffic and roadside habitats enhanced immigration from large blocks of agricultural lands to the east and west. Weed control has become an important issue on both private and public lands surrounding GNP. As a result, the park has begun to implement programs to control species that have been legally designated as noxious by the State of Montana. In turn, the program has led to the introduction of synthetic chemical compounds into the park environment.

In some respects, development within GNP followed a pattern similar to that of peripheral lands; construction of roads and trails led to placement of facilities to meet the needs of both visitors and administrators. However, the basic infrastructure was esentially in place several decades after the park was established and its design thereafter served as the focus for nearly all planning and management. Although some developments have been removed, the general trend has been toward increasingly intensive use and management of this historic network of travel routes and service facilities. The trend is likely to continue until such time that capacities are reached and in equilibrium with regional travel.

Park developments occupy or directly influence less than 5 percent of the the total park area. Unfortunately, they are frequently located on or near ecologically sensitive sites and their influence therefore extends beyond this seemingly small area. Techniques applied in developments include visitor control, stream alteration, hazard tree reduction, wildlife removal, vista clearing, building construction, historic preservation, cultural landscaping, herbicide application, sewage treatment, road improvement, and expanded parking. In some cases, the practice is designed to conserve the natural integrity of developments. In others, scientific knowledge and experimental management have helped to mitigate adverse ecological impacts. More generally, however, developments are insidiously drifting toward artificial environments designed largely for the convenience and safety of visitors. The trend is expected to continue and perhaps intensify so long as developments are socially and economically linked to the regional ecosystem.

Beyond the developed zone, park management practices have also created important changes in the state and function of the wilderness mountain landscape. Natural wildfires have been controlled, new fish species introduced, predators killed, wildlife populations culled, horses pastured, pests treated with chemicals, and new species introduced to control established alien species. In many cases such as fish stocking, negative impacts or marginal success led to discontinuance of the practice. In others such as wildfire control, revised programs based on knowledge or experimentation were implemented to restore park wilderness to more natural conditions. Park wilderness remains less than natural because past management practices did not complement the inherent value of landscape protection.

This divergence of management strategies seems to represent a conservation paradox for GNP. On one hand, most of the park has retained species richness and is returning toward a full expression of natural processes. On the other, development corridors are moving toward conditions defined largely in terms of human needs. It is possible that segmenting the landscape and developing ecologically sensitive sites impacts the natural wilderness areas. However, scientific research, experimental management, or both are required to test hypotheses relating to the nature of these relationships.

Nearly a century of cultural evolution, burgeoning human populations, and park history have set the stage for a new management paradigm in GNP. Protection will likely retain its fundamental management role as will the motivating influences of social values and economic needs. However, ecological isolation, landscape fragmentation, and special designations are establishing new risks and values that require incorporation into traditional management policy. Moreover, new laws are providing a legal means for public interests to express their will regarding those risks and values. In response, the new paradigm is moving into place with ecosystem management as its rationale and model (Johnson and Agee 1988).

Ecosystem management addresses landscape conservation through a conceptual model that includes an expression of desired conditions, a description of system boundaries, development of management strategies, and measurements of effectiveness. As might be expected, the concept is currently being explored with a sense of urgency in GNP; defining and describing desired ecological conditions in a changing cultural and ecological environment is only the first of many anticipated challenges. Certainly, management that intervenes with traditional social processes or pristine ecological conditions will be accompanied by scholarly debate as well as spirited controversy. Park attributes are likely to have a moderating influence on the rate at which intervention occurs.

Global change

The scientific community has recently presented evidence that points to unprecedented change in global environments. Most emphasis has been directed toward predicting and understanding the effects of a worldwide atmospheric warming. General circulation models suggest that along with warming, significant shifts in moisture regimes and weather events will occur. Should these predictions be accurate, the effect would complement and perhaps magnify landscape changes already being experienced in GNP.

From an ecological perspective, the location of the park and the orientation of its mountain highlands are significant in terms of predicted scenarios. Western slopes are likely to become warmer and wetter, forest communities flourish, and streamflow decrease as the hydrologic cycle responds. In the central highlands, snowpack will increase and timberline may move higher. Predictions for eastern slopes include warmer and drier conditions with a expansion of prairie grasslands. Throughout the park, storms and other meteorological events may become more frequent and intense.

At this point, predictions of accelerated climate change lack the precision required for understanding response at the local level. However, it is clear that any change beyond the usual weather patterns would induce ecological response of significance to management. For example, populations of some species may move upward or northward as they seek the cool habitats to which they are adapted. In turn, they may be replaced by new species that find the park environment suitable for their needs. In essence, GNP would assume the ecological characteristics of a more southern mountain landscape.

Climate change thus presents an interesting dilemma for the park manager – a natural local response is predicted from a worldwide human impact. Conservation of dynamic ecosystems therefore extends to the landscape level and includes permanent directional trends induced by climate shifts. A part of the dilemma includes questions of intervention. Which invading species will be considered native rather than alien? Are there species that will require help in reaching new habitats? How should we respond to imminent extinction when emigrating species find ecological obstacles in their move to new habitats? These and a myriad of other questions point to the need for a revised park philosophy should climate change occur as predicted – one that incorporates broad issues of landscape management within its purview.

With global change, the inherent scientific value of GNP will in all likelihood reach its zenith. The concept of scientific value for wilderness was expressed by Leopold (1949), „A science of land health needs, first of all, a base datum of normality, a picture of how healthy land maintains itself as an organism." GNP is an attractive scientific resource for this as well as another important reason; the seven park attributes provide the resource and organizational continuity required for contemporary ecosystem research. In response, the scientific community has identified GNP as an important site for long-term global change research.

Conclusion

In less than a century, GNP has been transformed from a scenic frontier sanctuary to what is now little more than a relict of the western wilderness. The early years were sustained by a robust ideology, legal covenants, and protective management that served as effective means for conserving the biological diversity of a remote mountain sanctuary. But human population growth and cultural evolution were in place at the beginning and continue as agents of change for park management programs. Change accelerated to a vigorous pace during recent decades; the trend is likely to continue into the twenty-first century.

While the passive act of protection continues in its fundamental role, active management that responds to expanding social values and compensates for human impacts has become an important element of park conservation. In response, the concept of regional ecosystem management has been explored for both its social and ecological benefits. In theory, ecosytem management provides for a diverse and sustainable environment with values shared by all participants. For GNP, an explicit definition of purpose as a conservation area is required or its unique identity as a natural sanctuary will tend to merge with that of the surrounding landscape.

It is of more than passing interest to note that the prospect of global climate change has prompted some authors to question the future of national parks (McKibben 1989, Abrahamson 1989). They argue that a world of continuous ecological change will deprive nature of its independence, thereby rendering the preservation ethic irrelevant. When considered with landscape fragmentation, climate change thus presents a dilemma of significant proportions for GNP. Certainly, it seems appropriate to revisit traditional conservation philosophy and construct a new framework that includes the reality of permanent ecological change.

National parks have contributed intellectual and spiritual depth to many millions of people throughout the world. This cultural foundation, nourished with ecological rationale, supports a prediction that parks will persist and their numbers increase during the twenty-first century. It is likely to be a dynamic future filled with the uncertainty of change – philosophy and tradition will provide pathways and inertia for moderating the seemingly inevitable transformation. And so long as contrast with surrounding landscapes is maintained, the cultural contribution of national parks as originally envisioned will remain largely intact.

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