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Evaluating Recreation Impacts: A Multi-Faceted Research Design

By Jeffrey L. Marion and David N. Cole

Management goals for most National Park Service lands stress preserving natural conditions and avoiding conspicuous evidence of human use. Environmental impacts resulting from different types of recreational use compromise these goals to varying degrees. In the Mid-Atlantic Region, concern over resource impacts associated with expanding river recreation and camping activities led to the initiation, in 1985, of recreation impact research in three river oriented parks: Delaware Water Gap National Recreation Area, Upper Delaware Scenic and Recreational River, and New River Gorge National River.

Most recreational impact research consists of short-term, one-of-a-kind studies that do not build on one another. This is unfortunate because the recreation impact system is complex, with interacting and confounding variables. Most research designs have serious limitations and when a long-term perspective is lacking, results are frequently misleading. We tried to minimize these problems by designing a multi-faceted research project that would provide a more comprehensive picture of what impacts were occurring and how they might be monitored and managed. This paper describes the range of studies we designed in the hope that this might serve as a model for studies with similar objectives.

Research Objectives

The primary goals of our research program were (1) to characterize the nature of site impacts resulting from recreational use and (2) to assess how the number and type of recreational users and the characteristics of the sites they use influence these impacts. Many techniques for managing recreational impacts exist, but the most appropriate and effective techniques for managing particular situations are not always obvious. Management programs aimed at minimizing such impacts require answers to a number of questions. What types of impacts are occurring and what is their current severity and distribution? How and to what extent are impacts related to environmental factors such as vegetation, soil, and landform types? How and to what extent are impacts related to different types and amounts of use? How and to what extent are impacts changing over time?

Research Approach and Methodology

After assessing the advantages, disadvantages and implicit assumptions of various research approaches, the following set of studies was selected:

1. *Cross-Sectional Descriptive Survey of Recreation Sites and Adjacent Control Sites* – A series of measurements, including assessments of recreation site area, devegetated core area, tree damage, tree reproduction, vegetative ground cover, vegetative composition, soil loss, soil compaction, and soil moisture, were taken on 55 recreation sites in the three parks. Similar measurements were taken on neighboring undisturbed sites (controls) with similar environmental settings. Differences between recreation sites and controls provide an estimate of how much impact has occurred as a result of recreational use. We compared amount of impact on sites with different amounts of use, types of users and in different environmental settings, to determine the importance of these independent variables.

2. *Longitudinal Study of Change Over Time on Long-Established Sites* – The descriptive survey was based on measurements that could be precisely replicated at a future date. This will allow us to repeat measurements in five years and determine how these sites – again stratified by amount and type of use and environment – are changing over time.

3. *Longitudinal Study of Change Following Site Creation* – Site conditions were measured on several new sites prior to and at periodic intervals after they were opened for use. Measurements were similar to those in the descriptive survey. Changes were also monitored on control sites in order to incorporate changes not related to recreational use into the final interpretation of results. This study will be continued for at least three years. This approach provides more accurate assessments of recreational impact than the descriptive survey because it eliminates errors associated with the assumption that a site was originally identical to a control. The problems with this approach are that results are not available for several years and it can be difficult to locate new sites that are typical of user-created campsites.

4. *Longitudinal Study of Change Following Site Closure* – Site conditions were measured on several sites prior to and at periodic intervals after they were closed to use. As above, measurements were similar to those in the descriptive survey, changes were also monitored on control sites, and the study will be continued for at least three years.

5. *Experimental Trampling Study in Different Environments* – Experimental trampling, within a factorial research design, was used to evaluate the relationships between trampling impacts to vegetation and soil and (a) amount of trampling, and (b) vegetation type. Two different vegetation types, a grassland and a forest with an understory of forbs, were trampled at intensities of between 5 and 1000 passes per year. Trampling treatments and all vegetation and soil measurements will be repeated each year for at least three years in order to predict the long-term consequences of continued use. Experiments provide the best opportunity to control amount of use and to minimize differences in environment and type of use that tend to confound results. The major drawback is that experimental trampling does not truly simulate recreational activities.

In a related study, we are developing impact assessment and monitoring systems for the parks. Research included the following:

1. Impact assessment procedures developed elsewhere were evaluated in terms of their management efficiency, precision, and accuracy. The procedures judged to have the most promise were then modified to fit the conditions at Delaware Water Gap and New River Gorge. Monitoring programs are now in place at each of these parks.

2. Microcomputer software was modified to facilitate the entry and analysis of impact monitoring data. Extensive menu-driven programming, within the dBASE III package, has enhanced our ability to analyze the impact monitoring data bases at Delaware Water Gap and New River Gorge.

Results

Results of the descriptive survey are already available. We found, in general, that the nature and magnitude of impacts in these eastern riparian forests were quite similar to those reported in wilderness areas in the western United States and northern Minnesota, despite more favorable growing conditions. This suggests that the effectiveness of basic strategies for managing impact – such as visitor dispersal, visitor containment, visitor education or site management – should not differ greatly between regions.

Continued on page 24

Greenhouse Effect

Continued from page 22

for instance, could inhibit flowering of keystone fruit trees, leading to famine among frugivores.

How can we lessen the loss of biodiversity that seems imminent? First, improve knowledge, emphasizing processes rather than species. More refined models of climate change are an obvious requirement. Much interdisciplinary research is needed, and institutional adjustments and professional rewards to encourage this now unpopular activity. We need to expand development of integrated models, and increase long-term research. Boyd Evison stressed the need for basic data about current conditions, so biological effects of climate change can be better detected.

More active management of natural communities will also be required. "We will have to become ecological engineers of the first order," said Jerry Franklin. What this would entail was not the focus of this conference, but someone facetiously suggested moving trees rather than MX missiles northward on railroad flatcars. More seriously, Margaret Davis urged research on procedures necessary to artificially recreate natural forest communities in new locations farther north. Forest management should be directed toward reducing fragmentation and providing a landscape matrix that nurtures biological diversity. Such a landscape would be more resilient to climate change and would ease the passage of migrating species. Natural reserves, it was stated, should be very large to minimize effects of random disturbance.

Besides seeking management mitigation practices, the underlying economic and political bases of the problem must be attacked. Congresswoman Claudine Schneider eloquently addressed this side of the issue while describing a bill she recently introduced to reduce emissions of greenhouse gases. She concluded by urging scientists to become lobbyists. "You must not sit by the sick bed," she said.

I found this conference extremely informative. It told us in some detail about the kinds of biological responses to expect. Future conferences no doubt will address the next questions: how species migrate, how we can assist in that process, and how we can maintain biological diversity until the long-term problem of atmospheric pollution is resolved. Papers from this conference will be published by Yale University Press in late 1989. If you wish to obtain them contact Stacey Roberts, Conference Coordinator, World Wildlife Fund-U.S., 1250 - 24th Street NW, Washington, D.C. 20037. Phone: (202) 778-9572.

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Continued from page 23

Instead it is the details of intensive management that will differ between regions and from area to area. How much use can occur before thresholds of acceptable change are exceeded? And how do these thresholds vary between environments or with type of use? How effective is site rehabilitation likely to be and how can rehabilitation be assisted?

We expect that further analysis of results from these studies will provide a more detailed understanding of the complex relationships between recreational use and resultant ecological changes in these parks. Direct management implications include, but are not limited to, identification of use thresholds for varied ecosystem types, improved campsite selection and design criteria, improved site management and rehabilitation techniques, improved minimum impact education messages, and evaluation and recommendation of appropriate management practices.

Finally, the development of efficient impact monitoring programs will enable resource managers to: (1) develop a quantitative data base documenting long-term changes resulting from recreational use, (2) detect and evaluate deteriorating and improving conditions, (3) analyze relationships between specific impacts and environmental features or use-related information, (4) evaluate the effectiveness of resource protection measures, and (5) set and monitor limits of acceptable change for resource conditions.

Readers interested in further information can request any or all of several reports from the senior author. These include a detailed study plan for the research program, Mid-Atlantic Region Research/Resources Management Reports on results of the descriptive surveys (one for each of the three parks) and the impact monitoring program at Delaware Water Gap; an article in *Environmental Management* on results of the descriptive survey; and a number of papers on monitoring methods.

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Interpretation

Virgin Islands Birdlife Joint NPS/UVI Publication

"Keep a green tree in your heart and perhaps the singing bird will come."

With this Chinese proverb, **Virgin Islands Birdlife**, by Roland H. Wauer, opens a book on the avian world of these Caribbean islands.

The 35-page, illustrated booklet describes the five bird communities of the Virgin Islands – ocean/bay, wetland, dry forest, moist forest, and developed areas. The most common birds are discussed first, followed by a chapter on enjoying and identifying, and another on protecting, wild birds. A section on "The Virgin Islands Connection" considers the importance of these "wintering grounds" for many of the U.S. migratory birds, especially the warblers. The appendices include a glossary of V.I. bird names, a checklist, and useful references.

The book breaks new ground in collaboration between the University of the Virgin Islands and NPS. Wauer is an NPS research scientist stationed in the Virgin Islands.

NPS and the Law

The National Parks and Conservation Association's newest publication, *Our Common Lands: Defending the National Parks*, is a compilation of 18 essays by some of America's most noted legal scholars, examining the current state of park protection law in the United States. From the NPS Organic Act to the Clean Air Act, the book describes where American environmental law has been both effective and ineffective in protecting national parks.

Former Interior Secretary Stewart L. Udall has described the book as "First rate ... invaluable. This superb book contains all the elements of a battle plan to preserve the national parks."

The book will be reviewed in the Spring issue of *Park Science* by Ray Herrmann, Chief of the Water Resources Division's Branch of Applied Research.