

WATER: A SERIOUSLY THREATENED RESOURCE IN  
THE NATIONAL PARK SYSTEM

by

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INTRODUCTION

The results of human development of the United States during the past 50 years make it clear that units of the National Park System are not isolated self-regenerating ecological entities. Instead, these islands of naturalness are surrounded by, and interact with, seas of human dominated landscapes, and traditional types of ecosystem exchange are being supplanted or lost. Water is one such ecosystem element, and the purpose of this paper is to examine the following major points with respect to water resources in the National Park System:

1. The water resources of the Nation's National Parks are believed to be seriously threatened, although adequate data to document the severity and extent of threats is inadequate or lacking.
2. Present water resource management programs within the agency are not able to deal with the real and suspected problems due to insufficient staffing and funding and to limitations in program scope.
3. A major shift in priority management strategies for future NPS water resource management program activities is required if

the National Park Service is to fulfill its mandate to protect and preserve park water resources for future generations.

#### INFORMATION ABOUT THREATS TO NPS WATER RESOURCES

In July, 1979, the House Subcommittee on Public Lands and National Parks of the House Committee on Interior and Insular Affairs asked the Director of the National Park Service for a State of the Parks Report. As a follow-up to this request, the National Park Service sent to every field area a three-part query that included a seven-part questionnaire and dual sections on sources of threats and resources threatened. The questionnaire served as a checklist of threats and asked the question: "In light of the enabling legislation, the legislative history, and the statement for management, what threats are impacting the park resources and to what extent?" The seven threat categories included: (1) air pollution; (2) water quality pollution and water quantity changes; (3) aesthetic degradation; (4) physical removal of resources; (5) exotic species encroachment; (6) visitor physical impacts; and, (7) park operations.

The data received from 310 park units were tabulated, computerized, analyzed and interpreted in a NPS report titled, "State of the Parks - 1980: A Report to the Congress." The report focused on three aspects of the threats to the parks problem: first, the report identified specific threats endangering the resources of individual parks; second, it identified sources of threats, both internal and external to park boundaries, and then it identified the park resources endangered by the threats.

This report, based on extensive information submitted by park superintendents, park natural and cultural resource managers, park

scientists, and park planners, identified a broad spectrum of problems and issues with which the National Park Service must deal.

The term "threats" as defined in the report included those pollutants, visitor activities, exotic species, industrial development projects, or other such sources which have the potential to cause significant damage to park resources or to seriously degrade important park values or visitor experiences. The mean number of threats reported per park was 13.6 Servicewide. The 63 national park natural areas greater than 30,000 acres in size reported an average number of threats nearly double the Servicewide norm. Included in this category were such well known crown jewels as Yellowstone, Yosemite, Great Smoky Mountains, Everglades, Olympic, Sequoia, McKinley, and Glacier National Parks. Most of these great natural areas were at one time pristine wildernesses surrounded and protected by equally vast wild areas. Today, with the park's surrounding buffer zones badly eroded, many of these parks are experiencing significant and widespread degradations.

The 12 Biosphere Reserve Parks, which are unique natural areas that range in size from 15,000 acres to more than two million acres and which are dedicated to long-term ecosystem monitoring under the UNESCO Man and the Biosphere Program, surprisingly reported an average number of threats nearly three times the Servicewide norm. This magnitude of reported threats is particularly disturbing because the Biosphere Reserve parks are considered to be model ecological control areas for the network of International Biosphere Reserves.

The large number of threats reported for these natural parks may reflect the greater emphasis directed to monitoring of these areas. If in fact the reason for increased occurrence of reported threats is greater monitoring, then significant numbers of threats may have been

overlooked in other parks which, to date, have received much less research and monitoring attention.

Threats identified in this survey originated either within or outside park boundaries. The most frequently reported internal threats were associated with heavy visitor use, including park utility access corridors, vehicle noise, soil erosion, and exotic plant and animal introductions. More than 50 percent of the reported threats were attributed to external sources or activities often located at considerable distances from the parks. The most frequently identified external threats included industrial and commercial development projects on adjacent lands; air pollution emissions, often associated with facilities located considerable distances from the affected parks; and urban encroachment: housing and athletic complexes and the like. External threats also included land clearing, cattle and other feral animals, dust, burning of fields and refuse, application of fertilizers and other toxic chemicals, and even DDT's use in Mexico. Many or most of these external threats potentially can impact park resources through interaction with park hydrological cycles.

#### Water-Related Threats

Water related threats such as dams, flood control canals, cooling water discharge, dredging, flooding, and water mining all were reported as directly or indirectly affecting the unique resources of the national parks. Watercourses flowing through national parks and their lakes and swamps may be polluted or silted or dried up because of human activities occurring hundreds of miles away. Irrigation schemes upstream in rivers which flow through national parks have upset the ecology of protected areas, resulting in adverse chain reactions affecting the vegetation and the fauna.

In the threats survey, the water related threats category included the following subcategory threats, expressed as percents of the 466 total threats reported for the water-related category: organic (20%), changes in flow rates (15%), toxic chemicals (14%), salt/sediment deposition (11%), oil spills (10%), other (6%), acid mine drainage (5%), radioactivity (3%), and thermal discharge (2%).

A few brief examples of specific water related threats include:

Inorganic water pollution problems stem from both point and nonpoint sources.

- Glacier NP is an example where outside logging, a nonpoint source, is causing leaching of nitrates and phosphates into the park.
- Everglades NP receives inorganic pollutants from agricultural activities upstream.
- Antietam NB suffers from sediment deposition caused by nearby construction and fertilizer runoff from agricultural/urban ecosystems.

Organic Chemical sources may be internal, as in Glen Canyon NRA where sewage holding tanks from recreational vehicles, boats, and portable sanitation facilities are leaking into the waters of Lake Powell, or external, as at a number of urban park areas, including Catoctin Mountain Park, Cuyahoga Valley NRA and Indiana Dunes National Lakeshore.

Salt Deposition occurs in western parks which are suffering from reduced water flow, such as Death Valley NM and Great Sand Dunes NM. Road salting in such northern areas as Indiana Dunes NL and many northern urban parks is also a problem.

Sediment Deposition is also a problem in parks with flooding. Aztec Ruins NM, Oxen Hill Farm Park, and Kenilworth Gardens are examples of the many parks which cited this as a problem.

Thermal Discharge is potentially a problem at parks near power plants with cooling towers or cooling ponds, such as Biscayne NM.

Unnatural Flooding is caused by such diverse sources as release of impoundment waters above park areas at times of high water, as reported by Everglades NP, Dinosaur NM, and Devils Tower NM, and sheetflow over clearcut areas outside park boundaries, reported by Redwoods NP.

Unnatural Flow Decrease has become a problem due to aquifer draw-down at Curecanti NRA, Death Valley NM, and other arid land parks, especially those along the Colorado River.

Oil Spills from external sources pose a constant threat to coastal park areas. Padre Island NS, Fire Island NS, Channel Island NS, Olympic NP, and Gulf Islands NS are just a few examples.

Radioactivity from atomic energy and defense activities has been recorded by a number of parks. Man-caused radioactivity, either actual or potential, was of concern at Biscayne NM and Everglades NP due to the nearby Turkey Point Nuclear Plant, at Pipe Spring NP because of its proximity to a military facility testing atomic bombs, and at Arches NP because of a possible future nuclear waste storage site nearby.

Uranium mining activities create the potential for water contamination throughout the Rocky Mountains. Natural radiation was cited as a problem both in Bighorn Canyon NRA and Mammoth Cave NP.

Acid Mine Drainage has surfaced as a problem in eastern states where the acid water runoff from old coal mines has contaminated park waters. Acid water kills fish, salamander, and invertebrate populations

both directly and through synergistic effects with mobilized chemicals. The Chesapeake and Ohio Canal NHP and Prince William Forest Park have suffered from this threat.

Toxic Chemicals derived from external sources, can enter parks via rivers, such as at Bighorn Canyon NRA, where mining of bentonite is a problem, and at Indiana Dunes NL and Cuyahoga Valley NRA. Toxic chemicals can also enter from the air as acid rain and affect park waters, as at Great Smoky Mountains NP.

Other Threats include mining of the aquifer under Castillo de San Marcos NM and water rights adjudication procedures at Dinosaur NM. Both can ultimately cause water shortages leading to extended periods of drought and loss from park ecosystems of water dependent native biota.

#### The Threatened Resources

In addition to examining types of threats and sources of threats, the third factor that the State of the Parks Report addressed was the threatened resources, themselves. These threatened resources are the natural and cultural features which national parks are created and managed to protect and preserve, the very essence of park protection and visitor interest. Forty-nine identified groups were aggregated into five resource categories: biological, physical, aesthetic, cultural, and operational.

Thirty-two percent of all reported threatened resources were biological, such as plants, mammals, forest habitats, and a range of other living organisms. Physical resources, such as air and water, constituted 24 percent of all the reported threatened resources. Threatened aesthetic resources, which comprise subjective and sometimes intangible features such as silence, odors, general scene, wilderness

and the like, constituted 20 percent of all the reported threatened resources. And operations, such as roads, trails, facilities, as well as health and safety of visitors and employees, constituted 8 percent of the total reported threatened resources.

These generalities don't adequately address the significance of these threatened resources because some, like coral reefs and mangrove habitats, may only be found in one or a few parks. They represent extremely important resources within the National Park System because they occur in only one of a few localities.

#### What Do We Know About These Threatened Situations?

Seventy-five percent of all the reported threats were classified by onsite observers as inadequately documented by research or other valid methods. Threats associated with air pollution, water pollution, and visitor related activities were cited as needing additional monitoring, scientific measurements or research documentation.

The paucity of information about park ecosystems relates not only to resources conditions and the status of impinging internal and external activities, but also to the baseline information available for planning and decision-making. Very few park units possess sufficient natural and cultural resource information needed to permit identification of incremental changes that may be caused by any given threat. Service priorities assigned to the development of sound resource information baselines traditionally have been very low compared to the priorities assigned to meeting use-oriented construction and maintenance needs. In general, research and resources management activities have been relegated to a position where only the most visible and severe problems are addressed, primarily through short-term quick fixes.



Nowhere within the National Park System is the absence of adequate baseline information about park resources more glaringly apparent than in the water resource area:

- To date there has been no systematic, Servicewide inventory and assessment of existing water resources data.
- There is no systematic Servicewide effort currently underway to identify critical, high priority gaps in each park's water resource data base.
- More than two years after adoption of a water resources planning program, not a single park water resource management plan has been completed and approved by the Service.
- Quantification of NPS Federal reserved water rights in the 11 western states is virtually at a standstill within the agency at a time when the reserved water right controversy is becoming more acute and the consumption demands on western water are escalating logarithmically.

In summary, the data show that the water resources of the National Park System are threatened, but that information is lacking to assess the gravity of the situation.

#### INADEQUATE STAFFING AND FUNDING

The 1980 State of the Parks Report concluded that to deal with the wide range of pervasive and complex problems facing the parks today, "...will require a comprehensive science and resource management program that addresses sound resources management planning, the development of an information data base for each park unit, a carefully structured and well documented monitoring program, and a resources management plan that adequately addresses not only the many threats that exist Servicewide,

but additionally the steps to be taken to mitigate these problems." The essence of this conclusion is very similar to the findings of the Leopold and Robbins reports of 1963, which stressed the need for science to form the basis of any resource management program, and to the concerns of the Service's first scientist, who in 1932 wrote, "...no management measure or other interference with biotic relationships shall be undertaken prior to a properly conducted investigation."

What kind of comprehensive science and resource management program does the Service apply to park water resources today? The Service's FY 1982 Water Resources Program Budget is approximately \$2,114,000, or less than 0.4 percent of the total National Park Service budget. Similarly, the Service has fewer than 20 professional hydrologists and/or hydraulic engineers as permanent employees working on water resource programs. Seven of those positions are duty stationed in only three parks; all the others are either in the ten Regional Offices, the Washington Office, or at the Service's Fort Collins Water Resource Laboratory. These 20 positions constitute roughly 0.2 percent of the total National Park Service permanent staff.

Simply stated, the current levels of funding and staffing assigned to water resource activities are unable to cope effectively with the broad spectrum of threats and problems which have been identified by the Service.

#### CURRENT PROGRAM DIRECTIONS

The National Park Service has, for the first time, prepared a draft Servicewide Water Resources Division Program Management Plan for Fiscal Year 1982, setting forth the major objectives and goals of the water resources program and containing 1-2 page summary work plans for all

on-going water resource projects (53 work plans Servicewide). Five primary program activities are presently being addressed within the overall program:

1. Energy Effects Analysis Program - Subobjective: to pursue an active research effort designed to provide resource managers with effective technical tools and data to meet evolving threats to riparian or aquatic ecosystems stemming from external energy resource development.
2. Water Resource Planning Program - Subobjective: to facilitate sound water resource management planning throughout the Service for the long-term protection of surface and groundwater resources and to develop appropriate water supplies for park visitors and operations.
3. Atmospheric Deposition ("Acid Rain") Program - Subobjective: to monitor, investigate, and determine the scope, magnitude, and trends of actual or potential long-term effects to park natural resources which stem from or are exacerbated by atmospheric deposition.
4. Outer Continental Shelf Coordination Program - Subobjective: to facilitate the Department's OCS leasing program by providing timely and accurate information and coordination to the Bureau of Land Management and the Department on Servicewide coastal resources.
5. Technical Assistance Program - Subobjective: to provide NPS Regions, and through them, the parks with scientifically and technically sound methods and guidance to solve resource management problems related to water quality, supply and mitigation issues.

## POSSIBLE ALTERNATIVE PROGRAM INITIATIVES

While the current program management plan constitutes a positive initial step forward in redirecting what has heretofore been a highly fragmented program, there are a number of additional initiatives which could be actively considered for implementation by the Service. These are as follows:

1. Complete a comprehensive inventory of all known existing water resource data on a park-by-park basis. All water records available from the National Water Data Exchange (NAWDEX) computerized data base maintained by the USGS and the Storage and Retrieval System (STORET) of the U.S. EPA (as well as those noncomputerized water records in the NPS) would be cataloged, indexed, and assessed to develop a historical account of water resources management in each park.
2. Develop and implement a phased program of completing baseline water budgets for all parks with significant water resources, identifying critical data gaps on water inputs, storages and outputs. Funding priorities for capturing additional water resource data should be determined by consideration of the currently available data and by the urgency of threats confronting the individual parks.
3. Develop and implement a National Park Service National Hydrologic Bench-mark Network. Such parameters as stream flow, chemical and physical quality of water, groundwater conditions, and the various characteristics of weather (principally precipitation) should be monitored in selected parks to document natural changes in hydrological characteristics with

time, to provide a better understanding of the hydrologic structure of natural basins, and provide a baseline for assessing the effects of man on park environments. This network should be incorporated into the USGS's National Hydrologic Bench-mark Network.

4. Develop and implement a comprehensive program to inventory and quantify NPS federal reserved water rights. Vital nonconsumptive water quantity, quality and timing requirements needed to protect fish and wildlife communities, riparian vegetation, recreational opportunities, and aesthetic values should be identified and quantified through rigorous scientific endeavor.
5. Develop and implement a computerized water resource information management system to store and analyze all Service water resource data.
6. Complete water resources management plans for all parks possessing significant water resources.

While not intended to be an exhaustive list of possible additional Service initiatives, we believe that accomplishment of the tasks outlined above would constitute significant forward progress in addressing the concerns discussed in this paper.

#### SUMMARY

We hope that it is clear from the above presentation that a continuing and expanded nationwide commitment is required to address the wide range of NPS water resource issues. The capability to better quantify and document the impact of various threats, particularly those which are believed to most seriously affect important park resources and

park values must be improved. As the 1980 State of the Parks Report pointed out, the ability to preserve park resources depends heavily on the use of research to define threshold damage levels and to develop response versus exposure relationships. Such a park resource preservation program needs comprehensive monitoring programs to quantify existing environmental and ecosystem conditions. It needs the development of a much better capability to predict how proposed new sources or activities will affect water quality and quantity and other park resources. As an internal management tool, this resource preservation program needs baseline information as a guide for setting priorities and allocating available resources, for knowing when and where to initiate mitigation programs, and as a basis for formulating and supporting policy positions in adversary proceedings. Lastly, this resource preservation program needs the support of scientists throughout the nation. Such support should be in terms not only of a willingness to work on National Park Service contracts, but also in terms of developing opportunities to use other funding sources to support work on park resources, of involving classroom students and park visitors in learning about park resource problems, and of providing decision makers with the tools for using scientific information in making the many resource value choices that they will face as they resolve the threats to our parks.