or through structuring, such as making some places more difficult to reach than others. To provide the exact same experience for everyone in the name of equity is, in most cases, to satisfy no one.

Visitors also need information to achieve effectively their own density dependent objectives. They need to know what they can expect in terms of encounters with other visitors if they go to certain locations at certain times. Those willing to tolerate high use levels will self select accordingly. Those who prefer lower levels will have more accurate expectations. Our research shows that seeing more than you EXPECT has much to do with how crowded people feel. So if visitors have appropriate expectations, there will be a less negative impact from numbers of people on their evaluation of the recreation experience. Even if a manager can do nothing to limit use, visitors can be informed that use level on a given day is twice or three times the social carrying capacity.

What needs to be done in Great Lakes region parks to establish social carrying capacity as a legitimate concept and to encourage capacity management is to 1) identify the types and styles of recreation experiences provided in each park, 2) make judgments about the preferred and tolerable number or range of contacts for each, 3) identify inconsistent activities that presently are mixed, 4) suggest ways of separating these activities and 5) develop mechanisms for providing information or feedback to visitors. None of these objectives, themselves, necessarily require extensive research or data collection.

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THE ROLE OF SCIENCE

In The Great Lakes National Parks

Mark Reshkin

Science: An Unsure Role

The role of Science in the National Park Service has undergone many changes since 1916 when the nation formalized its commitment to both preserve and yet make available for enjoyment our most significant natural areas.[1] Scientists perform two functions in this endeavor; provision of an understanding of these natural resources including their functioning and extent, and recommendations for management such that these natural riches persist for the enjoyment of future generations of visitors.

For the most part the role of science has been reactive to the changes that have occurred in NPS natural resource management

philosophy. With these changes the prominence of science activities over the years has waxed and waned. In recent years, as visitorship increased dramatically and external human activities began to impact more and more parks, the role of professional science in the National Park Service gradually has increased. Though the role of science has grown, it still is reflective of a limited commitment to having professional science within the agency. A study of an appropriate role continues to await funding by the NPS and analysis by the National Academy of Science.[2]

Today, in 1982, as each NPS area completes its resource management plan, the opportunity exists to conduct clearly-defined mission-oriented research to provide an inventory of the natural resources present and an understanding or "working-knowledge" of the natural processes for each area. But, because the science resource is limited, NPS scientists should focus their efforts primarily on understanding the natural processes and secondarily on inventorying resources.

These natural resource data and understanding of processes then serve as major bases on which park managers can make and implement the wisest possible natural resource management decisions. Because both use and preservation are almost always present as conflicting mandates, these decisions often involve trade-offs such that several management options are viable. The role of the scientist is to present a scientific resource management understanding of all viable options. This should be done as objectively as possible, but certainly with the scientific preferences indicated.

Thus, the role of the NPS scientist should be that of the mission-oriented researcher and the natural resource management advisor. But just as the science role has become better defined, the management policies of the entire executive branch of the Federal Government are changing. A concerted effort is underway to reduce the size of the federal work force and to contain the costs of government. These efforts can affect significantly the role of science in the Great Lakes area (and other) national parks. Stricter limits on the number of NPS employees have been imposed, creating greater stresses on the human resources available to provide operational services. Will the role of Science once again wane? Will funding and staff be diverted away from non-operational research activities? Will more scientific research be done under contract by universities and/or private research corporations? Can cooperative park study units be expanded in the Great Lakes region? The answers to these questions certainly will determine the immediate future role of science in the Great Lakes national parks.

Natural Resource Management in National Parks

The National Park Service is perhaps the prime governmental agency in the United States charged with the responsibility of preserving and protecting our natural resources for their inherent and essential non-commercial value. Beginning with the earliest

parks, strict protection became the natural resource management philosophy. Well-meaning policies and programs were instituted to protect "valuable" native plant and animal species, and "significant" land forms. Protection of forests from wildfires and prevention of natural shoreline erosion are striking examples of such strict protection policies.

By the mid-twentieth century, the concepts associated with managing entire ecosystems had come to the fore. A report to the Secretary of the Interior in 1963 by a committee of scientists chaired by A. Starker Leopold, recommended both preservation of and restoration to the ecologic scenes in national park areas such as they were when viewed by the first European visitors.[3] Natural resource management policies changed and efforts were begun to manage "pristine" areas naturally and to restore altered areas to a more natural state where technologically and economically feasible.

Today, the concept of managing entire ecosystems as dynamic, open-state systems has become the guiding principle in natural resource management philosophy. However, national park areas are no longer (if they ever really were) isolated areas apart from the stresses of human enterprise. Today, virtually every national park experiences the internal impacts of expanding visitor uses and the external impacts of an urbanizing technological society encroaching upon these preserves. To further compound these concerns, new parks have been established, to preserve and also to make available significant natural resources in or near to the nation's urban centers. Several such parks are in the Great Lakes region.

Natural resource management in national parks must accommodate an amazingly broad spectrum of permissable uses. For example, uses range from backpacking in protected wilderness areas to boating, fishing, swimming and skiing in active recreational areas to extractive activities in areas approved for mining. The preservation versus use dichotomy is as old as the first national park, Yellowstone, and as new as the most recently authorized area. Any attempt at resource management, therefore, must consider the carrying capacity for each and every allowable use. But carrying capacities are only concepts and not formulas.[4]

A recently adopted goal of the National Park Service is to train 30 resource management specialists each year. The role of the scientist is to understand the processes which naturally operate and how they are altered by human activities and the role of the resource management specialist is to develop and implement management practices which maintain the dynamic stability of parklands. Through study, management and monitoring the scientist and resource management specialist should, between them, recommend to the park manager uses that are consistent with carrying capacities and preservation and restoration goals. Thus, every parkland requires a continuous resource management effort and an initial and sometimes extensive and repeated scientific research effort.

Threats to The Parks

A growing nation and an expanding park system have led inevitably to increased stresses on the delicate ecologic balances of each area. Parklands encroach upon urgan areas and urbanization reaches parklands. Visitorship grows substantially. The extent of both internal and external impacts on parkland natural resources was estimated in a report entitled *State of the Parks—1980: A Report to Congress.*[5] The report contained listings and tabulations of threats to all the national parks showing as expected that, in the Great Lakes region, parks in the urban areas are the most impacted. Each of the 10 Great Lakes national park areas is impacted as shown in the following table.

Table 1. Number of Threats and Number of Scientists in Great Lakes Parks: 1980.

Park Area	*Number of:*	
	Threats	*Scientists*[1]
Cuyahoga Valley	58	0
Indiana Dunes	44	6
Grand Portage	33	0
Ice Age	23	0[2]
Pictured Rocks	23	0[3]
Sleeping Bear Dunes	18	0
Apostle Islands	16	1
Isle Royale	14	0[3]
Voyageurs	9	1
Perry's Victory	3	0

1: Two scientists are stationed at the Midwest Regional Office in Omaha, Nebraska.
2: Managed by the State of Wisconsin.
3: Served in part by an NPS scientist stationed at Michigan Technological University.

A Recommended Science Role in Great Lakes Parks

The need for scientific research in the 10 Great Lakes national parks is great, yet there are but 8 professional scientists assigned to the area. Six are at one park and several have none (table 1). Many of these park areas are relatively new additions and much remains to be learned about their natural resources. A growing technological society and increased visitorship have resulted in the documentation of some 241 threats to these parks. With the completion this year of a resource management plan for each park

and in light of the current federal policies of staff reduction and cost containment, the following actions with regard to Great Lakes science research are recommended:

1. Development of a 5 to 10 year, integrated scientific research plan for the 10 Great Lakes national parks.
2. Development of mechanisms to encourage better communication, interaction and direction of the National Park Service scientists to conduct mission-oriented research throughout the 10 parks.
3. Development of one or more additional cooperative park studies units in the Great Lakes region (Director Dickenson indicated such expansion in his intent Service-wide, in testimony before the U. S. House of Representatives Committee on Interior and Insular Affairs on February 8, 1982[6].
4. Encouragement of much more extensive university-sponsored research in these parks by providing housing and/or camping facilities and subsistence fellowship-funding for students.

With the impending severe reduction or total removal of Great Lakes research efforts by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA), it is imperative for the National Park Service to expand its scientific research in its Great Lakes parks. A formal National Park Service Great Lakes scientific research program should be established now.

Coastal Erosion In The Great Lakes Parks

Five of the Great Lakes national parks are experiencing serious shoreline erosion. Shoreline erosion is the highest priority natural resource management concern at the Indiana Dunes and Pictured Rocks national lakeshores and at Grand Portage National Monument. A National Park Service shoreline management policy has evolved, after much misfortune in managing Atlantic coastal areas, to a guiding philosophy of managing natural areas "naturally". Thus, when coastal erosion in the Great Lakes results from storm activity occurring during naturally-high lake level stages, the erosion is accepted as a natural phenomenon. Coastal deposition will follow when lake levels fall.

In several Great Lakes parks, however, the natural coastal erosion is exacerbated by human intervention. Coastal harbor structures produce up-current deposition and down-current erosion (Indiana Dunes) and artificially-maintained lake levels add to or prolong natural erosion (Grand Portage). It is the "unnatural" erosion for which mitigation is sought. But the necessary study and mitigation are both time-consuming and costly. Perhaps a Co-operative Park Studies Unit (CPSU) focusing primarily on coastal erosion and deposition in Great Lakes national parks should be created.

NOTES:

1. United States. 1916. AN ACT TO ESTABLISH A NATIONAL PARK SERVICE AND FOR OTHER PURPOSES. U. S. Statutes at Large, vol. 39 (1915-1917).

2. United States. 1982. U. S. Congress, House Committee on Interior and Insular Affairs before a Subcommittee of the Committee on Energy and Natural Resources, HB5552, 97th Cong. 2nd Sess., February 8, 1982.

3. Leopold, A. Starker, Stanley A. Cain, Clarence M. Cottam, Ira N. Gabrielson and Thomas L. Kimball. 1963. WILDLIFE MANAGEMENT IN THE NATIONAL PARKS. U. S. Department of the Interior, Washington, DC.

4. Wauer, Roland H. 1980. THE ROLE OF THE NATIONAL PARK SERVICE NATURAL RESOURCES MANAGER. NPS CPSU/University of Washington, B-80-2. Seattle.

5. U. S. National Park Service. 1980. STATE OF THE PARKS—1980: A REPORT TO CONGRESS.

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AIR POLLUTION THREATS TO NATIONAL PARKS

In The Great Lakes Region

T. V. Armentano and O. L. Loucks

A Background Paper for
Great Lakes National Parks: A Conference
on Policy and Participation

Introduction

The National Parks and Lakeshores of the Great Lakes Basin are of special significance because they are accessible to the large population of the region in no more than one day's travel. This is much greater accessibility than most of the National Park System. However, industry and related activities are also associated with this population—agriculture, manufacturing, electricity generation and automobile travel. All of these, we are now finding, contribute to regional pollutant loads having the potential to affect the Great Lakes parks.

Data from Region V of the U.S. Environmental Protection Agency, covering most of the states bordering the Great Lakes[1], illustrates the problem. An indication of air pollution in this Region is available from the Council on Environmental Quality (CEQ) Annual Report (1979) which summarized monitoring data on criteria pollutants by region. In the region's 524 counties, 64% of the 67 counties with O_3 monitors were in violation of National Ambient Air Quality Standards, 24% of the 122 counties monitored for total soluble particulates and 11% of the 160 counties monitored for sulfur dioxide.

The Air Quality Control Region (AQCR) is the geographic unit for which the need for air quality control strategies are evaluated