The George Wright
FORUM

Volume 10 1993 Number 1

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of Cultural and Natural Parks and Reserves
Through Research and Education

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A National Biological Survey:
Some Issues, Concerns, and Historical Background

A Memo from the GWS Executive Office

By the time you read this, the Clinton Administration is to have officially proposed the creation of a National Biological Survey (NBS). The idea was announced in March 1993 by Secretary of the Interior Bruce Babbitt. All indications are that the NBS will be a separate agency within the Department of the Interior. The purpose of the NBS is to inventory the USA's biological resources, and to assay the nation's biodiversity.

On a more political level, the NBS could–by virtue of taking a proactive, ecosystem approach–conceivably head off paralyzing conflicts under the Endangered Species Act. As Babbitt said in a newspaper interview in March, the NBS could allow the government "to spot the problems coming while there's still flexibility and time to deal with them" rather than trying to address ecosystem issues after economic and environmental interests have locked horns.

The agency that will be affected most by the creation of the NBS is the U.S. Fish and Wildlife Service. It appears that most of the NBS's proposed funding will be transferred from the USFWS and USNPS, with other Interior agencies contributing lesser amounts. The nucleus of the NBS will be USFWS's existing research establishment. In some ways, the NBS will be patterned after the U.S. Geological Survey, whose genesis in 1879 came about as a collaboration between the Interior department, the Smithsonian Institution, and the National Academy of Sciences. The NBS would also seek cooperation with other non-Interior agencies (such as the U.S. Forest Service and state agencies). The Smithsonian has already expressed its enthusiasm for the NBS.

What we'd like to do in this memo is lay out a few of the issues and concerns that have been raised about the NBS. We also will discuss in some greater detail a few of the possible effects on the USNPS science program, which, perhaps, is in the most tenuous position of those that will be affected. (There is, in fact, a precedent in USNPS history for national park biological programs being conducted by other agencies.) We must emphasize that the information offered here should not be taken to imply any official judgment by the George Wright Society on the merit of creating an NBS, for none has been made.

There seems to be little disagreement that doing a nationwide survey of biological resources would be a worthy endeavor. Such an inventory is a pivotal part of the data sets needed for scientific management of protected areas. (The article in this issue by Gregg, Serabian, and Ruggiero is a case in point.) No such inventory of the USA exists, although many individual elements do, scattered among the files of universities, government agencies, and non-governmental organizations (especially The Nature Conservancy). Presumably the NBS will not only pull together and harmonize this disparate in-

formation, but will do extensive original research on biological richness and biodiversity.

One of the objectives of the *Global Biodiversity Strategy* (WRI, IUCN, and UNEP 1992) is to "establish or strengthen national or subnational institutions providing information on the conservation and potential values of biodiversity." The NBS could potentially coordinate the flow of information on biological resources to communities and users of that information. Sectors of society which could benefit from an NBS include education, agriculture, tourism, planning, forestry, biotechnology, investment, fisheries, and others. It is possible that the NBS could comprise database and collections management, inventories, monitoring, and other research functions. An effective NBS could help create successful regional management regimes in which protected area conservation is integrated with that of agriculture, forestry, fisheries, watersheds, and environmental services. And the NBS could raise the public's awareness of the importance and value of biodiversity (as opposed to charismatic individual species) and the healthy ecosystems upon which biodiversity depends.

Other countries have taken what is basically the same idea and adapted it to their own needs—in the process producing some innovative institutions. Probably the best example is from Costa Rica, where a private nonprofit organization, the Instituto Nacional de Biodiversidad (INBio) was created in 1989. INBio has launched a national inventory of Costa Rica's rich biodiversity. To pay for this, INBio is proposing to broker naturally derived chemical substances to industry, particularly biotechnology. INBio has also been widely praised for its employment of paraprofessional taxonomists: people who are trained to identify species from their locality, thus giving local residents an economic stake in protecting ecosystems (WRI, IUCN, and UNEP 1992). In sum, the potential of a U.S. National Biological Survey could conceivably go well beyond merely documenting biological resources and their diversity.

There are, however, many concerns that have been raised about the effect a new agency would have on biological research focused on and based in protected areas. The concerns are particularly acute with respect to USNPS , whose science program is only now beginning to emerge from a long period of languor. Just last year, the National Research Council's Committee on Improving the Science and Technology Programs of the National Park Service recommended giving the agency's science program "substantial organizational and budgetary autonomy"—though it is apparent the Committee had in mind autonomy *within* the USNPS, not the creation of a whole new agency (National Research Council 1992). The mechanics of creating a separate agency raises a series of questions:

- Will the NBS increase or decrease USNPS direct access to scientific expertise for dealing with resource issues? Will the USNPS have to pay NBS to do the research?
- Will the current trend within USNPS—toward the use of research information in decision-making and the emphasis on resource management—be reversed if USNPS scientists are removed as internal advocates? Who would be left within USNPS to advocate research?
- Where will national parks and other protected areas fit into the NBS's priorities? Since parks and other protected areas are such a small part of the country's land base, and because there may be a perception that they are not as much at risk as multiple-use lands, how much attention will they receive in a national inventory?

- How will the NBS react to changing politics in the Secretary of the Interior's office? Could a future, less-supportive, Administration undermine long-term projects? Could such an Administration manipulate the results?
- Might a career ladder develop in which junior scientists cut their teeth in the USNPS, only to move on to the NBS to address national-level biological concerns?

It may be of interest to reflect on the historical precedent for these concerns (for which we rely on a March 18, 1993, memorandum by Richard West Sellars, a USNPS historian; for more background on the history of science in the agency, see Sellars' article in this issue).

On the first day of 1940, Secretary of the Interior Harold Ickes transferred the USNPS's wildlife biologists to the Bureau of Biological Survey, who were then assigned to an office devoted to national park concerns. The effect of this removal is not clear. The USNPS's science program was already in decline in the late 1930s following George Wright's death in 1936, and all of the agency's programs were weakened by the advent of World War II. Ickes' motivations for the reorganization were varied, but probably his main concern was to centralize all federal land-managing agencies within the Interior Department, which was to be renamed the Department of Conservation.

Later in 1940, the Bureau of Biological Survey—which itself had been transformed, over the years, from a wildlife survey into an agency devoted to game management and predator control—was merged into the agency which is now known as the USFWS. The USNPS biologists stayed within Fish and Wildlife until the mid-1940s, when they were repatriated to the Park Service. USNPS's biology programs did not begin to gain strength again until the 1960s.

So park-related science programs were not strengthened by being removed to another agency. Yet it is an open question whether the separation itself or World War II or some other factor was the reason. Moreover, science programs within the USNPS languished for years before beginning to garner increased support.

The next few months will be ones of momentous decision, and we hope you will consider the pros and cons of an NBS carefully as events unfold. It goes without saying that the Society will be watching things closely. A National Academy of Sciences committee has been created to offer advice on how to organize the NBS, and is expected to report in September. At some point in the process the Society may be asked to provide formal information or state an official position. To help us prepare, we'd like to hear what you think. One of the suggestions we've already received is that the Society recommend that a section of the NBS be entirely devoted to research and inventory in protected areas such as parks and wilderness areas. The organizational structure of the NBS likely will be decided within a matter of weeks. Please send your comments ASAP to the Society's Hancock office and we'll make sure that they reach the Board of Directors.

References

National Research Council. 1992. *Science and the National Parks.* Washington: National Academy Press.

WRI, IUCN [The World Conservation Union], and UNEP [United Nations Environment Programme]. 1992. *Global Biodiversity Strategy.* Washington: WRI, IUCN, and UNEP.

Society News, Notes & Mail

Recent Publications by Society Members

From time to time we receive information on, or reviewer's copies of, new books edited or written by GWS members. We would like to occasionally publish brief notices of these in this column.

Stephen Woodley of the Canadian Parks Service has co-edited *Ecological Integrity and the Management of Ecosystems.* This volume, published in April 1993, is intended as a "road map" for anyone involved in ecosystem management. The book defines ecosystem integrity from several perspectives and puts it into a scientific framework, addresses key issues of scale and ecosystem hierarchy, and shows how to establish a national monitoring system from a working regional model. The price is US$55.00, plus US$4.95 per volume for shipping and handling. For more information, or to order, contact St. Lucie Press, 100 E. Linton Blvd., Suite 403B, Delray Beach, FL 33483; phone 407-274-9906; fax 407-274-9927. (Florida residents should add sales tax.)

The University of Illinois Press published R. Gerald Wright's *Wildlife Research and Management in the National Parks* in 1992. Wright traces the history of USNPS wildlife management and explores the many controversial issues associated with it, such as wolf reintroduction, grizzly bear management, and control of non-native species. For ordering information, contact the distributor, Island Press, at 800-828-1302.

Dickenson, Jarvis Join GWS Board; New Officers Named; Nominations for Fall 1993 Board Election Sought

Two new members were elected to the Society's Board of Directors as the result of last fall's balloting: Russell E. Dickenson of Bellevue, Washington, and Jonathan B. Jarvis of Arco, Idaho. In addition, Gary E. Davis of Ventura, California, was elected to a second term. All started three-year terms beginning January 1, 1993.

Dickenson, a graduate of Northern Arizona University, served with the USNPS for 39 years before he retired in 1985. He began his career in Grand Canyon National Park in 1946 and served in seven western national park areas and in the Midwest Regional Office. Over a span of 19 years, he held four important managerial posts with the USNPS: director, National Capital Region; deputy director; regional director, Pacific Northwest Region; and director (1980–85). His activities since retirement have included teaching a graduate class at the University of Washington, College of Forest Resources, since 1986; serving on the USNPS Advisory Board; and serving on a number of Boards of Directors, including those of the Student Conservation Association, the North Cascade Institute, Tourmobile, Inc., and the Eastern National Park & Monument Association.

Jarvis has a degree in biology from the College of William and Mary (1975). His current position is

superintendent of Craters of the Moon National Monument. He joined the USNPS in 1976 as a seasonal interpreter in the National Capital Region, and has since been resource management ranger at Prince William Forest Park, district ranger at Guadalupe Mountains National Park, resource management specialist at Crater Lake National Park, and chief of natural and cultural resource management at North Cascades National Park Service Complex. He completed the first Natural Resource Management Trainee Program (1982-1984). His interests include natural resources policy, wilderness management, and relationships between science and management.

Davis was vice-president of the George Wright Society from 1990-1992. He is a research marine biologist with the USNPS. From the Cooperative Park Studies Unit at the University of California–Davis, he conducts research on long-term ecosystem dynamics in marine protected areas and on marine fisheries in Channel Islands National Park, California. He also consults on establishment and management of marine parks worldwide. A native of San Diego and a graduate of San Diego State College (BS and MS in Biology), he conducted research and administered science programs in the U.S. Virgin Islands and Florida at Everglades, Biscayne, and Virgin Islands National Parks, and at Ft. Jefferson National Monument, from 1968 to 1980. He returned to California and assumed his current post when Channel Islands National Park was established in 1980. Davis has been active in several professional societies in addition to the George Wright Society.

In addition, four sitting Board members ran unopposed for extensions of less than three years, thus enabling the Board to achieve a schedule of staggered terms. Stephanie Toothman and Stephen D. Veirs, Jr., were elected to one-year terms; they are eligible to run for an additional three-year term this fall. Jonathan Bayless and Melody Webb were elected to two-year terms.

At the Board's March 1993 meeting, the following officers were elected: Gary Davis, president; Stephanie Toothman, vice-president; Elizabeth Smart, secretary; and Stephen Veirs, treasurer.

We are now seeking nominations from Society members for the two Board seats whose terms will run from January 1, 1994, through December 31, 1996. To be eligible, a nominee must be a GWS member in good standing. The Board meets at least once per year, sometimes more, and this requires some travel. Travel costs and per diem are paid by the Society; otherwise there is no remuneration. Each Board member serves on at least one committee–usually more.

To suggest a candidate for nomination, send his or her name, mailing address, and telephone and fax numbers to:

Nominating Committee
George Wright Society
P.O. Box 65
Hancock, MI 49930 USA

The Nominating Committee will then contact suggested candidates to determine the ballot. *The deadline for nomination suggestions is June 1, 1993.*

Upcoming Conferences

The **Western History Association's 1993 Annual Meeting** will be October 13-16, 1993, in Tulsa, Oklahoma. The sessions will feature the resources of the Gilcrease Institute. For more information, contact Patricia Campbell, University of New Mexico, 1080 Mesa Vista Hall, Albu-

querque, NM 87131; (505) 277-5234. The **1994 WHA Annual Meeting** will be October 20-23 in Albuquerque. Send session proposals to the program chairperson, Melody Webb, P.O. Box 308, Moose, WY 83012. The deadline for proposals is September 1, 1993.

The **Fifth International Symposium on Society and Resource Management** will be held at Colorado State University, Fort Collins, June 7-10, 1994. The main focus will be on the utility of social science for natural resource managers and policy makers. Abstracts no longer than two double-spaced pages should be sent by November 1, 1993, to Michael J. Manfredo, Program Chair, Human Dimensions in Natural Resources Unit, Colorado State University, Fort Collins, CO 80523.

1995 GWS Conference Goes to Oregon; Jacksonville Questionnaire Draws Many Suggestions

The 8th George Wright Society Conference will be held in Oregon's largest city, Portland, from April 17-22, 1995. The theme of the conference will center on the concept of sustainability as it relates to protected areas. A Conference Committee, chaired by GWS vice-president Stephanie Toothman, is currently being formed. A Call for Papers will be issued in October 1993.

At the 7th Conference in Jacksonville, we passed out a questionnaire to elicit suggestions for improving things. One hundred fifty were returned—an exceptionally high response. Many people commented on how valuable they found the conference, but there were plenty of areas for improvement too. Some of the most frequent suggestions were:

1. Publish a schedule of times for individual presentations within sessions and stick to the schedule (as was done in El Paso). Most people like to duck into and out of sessions to catch individual presentations of interest. This was the most frequent comment.
2. Give each speaker more time—20 minutes. Too many of the Jacksonville speakers were rushed. This would mean fewer presenters in both concurrents and plenaries, and fewer sessions themselves.
3. Try a more dynamic format for some sessions, such as debates. Try to get more audience involvement at sessions.
4. Arrange for daycare on-site or close by.
5. House all participants at the conference hotel. This is quite important for networking. (We always try to do this, but at Jacksonville a large number of people missed the registration deadline and had to be placed in another hotel.)
6. Keep doing field trips in the middle of the week—this was very popular.
7. Make sure we recycle. (The Marina Hotel did, but we should have let people know.)

We intend to take these suggestions and try to incorporate them into the Portland conference. Our thanks go out to everyone who took time to fill out the questionnaire. We welcome further suggestions from our readers; please send them to the Hancock office.

Debating the Future of Public Lands: A Proposal for a Series of Forums

Dear Editor:

Many of us in the Association of National Park Rangers read with considerable interest Gaylord Nelson's analysis of the issues which surround public lands management in the latest issue of the FORUM (Volume 9, Nos. 3/4). Without wishing to become too deeply involved in partisan politics, we agree that the citizens of this country need to consider very seriously how they want their public lands to appear in, say, ten years' time. Without thoughtful public debate on land management issues, we will all continue to drift along as we have for the last decade or so, on a course that will lead to increasing degradation of public lands, even in those areas which presumably receive the highest level of protection—our wilderness areas and our national parks.

During this debate, it will be important that the voices of professional land managers, protectors and interpreters be heard. The problem is that such voices are almost always drowned out because it has become nigh on to impossible to have an intelligent discussion about public land issues. We have become so polarized that shouting and posturing have replaced rational discourse, threats of suits and counter-suits have replaced negotiation, and coalition-building has become much more important than consensus-building. Hoping not to appear hopelessly naïve, we would suggest that we all—friends, foes, ourselves—have to lower the intensity of our rhetoric before we can have the debate that we all presumably wish to promote.

What we would suggest is a series of public forums, each to be conducted on a university campus where there is some tradition, at least, of civil debate. Each of the forums should have a central theme—mining law reform, reauthorization of the Endangered Species Act, national parks for the next century—these are a few of the topics which come to mind. Others, undoubtedly, would suggest other topics.

These forums should be televised nationally in much the same way that candidate forums were televised during the last presidential campaign. The sponsors should be the shareholders in the issue—the mining industry, the Sierra Club, the ORV industry, the Audubon Society, the National Parks and Recreation Association, etc. The moderators could be senior political leaders—Secretary of the Interior Bruce Babbitt and Secretary of Agriculture Mike Espy, for instance. Perhaps Dan Rather, Peter Jennings, or Tom Brokaw would moderate one.

The important outcome would be that the issues could be fully explored and the public would have the opportunity to hear several sides of each issue, not just that of the National Parks and Conservation Association or of the Wise Use Movement. Additionally, professional land managers would speak at the forums, offering the benefit of their experiences and observations.

Who would pay for these forums? We think the shareholders should. We suspect that the commodity industries would welcome the chance to present their points of view in such a debate. Many members of conservation organizations would probably support an assessment to help fund such a debate. Public television might be willing to participate as a sponsor. Some foundation money might be available. There are many options to explore.

In the meantime, professional land managers, protectors, and interpreters continue to push for policies and procedures which are consistent with sound management practices. For every John Mumma or Lorraine Mintzmyer, casualties of the political warfare waged at their level of government, there are countless triumphs at the lower levels of the bureaucracy. There is the National Park Service interpreter who convinces her audience that a healthy Everglades is good for our country. There is the Bureau of Land Management archaeologist whose efforts lead to the arrest of a pot hunter. There is the Forest Service timber specialist who eliminates a proposed logging skid road from a timber harvest plan. There is the Fish and Wildlife Service biologist who is surveying wildlife habitat for an endangered species. These are the real heroes whose voices are being heard and whose actions get results. All these heroes are asking is that they be given the opportunity to apply their knowledge, skills, and abilities to the task at hand. It is up to all of us to create the environment in which this is possible.

RICHARD T. GALE
President, ANPR
Boise, Idaho

Social Science and Protected Area Management: The Principles of Partnership

Gary E. Machlis

U.S. NATIONAL PARK SERVICE COOPERATIVE PARKS STUDIES UNIT
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A paper presented at the Fourth World Congress on National Parks and Protected Areas, Caracas, Venezuela, February 1992

INTRODUCTION

The management of protected areas is necessarily the management of people, for kin, community, class, and culture are fundamental units in the use, conservation, and preservation of natural resources. In the past decade, there has been a growing realization within the conservation movement that biophysical and social systems are inextricably intertwined. Hence, the social sciences have emerged as a potential partner to conservation in general, and protected area management in particular. As the theme of the Fourth World Congress is enhancing the role of protected areas in sustaining society, the social sciences and protected area management seem poised for important cooperation. The purpose of this paper is to describe this partnership and make recommendations for improvement.

Several questions guide the analysis: What do protected area managers need that social science might provide? What exactly have the social sciences contributed that is "usable knowledge" for protected area managers? What contributions can be expected in the future? What is required to enable the social sciences to become an integral part of the protected area movement?

The answers attempted here are personal and subjective; other social scientists would likely provide different views and opinions. While the scope is international, the limits of language result in a general reliance on my experience with the English-language scientific literature. An overview and synthesis is intended, rather than a review of research results. The recommendations are, it is hoped, significant and amenable to action.

What is meant by "social science?" While definitions vary (and often confuse rather than clarify), the key characteristic of social science is the application of the scientific method to understanding social behavior. Those academic disciplines that include significant amounts of social science are anthropology, economics, geography, psychology, political science, and sociology. The distinctions between "real science" and social science, or between the "hard" and "soft" sciences, are largely intellectual marking of territory and of little importance: there is really only the scientific method, poorly or well-applied. Nor is any one social science necessarily preeminent; all have the potential to contribute to conservation. While there are organizational differences between basic research (pursuing knowledge for its own sake) and applied research (pursuing knowledge for a specific purpose), the scientific method remains essential for both. There are differences in the practice of social science from one country to another (sociology is practiced differently in Canada than in Cuba); I stress the similarities.

The paper is organized as follows. First, I suggest two central principles for partnership between protected area management and the social sciences: *the social sciences must provide "usable knowledge" to managers,* and *managers must integrate this knowledge into decision-making.* Since the scale of management is so crucial (what is usable knowledge for a local park superintendent may be of little value to a national park director), the concept of "scale-dependent management" is applied to protected area management, and several critical issues facing managers at each site are described. These issues represent the information needs that the social sciences should be able to help satisfy. Next, I critically evaluate the contributions of the social sciences, comparatively examining each discipline for its central focus and potential. Since the results are frustrating to both social scientist and protected area manager, a set of recommendations for invigorating the partnership between scientist and manager are presented.

USABLE KNOWLEDGE AND THE PRINCIPLES OF PARTNERSHIP

Protected area managers are faced with an often bewildering and complex set of decisions, most of which must be made relatively quickly, simultaneously, without complete information or understanding, and with feedback effects that then must also be dealt with by additional decision-making. A majority of these decisions have a socio-economic or socio-political component: actions to be taken will likely have important impacts upon the wider social system. Hence there is an almost continual opportunity for social science to assist in making such decisions, if it can provide "usable knowledge." The criteria for usable knowledge related to protected area decision-making are specific:

- The information must be provided at the proper point in the decision-making process. Timeliness is critical.
- The information must directly address the manager's needs and at a level of detail appropriate to the decision.

- The manager must understand the limitations of the data, the degree to which it can be applied, the certainty (or lack thereof) of successful application, and the authoritativeness of the authors.

Hence, a research project completed too late, dealing with issues of only tangential relevance to a manager's decision-making needs, presented without limits or explanation, and by scientists of unknown credibility will not likely result in usable knowledge. Note that such research could be excellent, even brilliant, science; it would still remain outside the boundaries of usable knowledge. A first principle for organizing an effective partnership can thus be stated: *The social sciences must provide usable knowledge to protected area managers.*

While the decision-making activities of protected area managers are often undertaken within a complex socio-political context, the use of scientific information in such decision-making is, in reality, quite limited. Information from the biophysical sciences is more likely to be employed than the social sciences; a water quality assessment or game population estimate is more likely to enter into a resource management decision than an employee survey is into an administrative one. Protected area managers often use common sense, folk knowledge, field experience, and ideological views to make decisions, and usable knowledge from the social sciences is frequently ignored or avoided.

In many cases, managers may not be aware of or understand the potential advantage of using social science information. Often, protected area managers are uncomfortable integrating scientific information into their decision-making. Scientific advice often limits the range of decision alternatives available to the manager, by identifying unacceptable consequences, prioritizing choices along scientific rather than political criteria, and creating the need for managers to defend their rationale for not following such delivered advice. For all these reasons, what occurs is *ad hoc* and fragmented use of social science information. Its potential is not being fully exploited. A second organizing principle for a full, effective partnership can thus be stated: *Protected area managers must integrate the usable knowledge of social science into decision-making.* How such integration might realistically occur, and to what degree protected area managers might profit from using social science, is discussed shortly.

THE CRITICAL IMPORTANCE OF SCALE

Protected area management takes place at significantly different scales, and the issue of scale is central to the partnership of science (social and biological) and conservation. Table 1 illustrates the major scales of protected area management. For each, there are key organizational units to be considered in decision-making. At the *protected area* level, key units of organization include visitor groups, resident populations, park staff, and within-park enterprises. At the *region* level, the park is seen as imbedded in a wider ecological and social system, with boundaries conceptually defined rather than gazetted. Regional units of concern include local communities, states and provinces, regional offices of park and other natural resource agencies, regional markets, and service economies.

At the *national* level, key units are the national legislatures, central administrations, large non-governmental organizations (NGOs), the media, and other national agencies managing resources. At the *realm* level, international organizations and other nations' park agencies are central.

Table 1. Scales of protected area management and key organizational units

Scale of Protected Area System	Key Organizational Units
Protected Area	visitor groups resident populations park staff concessions
Region	local communities states and provinces regional offices regional service economies
National Protected Area System	national legislatures central park administrations national NGOs national travel industries bilateral NGOs
Realm	international NGOs international treaty organizations
Global System	national NGOs international travel industry United Nations

At the emerging *global* level, international NGOs, treaty organizations, and world markets become significant organizational units.

At each scale, the decision-making process of protected area managers will vary, as different organizational units and political contexts interact. That is, the management of protected areas is *scale-dependent.* In addition, each level of management is significantly influenced by the adjacent levels, and are in actuality parts of a nested system of protected area management. Information needs of protected area managers will differ at each scale, though contributing to an overall set of needs. Hence, what will be considered usable knowledge at one scale may be irrelevant or of little use at another.

Table 2 illustrates this idea of scale dependency. At each scale, a set of primary ecosystem and institutional issues are suggested. Each are linked to management issues at other scales; for example, habitat change and population loss at the protected area level can contribute to habitat fragmentation and species loss at the regional level; policy formation is a major institutional issue at the national level, and a significant component of strategic planning and international cooperation at the global level. Since these scales largely determine the social science information needs of protected area managers, we discuss each level in turn.

Protected Area Three organizational units predominate at the park level: visitor groups, resident populations, and employees. Managers at the protected area level need to document the social ecology of visi-

Table 2. Key issues by scale of management

Scale of Protected Area System	Key Ecosystem Issues	Key Institutional Issues
Protected Area	population loss habitat conversion exotic introductions ecosystem effects	visitor services resource management sustainability local populations
Region	habitat fragmentation species loss ecosystem stress	training monitoring coordination policy implementation
National Protected Area System	reduced biodiversity species loss	policy formation funding acquisition development strategies
Realm	reduced biodiversity species diversity	international cooperation
Global System	reduced biodiversity climate change	international cooperation and assistance strategic planning

tors, i.e., the relationship of visitors to the park environment. Their distribution, abundance, demographic composition, behaviors, and resource demands are all important variables in determining ecosystem impacts and viable resource management strategies. Visitor wants, needs, opinions, and expenditure patterns are valuable in policy and marketing decisions. To be useful, such information must be contemporary, area-specific, and, where visitation varies by season, season-specific. In addition, managers need ways to predict changes in visitor use, effectively manage visitor services, design efficient facilities, and readily communicate protected area values to visitors.

Resident populations present managers at this level with a different set of information needs. The numbers, distribution and demographic composition of resident populations are of course important. In addition, there is the need to understand sustenance and cultural requirements of such peoples, and their impact upon park resources. Information must be area-specific, accurate, and sensitive to cultural differences. Managers need strategies for coordinating decision-making with resident political structures, and for setting sustainable levels of resident economic activity while protecting park values.

Employees are also a crucial organizational unit, and at the protected area level several information needs emerge. Employee job satisfaction, morale, and concerns should be monitored as a feedback mechanism for improved administration. The information must be area-specific, accurate, and timely. Managers

need effective supervision, training, and staff development techniques.

Region While protected areas are largely defined by their legal or political boundaries, or both, protected area regions include the protected area and adjacent, related ecosystems and human communities. Biosphere reserves are an exception, being (in the ideal) institutionalized protected area regions. Several organizational units are crucial to the management of such regions, and present managers at the regional level with a unique set of concerns. Local communities are an example. These communities, particularly those at or near gateways to protected areas, produce several information needs. These include an understanding of population trends and economic activity levels, a grasp of critical cultural values, political structures, and leadership processes, and the dependency of such communities upon park and regional resources. Assessment of sustainable development levels, prediction of social and economic impacts of policy decisions, and strategies for effective public involvement are all valuable management tools.

Other examples are institutions, particularly regional and provincial governments. Here, managers need an understanding of regional political processes (both ideal and real), power-sharing arrangements (both formal and informal), and agency decision-making. As protected areas are increasingly used as tools for economic development, knowledge of regional economic trends (including labor and capital flows) is both valuable and necessary. Strategies for evaluating the social and economic impacts of regional development projects, and for interagency coordination of governmental activities, are needed.

Nation Managers at the national level are faced with yet another set of organizational units. National legislatures, central agency administrations, national NGOs, media, and industrial sectors (such as the tourism industry) are examples. Information needs vary dramatically from previous levels. For example, while area managers need specific, seasonal descriptive information about park visitors, national managers do not; they need accurate statistics on total visitation levels, including trends, future projections, and, to a lesser extent, regional distributions. Data on the economic impact of protected areas are politically valuable, as are techniques for predicting future trends in visitor use, and principles for design of standardized facilities and services.

Administration is a central concern at this level, and information required for effective administration includes staffing requirements (both current and projected), inventory of human and financial resources, and evaluation of subordinate managers. Techniques for allocating scarce resources, monitoring the status of individual protected areas and regions, and training and supervision of employees are all required at this level. National policy initiatives, head-of-state decisions, and media influence are crucial elements in decision-making, and the ability to conduct policy analysis, respond to executive information requests, and monitor public opinion is both valued and necessary.

Realm Managing protected areas at the realm level is an example of emerging scale, and fewer kinds of organizational units have evolved than at the other levels so far described. International NGOs, bilateral cooperative ventures (through treaty, contract or agreement) and nascent realm organizations (such as that within IUCN) are examples. Management largely involves strategic planning, monitoring, training, the administration of international aid programs and technical assistance. Information needs include

assessment of research and development applications, monitoring of critical problems (both general and endemic to the realm) either at the national or area level, and assessment of technical assistance needs. Strategies for improving the efficacy of technical assistance programs, enhancing the adoption and diffusion of innovations, increasing communication between national level managers and networking among NGOs are significant needs.

Global System Like realm management, global system management is an emerging scale in conservation, and particularly in protected area management. Organizational units include the United Nations (and its subsidiary institutions), IUCN (and its subsidiary commissions), the globally operating NGOs (such as World Wildlife Fund), and national NGOs with international agendas. Also included are the developed nations' donor agencies, and world trade associations related to travel, tourism, and natural resource production. Management tasks revolve around strategic planning, allocation of resources, and technical assistance. Hence information needs of these managers tend to be monitoring of global trends (often using national-level data) and policy analysis. The ability to provide documentation and support for global initiatives, as well as assess the viability of conservation strategies within different social, political, and economic systems, are paramount needs of managers at this level.

The scale dependency of protected area management creates a wide range of information needs that can be addressed by the social sciences. However, it is not realistic to expect all of the social sciences to contribute equally to usable knowledge at each management scale. The social sciences diverge according to their key units of analysis, central concerns, and experience in protected area management issues. I now turn to a brief description of the various disciplines and their contribution to protected area management.

THE SOCIAL SCIENCES DESCRIBED

A history and description of the social sciences is neither possible nor necessary here; brief remarks as to the scope of the social sciences may be useful. Orthodox approaches place six disciplines in the social sciences: anthropology, economics, geography (human rather than physical), psychology, political science, and sociology. History is marginally excluded. Contrary to conventional wisdom, the social sciences are not a particularly young; economics for example, long precedes the development of modern chemistry and most of the social sciences precede ecology.

These sciences have much in common: research techniques such as social surveys and experiments are used by each and all. Boundaries between the sciences are nebulous and prone to arcane distinctions; subfields such as social psychology and economic sociology flourish in academe. New specializations emerge yearly, tracking the growth of knowledge (some of it usable knowledge) and the search for "relevance," funding, or both. Attend a meeting of modern geographers: there are papers being presented about *everything*.

For the protected area manager, what may be useful is a comparison of each discipline's special focus, i.e., where the discipline has traditionally concentrated intellect and effort. A "map" of the social sciences can be described in preliminary terms. Table 3 provides a basic outline, organizing the sciences around their key units of analysis (the scale of things they study) and the central "engine" of change (the driving forces considered most important).

Table 3. A basic outline of the social sciences

Discipline	Key Units of Analysis	Engine of Change (Driving Forces)
Anthropology	communities subcultures cultures	tradition & culture
Economics	markets industries	economic value
Geography	regions landscapes	spatial distribution
Psychology	individuals	communication
Political Science	institutions states	power
Sociology	social groups organizations communities	conflict & cohesion

Anthropology focuses primarily upon social groupings that are intensely cultural: communities, subcultural groups, and even entire cultures themselves. The driving forces are primarily cultural change, with the role of tradition being a critical interest. *Economics* (which could be split into macro- and micro-economics) treats markets, industries, and economies as key units of study; the driving force of change is economic value (broadly defined). *Geography* (specifically human geography) treats regions, landscapes, and other spatial units (governmental, environmental, and so forth) as critical, and the spatial distribution of people, resources, and culture is seen as a significant driving force. *Psychology's* key unit is the individual, and communication of meaning (within and between individuals) is a central driving force. *Political science* focuses upon the institutions of state (at many levels); the central engine of change to many political scientists is power and its use. *Sociology* treats social groups, organizations, and communities as key units of analysis, with conflict and cohesion as central forces driving change.

Several patterns emerge. The social sciences overlap considerably as to their units of analysis: a protected area manager interested in learning about a local community's culture could reasonably employ an anthropologist, political scientist, or sociologist. The sciences reflect the complexity of human social behavior: tradition, value, power, and space are all considered critical to understanding the human condition. To the extent that protected area management must also deal with the human condition (a central theme of this Congress), the social sciences have the *potential* to be relevant and useful. What has been their contribution?

THE CONTRIBUTIONS OF SOCIAL SCIENCE TO PROTECTED AREA MANAGEMENT

The social sciences have, since the early 1970s, made considerable progress in their understanding of issues related to conservation generally, and park management specifically. An example is in economics, where concepts such as maximum sustained yield and marginal opportunity cost have been employed to better grasp the causes and consequences of natural resource production. A review of the literature is impractical: literally hundreds of articles, essays, research reports, and books are published worldwide each month.

The contributions of *usable knowledge* are, however more modest. Numerous social scientists are working on specific projects that have or will produce useful results; their work is admirable and indicative of the social sciences' potential. If, however, we move from individuals to more widespread contributions, i.e., search for a pattern of sustained usable knowledge, then the results are meager and frustrating. Some examples, organized by the scale of protected area management, are described below.

At the protected area level, most usable knowledge has been the result of applying social science research techniques rather than their theoretical understanding or prediction. Visitor surveys have become common, though they are irregularly taken, often poorly designed and administered, and seldom archived for future use as baseline data. Protected area managers have used survey results to "better understand" their visitors, establish the economic impact of tourism, and evaluate visitor services. Their use in decision-making has been largely limited to influencing minor policy changes and facility design. Geography's melding of simple map overlays and modern computing has resulted in an increasing use of geographic information systems (GIS). Most digitized data have been biological rather than social, and the maps produced have been largely used as inventories. Several techniques for limiting or centrally planning visitor use have been adopted by protected area management agencies, derived from an amalgam of social science theory (primarily psychology) and field studies. Examples are the visitor impact management and limits of acceptable change techniques developed in the United States.

At the regional level, several of the social sciences (particularly anthropology and sociology) have provided protected area managers with usable knowledge regarding local populations and communities. The results, usually detailed cultural descriptions, have increasingly been integrated into decision-making by donor agencies and technical assistance programs, and, to a lesser extent, into protected area planning. Economic analyses have in recent years begun to provide input into the strategic planning of sustainable development; since "sustainability" takes years to assess, the value of such inputs remains to be seen. At the national level, the contributions of usable knowledge are especially sparse. Some basic data collection is continuous at this level, but it is of relatively chaotic quality and most often used by the media and in budget justifications. Economic measurement of protected area economic activity has been visible, yet its integration into decision-making is primarily through the political system, as leadership groups vie for dominance over resources on marginal, public, or communal lands.

At the realm and global levels, social science has provided a minor but growing contribution. Monitoring of global trends (primarily bio-

logical, but including social indicators such as per capita income, population growth, and so forth) has become popular, though its actual use in decision-making is unclear. GIS technology is now being applied at realm and global scales, and has been useful in the allocation of resources (particularly during emergencies such as drought). In a limited way, it is the work of anthropologists, geographers, economists, sociologists, and others that documented the need to link protected area management and the sustainability of local peoples, leading to a new paradigm of protected area management and directly contributing to the theme of this Congress.

THE POTENTIAL OF PARTNERSHIP

While my assessment of the current partnership of protected area management and social science has been somewhat harsh, the potential contributions of usable knowledge give cause for enthusiasm. The social sciences can provide usable knowledge, if properly focused and organized. Protected area managers can integrate such information into their decision-making, if properly prepared. And such a partnership can enhance the role of protected areas in sustaining society.

From a systems perspective, the most valuable contribution of the social sciences may be classified as *feedback* and *prediction*. The major uses of these by protected area managers in decision-making are for *assessment* and *mitigation*. Feedback, prediction, assessment, and mitigation form the core of partnership across the scales of protected area management.

At all scales, the social sciences can and should focus on developing feedback mechanisms for managers. Visitor surveys, monitoring of resident population resource needs, and reporting of socio-economic trends are examples of important feedback activity. The requirements of usable knowledge demand that such feedback be timely, deal with trends important to managers, and have clear and scientific integrity. Social scientists must therefore focus on adapting all aspects of their research techniques to the practical needs of managers, from study design to the final reporting of results.

The role and importance of prediction in science cannot be overstated. Prediction is the essence of the scientific method, and hence good science must attempt and provide prediction. Social scientists working on protected area issues have for too long avoided prediction for the safer realm of description–describing in social science terms what managers often see for themselves. The storehouse of theory and prediction available from the social sciences needs to be opened up to protected area managers. Social scientists need to apply their theories and make specific predictions–about sustainable activities, biodiversity loss, visitor satisfaction, cost and benefit, and a host of other managerial concerns. These predictions should be based on tested theory rather than favored ideologies, and the level of certainty assigned to each prediction must clearly be described. Some predictions will undoubtedly turn out to be in error; such results can be used to improve future predictions. When a protected area manager asks, "What might happen?", the social sciences must attempt an answer.

If the social sciences provide usable knowledge in the form of feedback and prediction, then protected area managers have a real opportunity to integrate such knowledge into their decision-making. One important arena is assessment. However informal, most protected area managers attempt an assessment of conditions before making decisions, from the siting of new tourist facilities to the regulation of sustenance use. Managers need to build into

their assessments a role for social science information. The more formal their assessment process (which will vary by scale, importance of decision, and other factors) the more formal a role for social science is required. For example, protected area planning should include a significant level of social science information on visitor, resident, and nearby population resource needs, and the planning process should be designed to make this possible.

In addition to using social science in assessment, protected area managers will benefit by employing such expertise in the mitigation of impacts. Protected area management decisions have consequences intended and unintended; a new visitor road opens up an area for poaching, a new regulation leads to conflict between locals and tourists. Armed with the predictions of its partner social science, the protected area manager at all scales can better mitigate effects. Social science can provide, if managers are willing, useful strategies for dealing with the consequences of decisions. Examples include the use of economic incentives, communication techniques, and conflict resolution.

These functions—feedback, prediction, assessment and mitigation—form the core of a successful partnership between social science and protected area management. What institutional change is required to achieve such cooperation?

CONCLUSION: RECOMMENDATIONS FOR AN INVIGORATED PARTNERSHIP

Institutional arrangements have a great influence on how social science and protected area management can and will cooperate. While there are significant differences in the level of partnership throughout the world, and at the different scales of park management, some general actions can be proposed for Congress participants to consider.

At each scale of protected area management, monitoring programs should be established. Some programs exist: many protected areas keep track of the number of visitors, and the World Conservation Monitoring Centre's Protected Areas Data Unit represents an important effort at the global level. Yet systematic monitoring of socio-economic trends is currently not available. Social scientists should develop these programs, and managers should be involved in determining what data are collected. Feedback to managers should be continuous and in easy-to-use form. Data collected at one level should, as much as is possible, be aggregated at the next. For example, national-level data can be combined to form indicators of realm-wide conditions. A major global assessment of key socio-economic trends should be produced prior to each World Congress, beginning in 2001.

An international network of Cooperative Protected Area Studies Units (CPASUs) should be established. These research stations should be located (whenever possible) at universities and funded by protected area agencies, and employ a mix of university and agency scientists. Such units are a viable and efficient way of producing usable knowledge in both the social and biological sciences. First institutionalized in the Pacific Northwest Region of the U.S. National Park Service, CPASUs can and should be adapted to the particular needs of each region, country, and realm. To staff such units, a generation of young, home-country social scientists must be nurtured and encouraged to apply their skills to protected area management. A network of such research stations can play a major role in the monitoring described above.

Social science research programs must be integrated into natural science research programs. One of the barriers

to the full use of social science by protected area managers has been that social science has most often been treated separately from the biological sciences in funding, staffing, and organizational structures. Since the problems faced by protected area managers are interdisciplinary, this artificial separation has led to a host of problems: lack of cooperation between biological and social scientists, inadequate and undependable funding for social science, excessive administration, lower standards of scientific rigor, and, most importantly, reduced usable knowledge for managers. While integration of the sciences will not solve all these problems, it is a necessary precursor to significant improvement. The U.S. National Park Service research program could lead by example, and merge its social and natural science programs into a coherent, cost-effective, and interdisciplinary effort.

The existing bureaucracy must be creatively used to encourage the production and use of usable knowledge. In many cases, existing regulations and policies have the potential to encourage and increase the amount of usable knowledge produced and used. For example, much of current social science is conducted under contracts or formal agreements between researchers and the protected area agency or organization. Such contracts can, if carefully prepared, increase usable knowledge by requiring manager involvement in study design, stipulating the need and format for usable results, and including as necessary products training workshops for managers on how to use the research in decision-making. Likewise, current supervisory systems can be revised to create incentives for managers to integrate social science into their decision-making, either by requiring formal assessments, evaluating managers on their use of social science in relevant decision-making, or significantly increasing relevant training.

Other recommendations are certainly appropriate, and these can be improved upon. Finally, note that I have *not* made the generic and expected recommendation that funding for social science be dramatically increased; a long-term strategy for partnership suggests that increased efficiency and clear demonstration of the ability to produce usable knowledge are the first steps toward that worthy goal. If the social sciences can meet their obligations toward this partnership, I believe that protected area managers, from local district ranger to park superintendent to national chief to the IUCN leadership, will do likewise. For these managers, represented by the participants at this Congress, well understand that the management of protected areas in the 21st century, now so close, is necessarily the management of people.

Building Resource Inventories on a Global Scale

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The International Network of Biosphere Reserves is the flagship of UNESCO's Man and the Biosphere Program (MAB). The network presently includes 311 sites in 81 countries. A foremost mission of the network is to facilitate long-term monitoring of representative ecosystems to improve the scientific basis for solving environmental problems (UNESCO 1971, 1974). To achieve this mission, biosphere reserves rely on protected core areas that are legally protected in their own right as national parks and equivalent reserves. Scientific activities in these areas have traditionally emphasized local management issues. In 1987, only one in nine biosphere reserves reported cooperation with a biosphere reserve in another country (Gregg and Wargo 1988). However, in recent years regional and global issues—such as habitat fragmentation, air pollution, acidic deposition, climatic change and sustainable development—have become major concerns of core area administrators. Such issues have spawned bilateral and multilateral programs involving biosphere reserves. Examples include long-term comparative studies of small watersheds in U.S. and Russian biosphere reserves (Herrmann 1990); the Smithsonian-MAB Program for inventory and monitoring of biodiversity, primarily in tropical developing countries (Gomez-Dallmeier 1992); and ongoing efforts to strengthen cooperation among circumpolar biosphere re-

serves (MAB Northern Science Network 1992). The U.S. National Research Council has recently recommended a stronger role for national parks in understanding environmental change, including improved linkages with research networks such as biosphere reserves (National Research Council 1992).

This paper focuses on a new program to promote cooperation among the 176 biosphere reserves in Canada, the U.S., and 30 European countries (Figure 1).

These sites compose 57% of the 311-site global network, and represent all but two of the world's 14 biomes. They provide exceptional opportunities for biome-based cooperation on regional and global issues in temperate broadleaf forests (64 sites), mixed mountain systems with complex zonation (48 sites), and Mediterranean ecosystems (23 sites). The EuroMAB biosphere reserves in these biomes constitute 43% of the global network (Figure 2).

The new program is being coordinated by EuroMAB, an organization established to encourage scientific cooperation among the national MAB organizations of Europe, Canada, and the United States. At its third congress in September 1991, EuroMAB launched the Biosphere Reserve Integrated Monitoring Program (BRIM) to facilitate and support an integrated, long-term ecological monitoring program in biosphere reserves (EuroMAB 1991). The mission of BRIM is to "harmonize" the collection, reporting, and accessibility of data from the biological, physical, and social sciences among EuroMAB biosphere reserves. BRIM would improve the scientific basis for detecting and predicting environmental change, understanding the role of natural and human influences, facilitating information synthesis to address problems at many temporal and spatial scales, and encouraging environmental learning and education.

To implement the program, EuroMAB plans a broad-based network of many biosphere reserves that contribute data sets applicable to a wide range of issues; and smaller in-depth sub-networks of selected biosphere reserves that contribute data sets to address particular problems.

EuroMAB has requested member states to select a national focal point for the program and to join in a follow-up effort to plan a European institution to facilitate and coordinate the BRIM network.

To help develop BRIM, the USNPS worked with the U.S. MAB Secretariat at the Department of State to update and analyze unpublished UNESCO survey data on 160 of the 166 EuroMAB biosphere reserves designated as of mid-1992. The survey contains 62 information categories that cover basic resource information, research topics, and site support capabilities. The database includes all 47 U.S. biosphere reserves that together contain 90 administrative units of which 30 are managed by the USNPS.

The survey results document the basic scientific and operational capabilities of the EuroMAB network. Biological inventory datasets are universally reported, although there are major differences among biological groups. Inventories are best represented for vascular plants (88% of the sites), followed by vertebrates (83%), invertebrates (69%) and nonvascular plants (62%). Monitoring is most frequently reported for climate (83%), vegetation (77%) and surface hydrology (65%). Water quality (58%), freshwater ecosystems (54%), air quality (48%), groundwater hydrology (41%), and precipitation chemistry (38%) are important emphases. More than half the sites report climate and vegetation data spanning ten years or more; 82% report vegetation maps. Nearly three-fourths report population research on rare and endangered species, and the dynamics of wildlife popula-

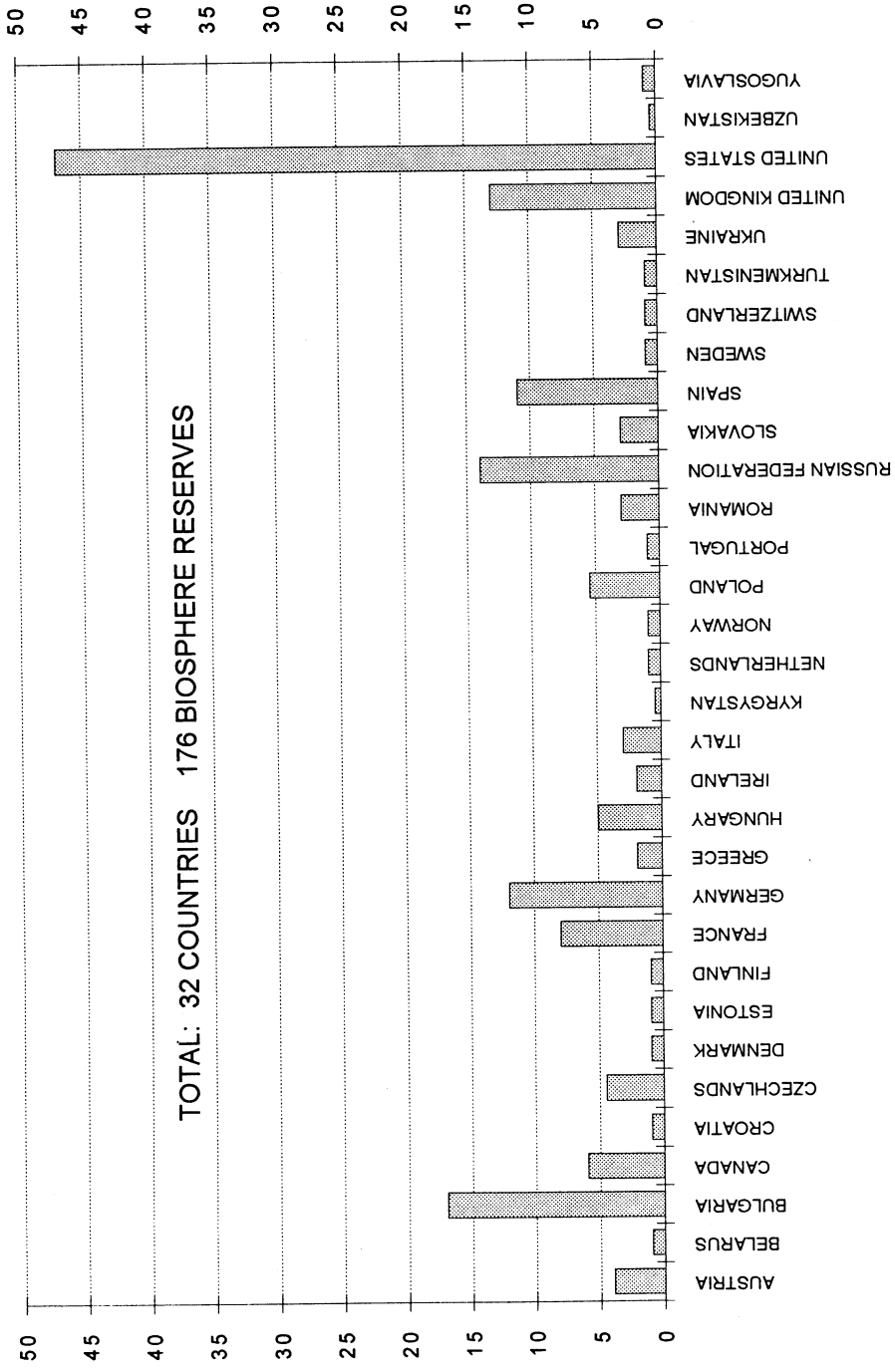

Figure 1. Number of EuroMAB biosphere reserves by country

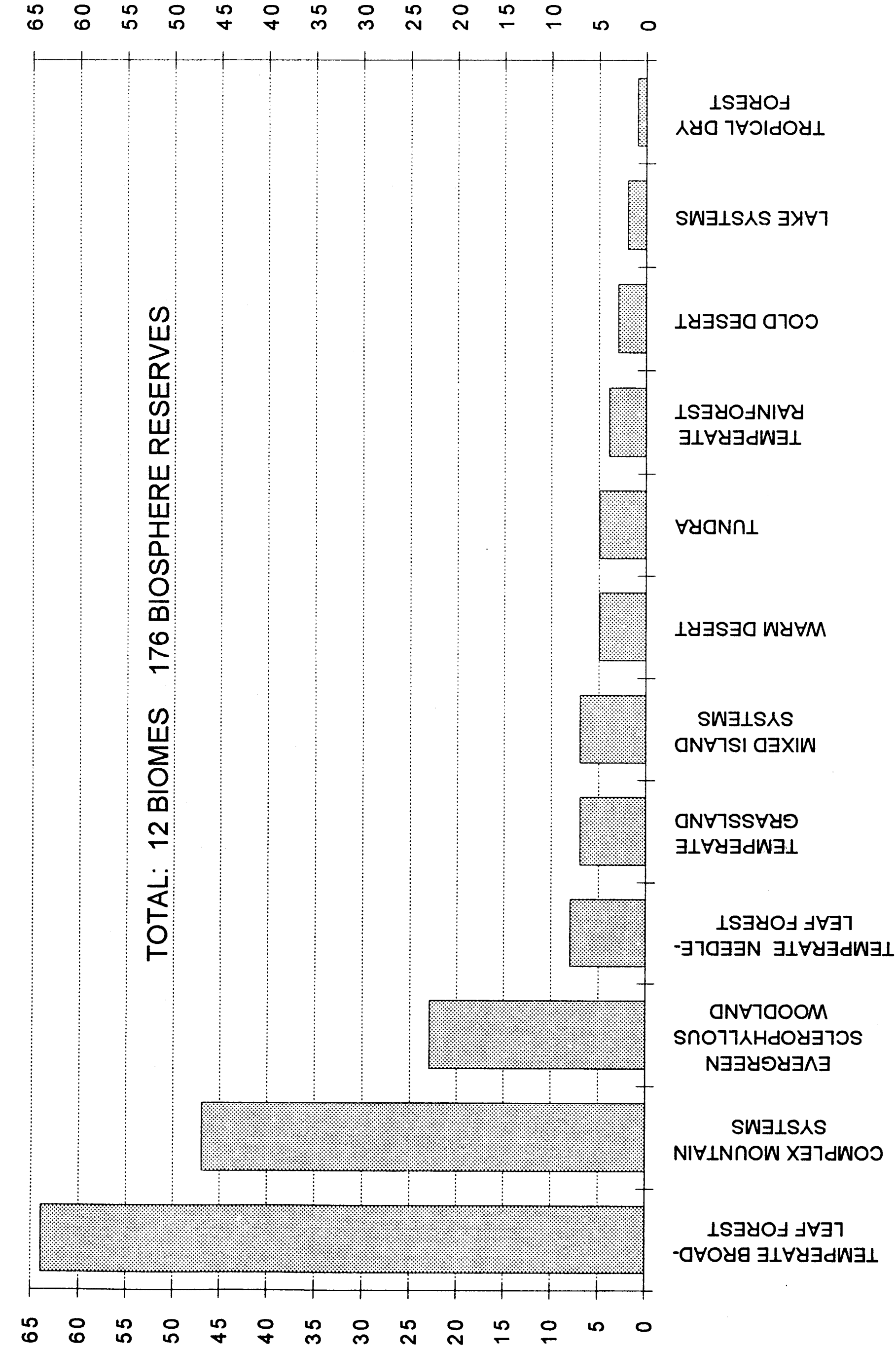

Figure 2. Number of EuroMAB biosphere reserves by biome

tions. Basic research on ecosystem cycles and processes is well represented, particularly work on ecological succession (69%) and comparative ecological research (63%). More than a third report work on fire history (43%), the hydrological cycle (42%), biogeochemical cycling (34%), and ecosystem modeling (39%)—areas likely to provide good opportunities for cooperation in understanding ecosystem responses to global change. EuroMAB reserves report considerable infrastructure for inventory and monitoring: weather stations (77%), hydrological stations (54%), curatorial facilities (45%), permanent vegetation plots (44%), air pollution stations (42%), and small watershed research sites (28%). Nearly two-thirds have a permanent research staff.

In early 1992, EuroMAB representatives identified six project areas for further development by country representatives:

- Preparation of a EuroMAB biosphere reserve directory;
- A pilot biological inventory project to obtain and share basic data on flora and fauna;
- A meta-database and recommended standards for permanent vegetation plots;
- A pilot project on ecological processes and global change;
- Projects on human systems, including guidelines for characterizing the socioeconomic environment of biosphere reserves and an annotated bibliography of case studies of creative approaches for facilitating cooperation in different cultural, legal, and institutional contexts; and
- Organization of the EuroMAB Network, including consideration of a regional EuroMAB center for network coordination, national centers for coordinating the participation of the biosphere reserves of individual countries, and development of compatible communication and data-sharing systems.

The USNPS, through the U.S. MAB Program, is providing technical assistance to EuroMAB on the directory and biological inventory projects. The directory will be a basic reference for the EuroMAB Biosphere Reserve network. It includes a national contact and country location map for biosphere reserves; basic site information on each biosphere reserve, including geographic coordinates, biogeographic province, administrator(s), contact(s), and principal research themes; and the results of an updated and expanded survey of basic resource information, research programs, and site support capabilities (71 information categories, see Table 1). The directory is expected to be available in hard copy and on computer disk in early 1993.

The second project—the development of biological inventory databases—will demonstrate the value of the broad based network. The integrated databases will support the conservation, scientific, educational, and sustainable development functions of biosphere reserves. The data are widely available in almost all biosphere reserves. Their usefulness and applications are generally appreciated. Perhaps most importantly, many administrators of core areas and multiple use components of biosphere reserves are expanding biological inventory programs in efforts to address biodiversity, sustainable development, and environmental issues. These factors favor broad participation in the project.

To develop a plan for documenting and completing biological inventories in biosphere reserves, EuroMAB specialists agreed on the need to summarize existing knowl-

Table 1. Categories of survey information for EuroMAB biosphere reserves

Biological Inventory
- Invertebrates
- Mammals
- Birds
- Nonvascular Plants
- Vascular Plants
- Vertebrates Other Than Mammals
- Biological Survey and Collections

Resource Maps
- Geological
- Land Use
- Soils
- Regional Land Tenure (ownership)
- Topographic
- Vegetation
- Geographic Information System

Research on Ecosystem Cycles and Processes
- Biogeochemical Cycles
- Comparative Ecological Research
- Ecological Succession
- Ecosystem Modeling
- Fire History Effects
- Hydrological Cycle
- Paleoecology
- Sedimentation

Research on Pollution
- Acidic Deposition
- Atmospheric Pollutants
- Pesticides
- Water Pollutants

Research on Management Practices
- Agricultural
- Appropriate Rural Technology
- Assessment of Resource Production Technologies
- Ecosystem Restoration
- Genetic Resource Management
- Mining Reclamation
- Rangeland Management

Permanent Research Staff

Ecological Monitoring
- Air Quality
- Climate
- Freshwater Ecosystems
- Groundwater Hydrology
- Marine Ecosystems
- Precipitation Chemistry
- Surface Hydrology
- Vegetation Data
- Water Quality

Historical Records
- Aerial Photography
- Bibliography
- History of Scientific Study

Research on Species Populations
- Pests and Diseases
- Rare & Endangered Species
- Wildlife Population Dynamics

Research on Human Systems
- Archeology
- Cultural Anthropology
- Demography & Settlement Patterns
- Ethnobiology
- Resource Economics
- Land Tenure, Use & Management Systems
- Traditional Land Use Systems

Infrastructure
- Conference Facilities
- Curatorial Facility
- Laboratory
- Library
- Lodging for Scientists
- Road Access

Monitoring and Research Facilities
- Air Pollution Station
- Hydrological Station
- Permanent Plots (Lake/Stream)
- Permanent Plots (Vegetation)
- Watershed Research Site
- Weather Station

edge. The experience of the USNPS proved to be especially relevant to this task. In 1990, the USNPS established a goal to complete, by the year 2000, inventories of vascular plants and vertebrate animals in the 240 units of the National Park System containing significant natural resources. To support this effort, the USNPS developed several databases to summarize the present status of biological inventories and to systematically record data on actual species occurrences. These databases are now operational, and are technically supported through cooperating universities (Stohlgren, Ruggiero, Quinn, and Waggoner 1991; Ruggiero, Stohlgren, and Waggoner 1992).

EuroMAB specialists recommended some minor modifications of the USNPS database structures so they could be tested in EuroMAB biosphere reserves. The *Biological Inventory Status* (MABBIS) database describes the present status of inventories for vascular plants, mammals, birds, reptiles, amphibians, and fish in a biosphere reserve. To develop this database, specialists for each group score the inventory for the group with respect to several categories of completeness. The scores are assigned on a scale of 1 (most complete) to 6 or 7 (least complete) based on actual species occurrences in the biosphere reserve. *Taxonomic completeness* refers to the coverage of the group's major taxa, such as families. *Geographic completeness* indicates how much of the area has been covered. *Ecological completeness* indicates how well the reserve's major ecological communities or habitat types are represented. *Seasonal completeness* indicates the extent to which appropriate seasons are included. A composite score, representing the sum of taxonomic, geographic, and ecological completeness scores, provides an indication of overall completeness of each group's inventory.

The *MABFLORA* and *MABFAUNA databases* provide frameworks for systematically recording data on actual species occurrences. These identically structured databases will contain species listings and associated data for each biosphere reserve based on documented occurrences of plant and animal species. For each species, the database will include information on taxonomy, source of nomenclature, and common name; geographic origin and special status of the species; presence, documentation of occurrence, distribution, resident status, and abundance within the biosphere reserve; available biosphere reserve databases; and reference citations. The databases are designed for widely available dBASE software that enables easy updating, sorting, and analysis.

Databases for vertebrates are now being developed in one biosphere reserve in each of ten countries (Canada, the Czech Republic, France, Germany, Romania, Russia, Spain, Sweden, the United Kingdom, and the United States). Each national contact for BRIM has received step-by-step guidelines for entering data into the database, and a computer disk containing the dBASE data format. The project will identify technical issues and operational problems in building the basic databases using standard software and protocols, given the considerable differences of language, institutional conditions, and technical capabilities in the EuroMAB biosphere reserves. The project will enable EuroMAB to consider how to expand the participation of biosphere reserves in building the databases, and the training and technical support required.

The USNPS is using its operational databases to prepare a preliminary inventory of the potential flora and fauna of the National Park System, aggregated at park, biome, and national levels; to assess the biologi-

cal similarity of parks; and to prepare a strategy for acquiring and managing new biological inventory data that will be collected during the remainder of the decade. Similar applications should be possible for the EuroMAB network.

The BRIM projects foster international recognition of the value of the biosphere reserve network. They are linking disparate land management units in different countries toward a common purpose of identifying contacts and sharing information on their datasets, programs, facilities, and management approaches. Such information will help managers and specialists to identify opportunities for cooperation. UNESCO's MAB International Coordinating Council has identified BRIM and other regional networks as an important focus for cooperation an concentration within the MAB Program (UNESCO 1993). Comparative studies, especially among biosphere reserves in the same biome, are urgently needed to detect significant environmental changes and discover ways to maintain natural processes and native species in a changing global environment. The BRIM projects should facilitate such efforts.

At the international level, developing a functional network is probably the greatest challenge of implementing the biosphere reserve concept (Gregg and Goigle 1984). EuroMAB is providing an aegis for international testing of methodologies developed to meet national needs, such as the USNPS biological inventory databases. In the future, EuroMAB may facilitate intergovernmental adoption of protocols for obtaining reliable scientific information from the many different types of land management units that participate in biosphere reserves.

For the USNPS, BRIM provides special opportunities. The USNPS participates in more biosphere reserves (25) in more biomes than any governmental entity in the world. It shares these biomes with 30 European countries that administer biosphere reserves—countries with vastly different land management systems, cultural traditions, land use histories, environmental conditions, and scientific capabilities. The USNPS has much to contribute to and learn from common efforts to understand the complex factors involved in the interaction of nature and human societies. Integrated regional approaches linking parks and their surrounding biogeocultural areas will be required. BRIM is an important step in marshaling the scientific knowledge and practical experience to enable biosphere reserves to fulfill their promise as the standard-bearers for demonstrating these approaches.

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Assessment of Hurricane Andrew's Immediate Impacts on Natural and Archeological Resources of Big Cypress National Preserve, Biscayne National Park, and Everglades National Park

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How did Hurricane Andrew affect the resources of U.S. National Park Service units in south Florida? This report describes resource conditions immediately after the storm. A team of 27 scientists conducted this rapid appraisal (for a full list, see the Appendix). The team made field observations for one week and gathered information from colleagues who were also active in the field before and after the storm. The report also presents the team's recommendations for immediate and long-term actions to protect threatened resources and to understand better the relative effects of human and natural perturbations to the parks' resources.

Instantaneous ecological responses of South Florida park ecosystems appeared normal. The USNPS must now determine if the systems are still naturally resilient. Can they recover normally in time, extent, and degree before the next perturbation? Or have chronic habitat fragmentation, altered air and water resources, non-native species, and human disturbance fatally weakened the natural ecological recovery processes of the parks?

Hurricane Andrew was a small, intense hurricane. When it made landfall in southern Florida at 5:00 AM on August 24th 1992, it was a category four hurricane. It was one of the most intense storms ever recorded in Florida, with a minimum pressure of 922 millibars and maximum sustained winds of 242 km hr^{-1} (150 mph; National Weather Service). The eye of the storm passed through Biscayne and Everglades National Parks and southern Big Cypress National Preserve with a forward speed of 50 km hr^{-1} (32 mph).

The storm hit near the time of high tide. It produced a large, but localized, storm surge in the coastal portion of southeastern Dade County, 25 km (15 miles) south of Miami. Storm surge overtopped coastal water control structures and levees. The U.S. Geological Survey estimated Hurricane Andrew's maximum storm surge at 5.2 m (16.2 ft). A 34-m (105-ft) vessel was blown from its deep water anchorage and transported inland. It came to rest on the bank of the C-100 canal upstream of a water control structure.

Coastal flooding was minor, but high winds caused extensive damage throughout the 40 km-wide (25 miles) storm path across the State. Rainfall from the storm was low, presumably in response to the storm's rapid forward movement. Average rainfall for August 24th in Dade County was just over 5 cm (1.97 inches). The highest reported rainfall was 14.6 cm (5.75 inches) near the Atlantic Coast. Rainfall in central Dade County was generally less than 5 cm. Rainfall and water levels were above normal throughout most of southern Florida before Hurricane Andrew arrived. Inland flooding was a problem primarily in southeastern Dade County, where saltwater inundated a large portion of the farming areas.

The following sections provide detailed descriptions of resource conditions immediately after the storm and identify actions that need to be taken quickly to avert additional resource damage and to recover irreplaceable information. This report also presents recommendations for actions to protect park resources through long-term monitoring and research.

CURRENT RESOURCE CONDITIONS

Upland resources Hurricane Andrew drastically affected a swath of vegetation about 50 km wide from Old Rhodes to Sands Keys in Biscayne National Park, across Long Pine Key, the Shark River Slough and southern Big Cypress National Preserve, to the west coast of Everglades National Park. Portions of Big Cypress National Preserve north of the storm track also experienced significant storm effects. The northern edge of Cape Sable marked the southern boundary of the affected area.

Perhaps the most dramatic direct effect of the storm was major structural damage to trees. Most damage occurred in hardwood hammocks, coastal mangrove forests, and pine forests on Long Pine Key in Everglades National Park and the old-growth pine forest at Lostman's Pines in Big Cypress National Preserve. Within the storm's path, virtually all large hammock trees were defoliated, and 20-30% were wind-thrown or experienced broken trunks or loss of major branches. About a quarter of the royal palms were wind-thrown; many others were

defoliated, but began resprouting within two weeks. Damage to upland woody vegetation was most severe in or near the eye of the storm, where winds were strongest. Severity of damage decreased rapidly away from the center of the storm track. Evidence of extreme cyclonic wind gusts also decreased with distance from the central storm track.

In all three parks, 25-40% of the pines were damaged by wind-throw or breakage. In Big Cypress National Preserve, pines were the most-impacted species, with 10% downed and 30% with broken trunks. Cypress trees fared much better than pines and hammock hardwoods. The cypress generally held their needles, but what appeared to be cyclonic winds leveled a few domes. Nearly 90% of the known red-cockcaded woodpecker nest trees were blown down and none of the active cavity trees remained standing in the storm's path.

The storm knocked down a total of about 28,000 ha (70,000 acres) of mangrove forests in the parks. In contrast to the gradation of effects on upland trees, the boundary of effects in mangrove forests was sharply defined. At Highland Beach, at the center of the storm track on the west coast, 85-90% of the mature mangroves were downed. Mortality in mangrove forests will probably continue for a year or more. Many of the surviving trees have seriously cracked trunks. Experience from other hurricanes suggests that many of these trees will eventually die as a result of the storm.

It is too soon to determine the fate of other damaged communities. Only 16% of the wind-thrown trees and 29% of the broken trees died within two years after Hurricane Gilbert, which struck vegetation similar to south Florida hammocks with 300 km hr^{-1} (188 mph) winds on the Yucatan Peninsula. Most of the defoliated trees in the south Florida parks were releafing within a few days of the storm, especially the tropical hardwoods. Many seriously injured trees will probably survive.

Understory plant communities were only moderately affected by the storm, other than damage from falling limbs and trunks. Many understory plants retained their leaves and even fruits formed before the storm.

Most rare and endemic plants in south Florida are found in forest understory. Although immediate storm effects on rare and endemic plants appeared minimal, long-term effects may be more substantial. Effects of reduced canopy and increased light penetration to the forest floor will change the competitive interactions between herbaceous endemics and hardwoods with unknown consequences.

Non-native plants have spread extensively in south Florida following hurricanes in the past. Hurricane Donna spread Australian pine, *Casuarina* spp., up the west coast of Everglades National Park in 1960, requiring an expensive eradication program in the 1970s. Brazilian pepper, *Schinus terebinthifolius*, introduced to South Florida in 1898, was not perceived as a problem until after the 1960 and 1965 hurricanes. Invasive non-native plant species, such as *Melaleuca quinquenervia*, may have been spread by wind and water during Hurricane Andrew, but it was difficult to determine the extent immediately after the storm. Seed pods were found scattered up to 20 meters from potential parental stocks. Until seedlings appear, it will not be possible to determine the actual extent of spread.

The status of non-native plants in Biscayne National Park is poorly known and needs to be evaluated before management actions can be recommended. Local control measures for *Schinus* and *Colubrina asiatica* may be effective in Biscayne National Park, if the non-natives are not yet widespread. In Everglades Na-

tional Park and Big Cypress National Preserve, the spread of some non-natives had nearly ceased before the storm. Their status may change if ecological conditions were altered by the storm.

Wildlife Storm surge, extreme rainfall, and flooding are generally the major causes of wildlife mortality in hurricanes. The major impacts of this storm were caused by high winds; consequently, wildlife fared relatively well. In spite of extensive surveys of the parks and contacts with field observers throughout South Florida, we found very little evidence of direct storm-caused mortality. Nevertheless, recruitment in several species may be low for the next year or more. In the single largest wildlife incident discovered, about 200 wading birds, mostly white ibis and egrets, were found dead near the Chicken Key roost in Biscayne Bay. Only one dead deer was found. It was in the stair-steps area between Everglades National Park and Big Cypress National Preserve, but this deer mortality cannot be positively related to the hurricane. In general, wildlife appeared unaffected by the storm. All radio-marked Florida panthers survived the storm. Radio-tagged black bears and snail kites survived the storm and appeared relatively normal, although some of the kites moved from storm-damaged roosts and feeding areas.

Deer seemed to be unaffected by the storm after three weeks. Hammock vegetation was re-leafing to provide both food and cover. All 32 radio-collared deer survived, but about one-third shifted their home ranges. We saw no evidence of deer over-browsing, and the current water levels of less than 0.5 m (20 inches) has not forced them onto limited high ground.

Adult alligators appeared unaffected by the storm, but nests and young of the year may have been impacted. The 1992 season was already a poor year for alligators before the storm arrived. In a normal year, egg mortality is 25%. In 1992, 43% died before the storm. The storm destroyed nests containing 27% of the year's egg production. The fate of those eggs is unknown because they were hatching as the storm struck. Some may have hatched and survived. This was already a poor year for alligator recruitment and the storm made it worse.

About 10% of the 160 wading bird rookeries in South Florida were in the storm path. Many interior rookeries were in willow heads and therefore relatively unaffected, but coastal rookeries in mangroves were severely altered. Except for the losses already described in Biscayne Bay, resident white ibis and egret populations seemed unaffected. Within the storm's path south of the Tamiami Trail, nearly all active red-cockaded woodpecker cavity trees were knocked down, but the impact on the population will not be known until nesting surveys can be conducted. Most bald eagle nests in the parks were outside the zone of major disturbance, but several nests were lost or damaged, and impacts on the population will not be known until nesting surveys are conducted.

A monkey was observed at the East Cape Dock on Cape Sable. The extent and nature of other non-native animal introductions into the parks remain unknown. Several facilities adjacent to the parks housed such animals and were destroyed by the storm, so it is not surprising that non-native animals are now in the parks.

Documented wildlife effects appeared minimal, given the severity of the storm. Alligators will experience low recruitment in 1992, but that is probably not attributable to Hurricane Andrew. Bald eagle nests within the storm area were damaged, but the eagles themselves were probably not harmed. It remains to

be determined if the eagles will rebuild their nests in the original areas. Though some dramatic mortality of wading birds was observed, it is not clear that this greatly altered their local abundance. The upcoming nesting season will provide the first opportunity to determine the effect of roosting habitat loss on nesting success. Finally, there is currently little evidence that white-tailed deer populations have been harmed by the hurricane. However, Hurricane Andrew apparently caused individual deer to migrate to new areas and some feeding areas were damaged. Further monitoring is needed to determine if food shortages arise because of population movements and loss of vegetation.

Freshwater resources Freshwater fish and macroinvertebrate populations seemed relatively unaffected by the storm, but historical data allow detection of only tenfold changes in populations. Strong seasonal and annual cycles in fish populations make short-term changes difficult to assess, even with optimal sampling schemes. The dynamics of these aquatic populations also vary with hydro-period. In some areas, fish abundance declined, apparently related to the loss of periphyton cover. At two central Shark River Slough sites, fish abundance dropped an order of magnitude after the storm and relative to normal seasonal levels (from 20 fish per meter^2 to 2 fish per meter^2, and from 54 fish per meter^2 to 5 fish per meter^2). High variability in the spotty historical record makes it difficult to be certain the observed declines were statistically significant and caused by the storm.

Storm effects on hydrology and interior water quality were not remarkable within the time-frame of this investigation, i.e., days to weeks. It was a relatively dry storm. The maximum precipitation recorded in the parks was 11.4 cm (4.5 inches), and most areas received less than 4 cm (1.5 inches) of rainfall. Pre-storm overland discharges of freshwater were normal for the summer wet season, and water levels were slightly higher than normal. Storm winds affected water levels, especially in Taylor Slough, where it rose over 30 cm (1 ft) briefly during the passage of the storm. The gradual rise observed in northwestern Shark River Slough at station P-34 over the weeks following the storm reflected high discharges through water control structures (S-12) following abnormally high rainfall in water management zones to the north. Suspension of flows into the northeast Shark Slough and loss of the two pump stations that deliver water to Taylor Slough combined to reduce wetland water levels, hasten drying of marshes, and reduce freshwater flow into northeastern Florida Bay. If the south Dade water delivery system is not restored quickly, marshes in eastern Everglades National Park will dry, persistent dry season flows will cease, and critically high Florida Bay salinities will increase even more. Paradoxically, Hurricane Andrew has thus far exacerbated the drought-like conditions in northeastern Florida Bay, rather than relieving it by flushing the bay with freshwater.

Within the constraints of limited grab-sample data, the storm appeared to have minimal effect on water quality in Everglades National Park. Nearly all post-storm water quality parameters were within the range of values recorded from 1986 to July 1992. The exceptions were temperatures at two central Shark River Slough stations that briefly increased four days after the storm, perhaps related to loss of periphyton cover. It is possible that we missed short-term water quality effects in samples taken 4 days and 24 days after the storm.

The most significant impact regarding freshwater resources was destruction of the hydrologic and me-

teorologic monitoring networks. Within the storm track, 80% of the monitoring stations sustained significant damage. Virtually all of the staff gauges will have to be re-surveyed to assure accurate reference to sea level.

Marine resources The major storm effects in the marine environment were changes in nearshore water quality, patches of intense bottom scouring, and beach overwash. Dramatically increased turbidity persisted in some areas at least 30 days after the storm, particularly in western Biscayne Bay where mangrove peat soils continued to break down and enter the water column. In northeastern Florida Bay, at the southern edge of the affected area, dissolved phosphate, ammonium, and dissolved organic carbon all increased dramatically. Plankton blooms added to increased turbidity, and combined with observed low oxygen levels will probably have severe, long-term effects on fish and invertebrate populations. Fuel from hundreds of damaged boats in Biscayne Bay and adjacent marinas continued to discharge into the water at least 27 days after the storm.

Hard-bottom communities in central Biscayne Bay were scoured heavily in some areas. Those areas gave the appearance of having been repeatedly trawled. Sponges, octocorals, and corals were sheared from the substrate, and found lying amongst expansive wracks of debris consisting of seagrass, algae, and mangrove leaves. Half of the sponges were missing from fixed plots sampled before and after the storm, and some remaining individuals were killed by sedimentation. In other areas it appeared that more than 90% of the larger sea whips and sponges were missing, though smaller individuals survived. Most of the juvenile spiny lobsters that resided under the sponges and corals in central Biscayne Bay were not present after the storm. Their fate may not be known for several years, until that cohort is recruited into the offshore fishery. In eastern Biscayne Bay, within a kilometer of Elliott Key, and in southeastern Florida Bay, benthic communities appeared relatively unaffected: lobster, sponge, and coral abundance were virtually the same before and after the storm.

Cape Sable and other west coast beaches experienced overwashes of 3-13 m, with as much as 100 cm deposition in a new beach ridge. Beach modifications associated with this storm are minor when compared to slower-moving historical Florida storms.

Disturbance to coral reefs was patchy, but locally severe. A few reef tops were scoured, 200-year-old corals were rolled over, and branching corals were broken. Loose sponges of unknown origin accumulated at the bases of deep reefs. The levels of disturbance observed, however, are consistent with normal reef diagenesis.

The most severe reef damage was associated with anthropogenic debris. Lobster and crab traps smashed into corals and sponges. A ship sunk as an artificial reef at a depth of 23 m broke up and moved into Biscayne National Park, where it was impaled on natural reefs.

Seagrass beds in the storm track survived remarkably intact. Propeller cuts in grass beds did not widen. Only a few areas south of Key Biscayne showed evidence of storm surge or wave action, with elongate scour patterns cut 50-100 cm into the seagrass-bed surface. These effects are in marked contrast with those of Hurricane Betsy in 1965 and other storms that have caused extensive destruction to seagrass beds. Fishes in the mangrove zone also appeared relatively unaffected, as evidenced by the presence of tagged fish in virtually the same places they were before the storm.

Direct effects on marine wildlife by the storm were not remarkable. A standard aerial census of manatees in Everglades National Park revealed 209 manatees in 9.5 hours, the most counted since monitoring began several years ago. Sea turtle nesting beaches were probably improved by the overwash and deposition of more sand. A successful hatching was seen after the storm, so surge and runoff did not inundate all existing nests. Known crocodile nesting beaches were south of the major storm influence and appeared unaffected. The status of adult and young-of-the-year crocodiles is unknown, but no evidence of storm-related mortality was found.

Special resource issues Disposal of hurricane-generated debris in metropolitan areas created two kinds of issues related to air and water resources in the parks. The assessment team defined the debris problems: how much debris, what kind of debris, where will it go, how will it get there (burn, bury, or carry away), and what are the likely effects on resources, and determined the points of control: what can be done to mitigate impacts and what are the management options?

The storm generated some 20 million cubic yards of debris (six times the volume of Cheops great pyramid at Giza, Egypt). Most of it was trees and shrubs (73%) and building materials (24%), but some was hazardous waste such as paint, solvents, insecticides, and batteries. In spite of the urgency to dispose of this material, the Florida Department of Environmental Regulation recognizes in its Emergency Final Order of August 26, 1992, that "The hurricane has . . . created a risk of further substantial impact on the environment" in addition to devastating direct storm impacts. As of September 21, 1992, Dade County Environmental Resources Management (DERM) had authorized 81 dump sites, and estimated that 100 will eventually be authorized. The Army Corps of Engineers manages most of the dump sites near USNPS interests and has prepared an Environmental Assessment describing their plans that has been reviewed by the assessment team and Everglades National Park staff. If this material is burned, some will enter the parks, and if it is stored in or on the ground some will leach into ground water that will enter Everglades National Park or Biscayne National Park. As burning began, no one was monitoring air quality in Dade County, including the USNPS, because the storm destroyed all monitoring equipment.

Archeological resources Marine archeologists resurveyed 14 of the 40 known wrecks in the parks and searched for newly uncovered sites. Storm-scour moved sediment off some vessels, thus revealing new artifacts, including a cannon and a wooden cannon truck from an early 18th-century man-of-war. The degree to which hurricanes rework sediments and compromise the stratigraphic integrity of submerged archeological material has been a difficult question to answer with the lack of storms on well-known sites. This storm revealed that hurricanes do not necessarily jumble wrecks, as has been suggested by some people. We found evidence of recent looting of shipwrecks in Biscayne National Park, with significant losses from at least one 1733-vintage site.

Archeologists assessed a representative sample of 22 of more than 500 known upland sites in the three parks. The sample was stratified by proximity to the storm tract and site type (i.e., hammock, shell mound) so a predictive model could be constructed to estimate total site disturbance.

Disturbance to upland archeological sites was generally minor. About 75% of the interior hammocks assessed contained wind-thrown trees that exposed about 5% of each

site. Sites along the Gulf Coast were similarly affected, with about 80% of the sites containing wind-thrown trees that disturbed 10% of each site. Storm surge deposited about 30 cm of shell and sand on about a third of the Gulf coast sites sampled, effectively covering any disturbance caused prior to the deposition.

CONCLUSIONS

While storm effects on natural resources were dramatic, initial ecosystem responses appeared normal. Trees sustained severe damage, especially mangroves and tropical hardwoods. Many defoliated trees resprouted within weeks of the storm, and rare plants in hammock and forest understories were relatively unaffected. Coastal wading bird rookeries, eagle nests, and red-cockaded woodpecker cavity trees were damaged, but no major mass mortality of wildlife occurred. Hurricane winds and water spread non-native plants. Exotic animals escaped from storm-damaged facilities and entered the parks. Some freshwater fish populations declined dramatically after the storm. Storm damage to the South Dade water delivery system interrupted normal freshwater flow into Florida Bay. The storm scoured shallow marine communities and altered marine water quality. An artificial reef broke up and moved into Biscayne National Park. Sea turtle nesting beaches may have been enhanced by storm overwash, and seagrass beds survived remarkably intact. Wind-thrown trees and storm-scour exposed previously unknown archeological artifacts on ship wrecks and upland sites. Disposal of urban debris from the hurricane threatens air and water quality in the parks.

Chronic anthropogenic stresses, such as habitat fragmentation, non-native species, altered water resources, and air pollution have affected ecosystem stability in south Florida. Can such stressed ecosystems recover to pre-storm conditions before the next major perturbation? Do storm clean-up activities threaten resources and human health and safety in the parks? These questions need to be addressed to protect park resources immediately, and to develop long-term strategies that assure their perpetuation. The following recommendations describe actions needed to provide the necessary information.

Recommendations for immediate action The highest priority items for immediate action are to:

- Restore park environmental monitoring capability;
- Protect exposed archeological material on shipwrecks;
- Remove non-native animals introduced by the storm;
- Determine short-term ecological storm effects; and
- Replace boat warning signs that protect manatees.

Next in urgency are actions to:

- Determine non-native and native plant population status;
- Determine wildlife population status;
- Improve environmental monitoring networks; and
- Limit urban debris disposal impacts.

Finally, resource impacts will accelerate or the window of opportunity will close if actions are not taken soon to:

- Survey disturbed archeological resources;
- Remove artificial reef remains from Biscayne National Park;
- Restore integrity of Cape Sable coastal marshes;
- Protect resources threatened by clean-up activities;

- Evaluate storm-altered management practices; and
- Determine urban debris disposal impacts on parks.

The storm destroyed most of the USNPS hydrologic, marine water quality, meteorologic, and air quality monitoring networks in the parks. The networks need to be replaced and activated to measure the potential effects of post-hurricane clean-up on air and water quality and to evaluate short-term ecological responses. Historic shipwrecks exposed by the storm need to be surveyed, stabilized, and monitoring to enhance site protection. Backcountry patrols need to be increased over normal levels to detect and remove non-native animals before they become established in the parks. Removal techniques for exotic animals may need to be developed and tested in conjunction with other agencies.

Studies to determine the short-term ecological effects of Hurricane Andrew need to be initiated while the first, most dramatic changes, are taking place. Historical data need to be compiled and analyzed to provide a basis for designing studies and establishing monitoring plots stratified by hurricane influence. Opportunities to determine spatial variability of storm effects, examine the roles of storm-altered detritus distribution and nutrient cycling, and to evaluate storm effects on fishery recruitment, subtidal sediments, and heavy metals in hardwood hammocks will be lost soon.

Surveys of seedling non-native plants need to be conducted to assess the extent and magnitude of storm-caused spread, and to determine if new control methods need to be developed. The status of mangrove forests and rare plant populations will not be apparent until a year after the storm. The environmental monitoring networks need to be hardened to survive future storms, in addition to restoring the pre-storm capability. Additional monitoring sites are needed to evaluate storm effects on park resources and link upland effects to estuarine and marine systems. Detection of storm impacts on fish and wildlife will require intensified surveys during reproductive seasons to document reproductive efforts, success, and recruitment.

Significant park staff time will be required to coordinate debris disposal regulated by other agencies to assure protection of park interests. The USNPS needs to characterize emissions from debris burning, model air quality and visibility, and monitor air quality, visibility and meteorology to establish actual impacts on park resources.

The hurricane exposed significant amounts of archeological material on upland sites that need to be surveyed, monitored, and protected from vandalism. Removal of artificial reef debris from natural reefs needs to be initiated before it is incorporated into the sediment and overgrown. Its damage to the reef needs to be documented to help develop guidelines for future artificial reef placement. Storm-breached plugs in canals on Cape Sable permit accelerated salt water intrusion into coastal marshes, and the plugs will continue to widen with tidal flushing if not repaired soon. More permanent solutions to restoring the integrity of these marshes need to be found, such as filling in longer sections near the coast, to prevent this kind of damage and repair costs with each hurricane. Fire management practices need to be verified following storm-altered fuel loads. Impacts of storm clean-up activities on rare plants and opportunities for interpreting hurricane influences on native communities need to be evaluated. The effects of storm-altered shelter for manatee and crocodile populations on protection activities need to be considered, before pub-

lic facilities and access are fully restored.

Recommendations for long-term actions There are long-term actions that need to be taken to protect park resources. Together these actions will provide a basis for understanding resource dynamics and the relative effects of human activities on park resources in South Florida and those of natural extreme events such as hurricanes. The actions are to establish ecological monitoring programs, and conduct long-term research on major resource issues.

Long-term data sets are needed to differentiate natural dynamics, driven by hurricanes, fires, and freezes, from changes caused by chronic environmental stresses such as habitat fragmentation, non-native species, and altered air and water quality. Correlations among system components will yield the best indications of ecological cause-and-effect relationships, until large-scale, long-term controlled experiments can be conducted. Such experiments may never be possible in South Florida, so we must continue to monitor system components in a systematic way to learn what drives the systems and thus place human impacts in proper perspective. For example, vegetation plots established to monitor effects on Hurricane Donna in 1960 were lost because the park had no monitoring program to maintain them. As a result, today we can not precisely project the effects of Hurricane Andrew and compare them with previous storms or human activities. Doubt about our understanding of park ecosystems will delay necessary actions to protect park resources. Better knowledge of system dynamics will speed and improve their protection.

The monitoring program will be designed to (1) determine current and future health of ecosystems, (2) establish empirical limits of variability, (3) diagnose abnormal conditions early enough to implement effective remedial actions, and (4) identify potential agents of ecological change.

Experimental research is also needed to assess the potential of Hurricane Andrew to alter flows of energy and nutrients in South Florida ecosystems. Potential nutrient release from storm-related detritus and the effect of changes in landscape heterogeneity on large animals need to be measured over time. Because the Everglades landscape may be described as a mosaic of terrains or drainage basins that traverse several physiographic subregions in southern Florida, a variety of approaches will be necessary to address these questions. Past research and restoration efforts have focused on individual species or habitats, usually within limited spatial or temporal scales. An integrated understanding of the system's response to anthropogenic and natural perturbations, such as Hurricane Andrew, would greatly refine ongoing restoration and management activities. Several critical hypotheses concerning the ecosystem's productivity and resilience must be resolved to produce a scientific basis for restoration and management.

Appendix: USNPS Resource Assessment Team and Active Collaborators

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Resource Protection through Cooperative Planning

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More Americans are choosing to live on the perimeter of national parks and other protected natural areas. Shenandoah National Park and many other protected areas throughout the country have become magnets for private development. For example, the 1990 census shows that the 20 counties in the three states surrounding Yellowstone National Park would have been the fastest growing state in the Union if they were a separate state.

Unplanned and unmanaged development can do great harm to these natural areas–reducing and fragmenting wildlife habitat, introducing exotic plants and animals, polluting streams before they flow through parks, impeding or expanding recreational uses, and degrading air quality. In addition, unplanned development threatens the very quality of life that attracts investment and development for communities adjacent to parks.

Most U.S. National Park Service managers and adjacent communities have not been eager to address the conflicts that may arise when park managers perceive adjacent development as incompatible or when local officials perceive protected lands as detrimental to the fiscal or social well-being of the

community. Park managers face difficulty getting involved in extra-territorial issues and risk triggering a negative backlash from unsympathetic local officials or offended landowners.

My remarks outline an alternative to polarization and conflict between managers of national parks and other protected lands and officials of adjacent communities. My hope is to instill a little more optimism about the potential advantages of an alternative approach and a little more information about examples of mutually beneficial relationships that have been created around the country.

First, some background. The Sonoran Institute was created in October 1990 (with assistance and funding from World Wildlife Fund and the Conservation Foundation) to create innovative mechanisms for reconciling potential conflicts between national parks and other protected areas and adjacent communities.

The Institute works with World Wildlife Fund in administering a program which provides small grants for innovative local land use initiatives around the country, provides information and education to resource managers and local land-use decision-makers about tools and techniques for better managing growth, and, most importantly, helps create projects that demonstrate the benefits of partnerships to meet the needs of both protected areas and adjacent landowners and communities.

Our mission and activities are based on the conviction that a sound environment is needed to sustain a vital economy and that, likewise, economic vitality is necessary to provide the funds and the will to ensure the integrity of protected natural areas and otherwise protect natural resources and environmental quality.

In its 1985 study, *National Parks for a New Generation,* the Conservation Foundation concluded that the most promising approach to such challenges is to devise protective measures tailor-made for the unique local circumstances surrounding each park, rather than following a uniform, nationwide methodology. The report called for creating diverse cooperative mechanisms involving landowners and local governments in ways that reflect the needs and aspirations of adjacent communities. The report concluded that such mechanisms are likely to be more effective if they involve strong local constituencies that recognize the contribution that national parks make to the local quality of life.

Following publication of this report, the Conservation Foundation launched the Successful Communities program to help implement these recommendations and later helped create the Sonoran Institute to carry on these activities. One of the Sonoran Institute's first projects was to enter into an innovative partnership to create and fund the Rincon Institute, which began working on issues related to Saguaro National Monument, which protects approximately 87,000 acres adjacent to the city of Tucson, Arizona.

The Monument consists of two units, each of which were some 20 miles from the city of Tucson when they were created. Over the years, Tucson has grown to the very boundaries of the Monument, making Saguaro a suburban wilderness area. By the mid-1980s, continued piecemeal subdivision and unplanned development of land adjacent to the Monument raised concerns about its ecological and scenic integrity.

A proposed mixed-use resort-oriented community on the 6,000-acre Rocking K Ranch, which shares a five-mile boundary with the Monument, embodied the diverse land-use

challenges facing the park. The Rocking K was one in a long series of issues arising from development of adjacent private lands that collectively will determine the future ecological integrity of the Monument and the quality of the visitor's experience.

Rocking K Development Company proposed to transform the ranch into a mixed-use resort and residential community. Realizing that some form of urban growth would very likely transform the Rocking K Ranch and the surrounding Rincon Valley over the next 20 years, the USNPS concluded that planned development with significant environmental protection measures would be preferable to incremental piecemeal development, even if the planned development had higher overall residential density. The scale of the proposed Rocking K development offered the opportunity to protect integrated corridors for undisturbed wildlife movement.

Saguaro National Monument, county officials, World Wildlife Fund, and local environmentalists worked with the developers to produce a site plan that protects critical wildlife habitat and restores degraded riparian habitat throughout the ranch. The development plan sets aside over one-half of the total area as protected open space in a system of integrated wildlife corridors, which are keyed to riparian habitat. The landowner has also joined national and local environmental organizations in supporting legislation to add 1,900 acres of the most ecologically significant portion of the Rocking K Ranch and another 1,600 acres of neighboring ranch lands to the Monument.

The development plan also includes provisions for restoring critical riparian habitat along Rincon Creek, a principal drainage which issues from the Monument and has been degraded by decades of farming and cattle grazing. This restoration—which will cost $6-8 million—is particularly important for the area's wildlife, since desert riparian environments are as much as ten times more productive wildlife habitat than desert uplands. The plan also provides new public access into the Monument and 15 miles of public hiking and equestrian trails, contributing substantially to the county's aggressive recreation and trails initiatives.

While these measures were desirable, alone they were insufficient to adequately ensure the Monument's long-term ecological integrity from regional growth pressures. The challenge was how to ensure stewardship of environmental values, not just in the short term, but through a succession of homeowners over the next several decades. Long-term guarantees were needed so that commitments made by the developer were not overlooked as development proceeded.

A new kind of institution was needed to meet the need for long-term stewardship. Therefore, the Rincon Institute, an independent, nonprofit organization, was created to provide long-term protection for park resources. The Rincon Institute provides independent professional guidance to ensure that development incorporates the highest level of environmental sensitivity.

The Institute has three principal functions: (1) managing natural open space for educational, scientific, conservation, and outdoor recreational values; (2) providing environmental education programs designed to provide for the study of natural history, and to instill a conservation ethic among contractors and construction workers, homeowners, commercial tenants, employees, and resort guests; and (3) providing professional guidance and oversight for the environmentally sensitive development and management of the Rincon Valley, includ-

ing developing principles for the ecological restoration of Rincon Creek.

The members of the board of directors include professors of renewable natural resources and landscape architecture at the University of Arizona, a land-use lawyer, a director of a local hospital, a representative of the developer, and the president of a local trails association. In addition, the director of the Pima County Parks and Recreation Department and the superintendent of Saguaro National Monument serve as board members in a non-voting, *ex officio* capacity.

The Rincon Institute and Rocking K Development Company have entered into a long-term agreement to fund the Institute's activities through start-up funding and innovative deed restrictions that bind future builders and landowners within the ranch. These deed restrictions require that various fees be paid to the Institute for habitat protection, environmental education, and conservation activities. In addition to start-up funding of $240,000 over five years, these deed restrictions will derive funds for the Institute through nightly hotel room fees, residential and commercial occupancy fees, real estate transfer fees, and monthly homeowner fees. For example, room fees from the first proposed resort hotel could generate approximately $50,000 per year for the Institute.

The Rincon Institute reflects the growing trend around the nation of creating effective partnerships between the managers of national parks and adjacent landowners and communities. For example, the Sonoran Institute is working with land owners, local governments, and Santa Monica Mountains National Recreation Area in Ventura County, California to create the Las Virgenes Institute for Natural Resource Preservation and Restoration. The Las Virgenes Institute is modeled closely after the Rincon Institute.

This arrangement—which is supported by the developer, the county, national conservation organizations, and local residents—involves the permanent protection of 10,000 acres of private land and development of a new compact, pedestrian-oriented community between Santa Monica Mountains National Recreation Area and the existing sprawl of Los Angeles County. In addition, the Las Virgenes Institute will undertake ecological restoration activities, provide environmental education, and manage 900 acres of open lands. Recognizing the value of proximity to protected land, the developer and the county propose expanding the National Recreation Area to include 2,600 acres adjacent to the new community.

Despite the currently elevated level of environment-bashing that accompanies a recessionary economy, economic and demographic trends lead me to think that such partnerships are more than a passing fad. I submit that partnerships will increasingly replace either ambivalence or confrontation as the principal characteristic of the relationship between protected areas and their adjacent communities.

First, the traditional formulas for creating jobs and tax revenues are not working in many rural communities. In the world's changing economy, a high-quality local environment and distinctive local character—along with quality education and other factors—are critical economic development factors. Economist David Birch concluded in a recent book entitled *Job Creation in America* that "high-innovation" businesses—such as information-oriented businesses and professional services— are creating most of the jobs in the American economy; that these businesses are increasingly "foot-loose" and locate where the owner prefers to live; and that the key to attracting these businesses is to offer an environment which

"bright, creative people find attractive."

The same principle holds true for attracting people whose retirement income or professional skills provide them a choice in where to live; and the growing number of vacationers looking for an authentic and high-quality alternative to highway clutter.

The principle has become apparent in many communities that protection and enhancement of community resources is a better, more sustainable, approach to economic development than short-term exploitation of community resources. For this reason, local interest in managing growth, attracting economic activity that builds upon local character, and conserving local resources is increasing in communities around the country.

Teton County and Jackson, Wyoming, offer an example. In Jackson—a community best known as a summer tourist destination and winter ski center—the largest payroll in the community is surprising to many people. It is a law firm with a national practice that could be situated anywhere. The firm remains in Jackson presumably because of the attraction of the community's western flavor and scenic resources.

Recognizing that extractive industries are in decline, Teton County has rejected a future overly dependent upon any single sector and is working to build a balanced economy which includes agriculture, "asset-based" tourism, retirement, "footloose" businesses and professional activity—which will not compromise the county's scenic attractiveness and unique Western character. As a result, while there is a severe statewide recession, Teton County is booming. Among many other measures, the county imposes a "bed tax" to fund promotional advertising and has recently acquired development rights to a 400-acre farm threatened by low-density residential development, in order to keep the farm on the tax rolls and in agricultural use.

Pittman Center, Tennessee—a community adjacent both to Great Smoky Mountains National Park and the Gatlinburg-Pigeon Forge tourism complex—offers another example. Citizens in Pittman Center, with the assistance of the Southern Appalachian Man and the Biosphere Program, have recently undertaken a comprehensive planning effort that led them to realize that residents prefer an emphasis on attracting high quality development while protecting the community's bucolic character. This provides an alternative both to the amusement park atmosphere of Gatlinburg, which has produced a seasonal, minimum-wage economy.

Also consider Cape Cod, Massachusetts. In the 1960s and 1970s, the federal Government acquired approximately 5,700 acres of upland to create the Cape Cod National Seashore. Federal acquisition slowed down dramatically in the 1980s, while at the same time local land acquisition took off. Five of the six communities within the National Seashore have approved local bond referendums to acquire and protect open space. Since the mid-1980s, fifteen of the sixteen communities throughout the Cape have approved approximately $117 million dollars in local funds to acquire over 5,000 acres of open space.

To be sure, the National Seashore and adjacent towns have plenty to fight about, but fundamentally both the towns and the National Seashore are working together toward conservation of environmentally sensitive lands and sustainable development that protects the Cape's distinctive regional character. Voters on the Cape have also approved creating a regional land use authority called the Cape Cod Commission which reviews developments of regional impact.

Finally, in the mid-West, a precedent-setting linear park running from Chicago down the Illinois and Michigan Canal to the Mississippi River serves as a model for numerous new partnerships between local communities, states, and federal agencies designed to protect a region's heritage and spur economic vitality based upon regional assets. The Illinois and Michigan Canal National Heritage Corridor runs 120 miles and protects historical resources of 41 canal towns while providing recreational assets and a boost to economically depressed communities. It links 39 natural areas and 200 historic sites. Old steel mills along the canal are being converted to an office complex that is being marketed by emphasizing the attractiveness of access to the historic locks and canals.

In sum, there is an increasing number of cooperative mechanisms tailor-made for unique local circumstances involving landowners, managers of national parks and other protected areas, and local governments in ways that reflect the needs of protected areas and the aspirations of adjacent communities.

The integrity of Shenandoah and many other national parks increasingly depends upon decisions made by local officials and land owners. At the same time, the economic vitality of many communities depends upon maintaining an attractive natural and built environment and capitalizing upon the tremendous economic impact of nearby national parks. The challenge facing both the USNPS and residents of nearby communities is to mobilize cooperative action that protects park values and capitalizes upon natural values to meet community objectives.

Certainly developing a dialogue between diverse interests on what kind of future the residents desire for a region is beneficial. A shared vision is the basis for many successful and far-reaching local initiatives. Boulder, Colorado, has for the past 20 years pursued its vision of an economically vital town surrounded by open lands. This vision has led to an attractive community, the protection of approximately 17,000 acres of land in a greenbelt around the city, and to economic success. For example, when U.S. West (the western "Baby Bell" telephone company) cut the ribbon on one of the premier new research and development facilities in the West, they said it was the natural amenities that Boulder offered that attracted them.

Lack of a clear vision based upon shared values creates a climate in which incremental degradation of natural and community values thrives. Many communities have successfully dealt with these problems by developing broad-based "quality of life" advocacy organizations created to provide dialogue between disparate elements of a community about land use and development issues. Sincere and informed communication—outside of heated public meetings—can lead to non-conventional coalitions that promote both conservation and economic initiatives. For example, in Fort Mill, South Carolina, conservation interests and the downtown merchants association worked together with major land owners to develop a plan supported by virtually the entire town. The plan identified ways to revitalize the downtown, to funnel new growth into areas that can sustain increased traffic, and to protect a greenbelt around Fort Mill protecting the town from sprawl encroaching from nearby Charlotte, North Carolina.

Local decisions also need to incorporate sound information about not only the ecological impact of development but also the economic impact of various types of development and conservation. In Alabama, the Huntsville Land Trust compared the public cost of development with that of open space ac-

quisition in its effort to preserve Monte Sano, the city's scenic mountainous backdrop. An independent study commissioned by the land trust concluded that public infrastructure costs of proposed development would be close to $5 million and that the net annual cost to provide city services to the new development would be $2,500 to $3,000 per acre. In comparison, the city's acquisition costs would be $3.3 million and annual maintenance costs for open space would be only $75 per acre. Voters have since approved a bond referendum to acquire and protect part of the mountain.

All over the country, people who care for parks and other protected areas are coming to realize that they cannot rely upon isolation and federal spending to protect the integrity of these areas. At the same time, many local leaders realize that the old formulas for economic development no longer work. In these places, residents are developing community development strategies that build upon and enhance the local and regional natural and cultural assets.

Disregard by local leaders for the legitimate needs for protecting the ecological integrity of national parks and other protected areas does not long benefit local aspirations. Disregard by park advocates for the legitimate economic aspirations of adjacent communities and landowners likewise fails to protect park values.

Creating diverse cooperative mechanisms to protect park values and realize local and landowner objectives is a promising approach for protecting the ecological and scenic integrity of national parks and other protected areas. Conserving our natural and cultural heritage requires that greater attention be paid to these cooperative approaches.

Protected Landscapes: One Way Forward

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INTRODUCTION

About 4% of the land area of the globe currently enjoys some form of protected area status—a monument to the vision and success of governments, nongovernmental organizations, and individuals across the world. It is a major contribution to global conservation.

However, major problems rise before us. In this paper we identify four problems and argue that the protected landscape approach (IUCN Category V) provides a timely opportunity to address and, given the political and social will, substantially resolve some of these problems. Believing that the United Kingdom is well-placed to provide a lead, we outline the nature of the challenge and develop an agenda for action.

PROTECTED AREAS: THE PROBLEMS

The size of the network Today's human population exceeds 5.5 billion and is growing at a rate of some 1.8% per year. Using even the most optimistic scenarios of economic growth, health care, provision of family planning, etc.,

stabilization of global humanity at below 8 billion is unlikely. The 4% of the land area of the earth currently enjoying some form of protected area status will substantially fail to conserve the earth's biological riches (Holdgate 1989).

The human cost The idea of protecting or safeguarding areas of land whether for spiritual, cultural, or hunting purposes is thousands of years old and is widespread. In North America in the 1870s this concept of protecting, or setting aside, wild areas from human occupation and exploitation took on a now-familiar form with the creation of Yellowstone National Park. During the next hundred years this model has been copied across the world. The concept was honorable and the program of designation is a record of the success of the early conservationists. However, the program often achieved its objectives at a cost to the people who inhabited these protected areas–a cost which, by today's values, is becoming increasingly unacceptable.

A set-aside approach Early national park designations were established in sparsely populated areas and readily met the IUCN definition of "a large area of wild land where resource use is generally prohibited." This is now no longer the case. In Asia and Africa, where poverty stalks the borders of such protected areas, exclusion is being challenged. Wildlife poaching and unauthorized settlements are increasing. As human demands for land increase, existing designations will fail to achieve their objectives and new designations will become more difficult to establish. "If we treat our national parks, nature reserves and protected areas as islands set aside from human use, they will come under increasing attack and be at risk of submergence in a human sea" (Holdgate 1989).

Conservation versus development Against the backcloth of the reports *Our Common Future* (World Commission on Environment and Development 1987) and *Caring for the Earth* (IUCN, UNEP, and WWF 1991), the protected area network, and its interpretation by the developed countries, is perceived as purist and inflexible, unable to respond to the development challenges clearly detailed in these two seminal reports.

Over a decade ago, the *World Conservation Strategy* (IUCN et al. 1980) emphasized that conservation of natural beauty, landscapes, and living richness had to be achieved within a framework of development that meets human needs. The protected areas network must play a constructive part in that global strategy; otherwise, it will be seen by the majority of the world's population as a rich countries' concept–the imposition of the untenable.

PROTECTED LANDSCAPES: THE OPPORTUNITIES

The purpose of a protected landscape or seascape is to maintain nationally significant natural landscapes which are characteristic of the harmonious interaction of people and land, while providing opportunities for public enjoyment through recreation and tourism within the normal lifestyle and economic activity of these areas. As P.H.C. Lucas (1992) states:

> The protected landscape approach provides a clear and legitimate alternative to the national park in areas where the presence and impacts of resident populations and private ownership either rule out the "Yellowstone-model" national park, or where it is the very harmony of people and nature which makes for an environment of quality and distinctiveness.

In this comprehensive book, *Protected Landscapes: A Guide for Policy Makers,* Lucas identifies the values of

the concept, and how to approach selection, establishment, and management. He makes it clear that there are many ways to approach designation, but emphasizes that certain principles apply universally. A cornerstone in establishing these principles was set in place by the Lake District Declaration at the International Symposium on Protected Landscapes in October 1987 and subsequently adopted by the 17th session of the General Assembly of IUCN one year later (see Appendix)

Opportunities for expanding the network In a world where the human population is increasing, and the demand for land for use by people essential for their livelihood is growing, it is becoming less easy to establish new protected areas. There has been a marked slowing down in the rate of establishment of such areas since 1980.

The burden of acquisition costs, and costs forgone, will make future state ownership less and less acceptable. Protection will have to be achieved in more subtle ways through controls allied to inducements to residents and landowners to favor beneficial land management practices. This is the heart of the protected landscape approach.

At IUCN's 18th General Assembly, held in Perth, Australia, 1990, delegates heard that Category V protected landscapes, often wrongly considered a dumping ground for unsuccessful national parks, could be the key to expanding the world network of protected areas. As Assembly rapporteur John D. Waugh observed, "Participants shared the conviction that the concept of protected landscapes is one whose time has come, offering greater opportunities for the future expansion of the network than additional Category II national parks."

Human approach There is increasing recognition that the people who live in protected areas must not only have their rights safeguarded, but must also play an active role in the planning and management of these fragile environments. It is they, more than anyone else, who have the most to lose by their destruction. As Damien Lewis (1990) concludes: "It is time that environmentalists looked towards a vision of conservation that embraces the indigenous people, safeguarding their lifestyles, their culture and their essential humanity from the destructive forces that are ravaging their lands."

Adrian Phillips (1989) states: "Our [U.K.] national parks have recently attracted a lot of international interest. Whereas, in the past, conservation around the world has tended to mean protecting nature against humankind, there is now a growing appreciation that, in many places, the environment is best protected through managing human activities so that they sustain environmental quality." The protected landscape approach provides a clear opportunity which not only allows, but actively encourages, the traditional lifestyle of the resident population to become an indispensable part of the conservation strategy.

Conservation through development *Caring for the Earth* is founded on the ethic of care for nature *and* for people: a strategy of mutually reinforcing actions. The protected landscape designation does not divorce nature conservation objectives from human activity; quite the opposite. The objectives are achieved through such activities. In a phrase: conservation through development. As the Lake District Declaration puts it: "Although often much changed from their natural state, [protected landscapes] make their own special contribution to the conservation of nature and of biological diversity: for many of the ecosystems they contain have evolved the continue to survive because of human intervention." Moreover, "protected landscape goals can be achieved only through

mechanisms which influence in a positive manner how people manage the land they occupy, how various local authorities exercise their functions in the area, and how policies and practices of outside agencies impact on landscapes" (Lucas 1992).

A model for sustainable development Protection of biological diversity has to be a major goal of multipurpose land management on the land outside the protected areas network—currently some 96% of the earth's land surface. The protected areas network must provide examples or models to help realize this goal. It must be integrated into wider global programs shown to have relevance, otherwise the network and the programs will fail—the very theme of this 4th World Congress. Human survival depends on maintaining a sustainable development regime.

Protected landscapes are protected areas where people live and work in a way which leaves an important role for nature. They can act as models for the sustainable management of the wider rural territory. For example, in the U.K. the national parks (which are actually equivalent to Category V protected landscapes) have been effective test beds for countryside planning and management techniques which have been adopted for use in the wider countryside areas, e.g., ranger services, information and interpretation facilities, conservation management agreements, key project work, etc.

THE CHALLENGE

The need for more protected landscape designations Planning and managing protected landscapes is a complex business, synchronizing ecological, economic, and social skills and maintaining a fine balance often against a changing political backcloth.

Across the five continents, rural land use patterns reflect and record centuries of interaction between humans and their natural environment. Some of these cultural landscapes are of international importance as increasingly a sense of shared heritage grows around the world. Many are designated as protected landscapes, indicating the wide application of the concept. Examples are wide-ranging and include:

- The dolmens, menhirs, cromlechs, and the terraces in Cevennes National Park in France.
- The Inanan great highway and ruins of Paredones in Cajas National Recreation Area in Ecuador.
- The "chalas" and "baids" amidst the paddy fields of Bhawal National Park in Bangladesh.
- The ancient Welsh language and associated culture in Snowdonia National Park in the U.K.
- The Sengen shrine and Sannji temple in Fuji National Park, Japan.

All of the above enjoy IUCN Category V protection, but many landscapes are under threat. Cultural diversity is giving way to bland uniformity as economic forces run unchecked. Urgent action is needed.

The nature of the challenge The Lake District Declaration states: "Protected landscapes are living models of the sustainable use of the land and natural resources upon which the future of this planet and its people depend. It is vital to protect such landscapes both for their present value and for the contribution that they will make to spreading the philosophy and practices of sustainable development over much larger areas of the world." Protected landscape objectives are often a combination of biodiversity and landscape conservation, and protection and enhancement of a traditional lifestyle. There is an early

need to identify and establish sound principles of good planning and management capable of wide application and adaptation to different situations (Lucas 1992). Such principles or models will represent a range of options enabling local people to influence change by selecting, developing, and adapting the model to their particular situation.

Change must be accommodated but continuity retained; thus key landscape features or cultural practices must be retained to pass on to future generations. Developing countries undergoing rapid population expansion represent a particularly stark challenge. In Central and Eastern Europe as countries move away from state ownership to embrace a market economy, and a strong sense of "localness" develops, the need for planning is urgent and the opportunity for enhancing local customs, local culture, and local landscapes is great.

THE WAY FORWARD

The protected landscape concept can make a unique contribution to the protected areas network, and to sustaining the future of human society. But action is needed now. The following agenda is submitted as a basis for action:

- Create a greater awareness of the concept to achieve universal recognition;
- Advance the priority of the concept;
- Urge governments, via IUCN, to recognize the crucial role that protected landscapes can play in achieving sustainable development and in the conservation of the cultural and natural heritage of all nations;
- Ask IUCN to promote an active exchange of experience between nations;
- Identify principles for the selection, planning, and management of protected landscapes;
- Urge governments, via IUCN, to designate, program, and fund additional protected landscapes;
- Establish working links between existing protected landscape agencies and authorities;
- Develop clear objectives for each protected landscape area, and prepare management plans sensitive to ecological and social conditions; and
- Encourage countries, or groups of countries, to establish codes of practice or conventions to protect and enhance the rich cultural landscape heritage of the world.

The International Centre for Protected Landscapes The agenda outlined above needs a focus to provide support and assistance to IUCN if significant progress is to be made. The International Centre for Protected Landscapes (ICPL) aims to provide such a focus. ICPL was established in April 1991 at the University College of Wales, Aberystwyth. A nonprofit organization, ICPL is funded by the Countryside Commission (England) and the Countryside Council for Wales. It also receives substantial financial support from British Petroleum plc. ICPL was established to:

- Provide a focal point for politicians, political advisors, senior administrators, planners, land managers, and academics interested in the protected landscape concept;
- Mobilize and bring forward experience relating to the planning and management of protected landscapes;
- Develop clear channels through which these experiences can be disseminated; and
- Receive and coordinate international visits, new ideas, and fresh experiences.

In seeking to achieve its objectives, ICPL welcomes associations and contacts with organizations and individuals interested in promoting the protected landscape concept worldwide. Contact: International Centre for Protected Landscapes; University College of Wales; Unit 8, Science Park; Aberystwyth, Dyfed SY23 3AH; Wales, U.K. Phone: 0970-622617. Fax: 0970-622619.

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Appendix. Highlights from the Lake District Declaration

In October 1987 an International Symposium on Protected Landscapes was held in England's Lake District. The declaration that came from this symposium underpins many of the aims of ICPL. The set of principles and actions in the Lake District Declaration include the following.

- People, in harmonious interaction with nature, have in many parts of the world fashioned landscapes of outstanding value, beauty, and interest.
- It is vital to protect such landscapes both for their present value and for the contribution that they will make to spreading the philosophy and practices of sustainable development over much larger areas of the world.
- There should therefore be universal recognition for this concept of landscape protection; much greater priority should be given to it; and there should be an active exchange of experience between nations.
- These inhabited landscapes are in a delicate and dynamic equilibrium; they cannot be allowed to stagnate or fossilize. But change must be guided so that it does not destroy but will indeed increase their inherent values. This means for each protected area a clear definition of objectives, to which land use policies within it should conform. It means also a style of management that is sensitive to ecological and social

emotional links to the land and by the operation of flexible systems of graded incentives and controls.

- The protection of these landscapes depends upon maintaining within them a vigorous economy and social structure, and a population that is sympathetic to the objectives of conservation. It means working with people at all levels, and especially those living and working in the area—the people most intimately affected by what happens in it.
- Governments, international organizations, development agencies, and nongovernmental organizations should recognize the crucial role that such landscapes can play in sustainable development and in the conservation of the cultural and natural heritage of nations, and should develop programs accordingly.
- Governments should adopt the protection of these landscapes as part of their public policies for the use of natural resources and provide sufficient funds to make this effective, and they should use these protected areas as models—"greenprints"—for the sustainable management of the wider countryside
- Governments and development agencies should direct funds destined for the support of agriculture or other economic objectives in these areas towards kinds of development that favor conservation.
- National and international organizations should promote a worldwide exchange of information and experience on the management of such landscapes and should encourage and extend training in this field.

Source: ICPL, *Protected Landscapes: Conservation through Development* (ICPL newsletter), No. 1, Spring 1992.

The Rise and Decline of Ecological Attitudes in National Park Management, 1929-1940
Part I

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Author's note: This series of articles on U.S. National Park Service biological programs of the 1930s is dedicated to Victor H. Cahalane, *who headed these programs from the mid-1930s to 1955. Like his fellow wildlife experts in the New Deal era, Cahalane advocated farsighted management policies to a tradition-bound Park Service. Many of these policies would not gain acceptance until 30 to 40 years later. Cahalane now resides in rural upstate New York, and maintains a keen interest in science and natural resource management.*

A survey of park wildlife initiated in the summer of 1929 and funded through the personal fortune of biologist George Wright marked the U.S. National Park Service's first extended, in-depth scientific research in support of natural resource management. The success of this effort motivated the Park Service to establish a "wildlife division" and inaugurated a decade of substantial scientific activity for the national parks. During this period, the wildlife biologists under George Wright developed new perspectives on natural resources in the parks, opening new options for park management.

They raised serious questions about the Park Service's utilitarian and recreational approach to natural resource management as practiced during Stephen Mather's directorship (1916-1929), and they promoted a greater concern for ecological preservation in the parks.

Yet in January 1940, little more than a decade after the survey began, the Park Service's wildlife biologists were transferred to the Interior Department's Bureau of Biological Survey.[1] While the biologists remained responsible for national park wildlife programs, their administrative separation symbolized the diminishing influence of science within the Park Service by the late 1930s. The decade of the 1930s witnessed a rise, and then decline, of ecological thinking in the National Park Service. The decade also experienced a great diversification of Park Service programs, expanding responsibilities beyond management of mostly large natural areas, and drawing attention to matters other than nature preservation.

DIFFERING PERSPECTIVES ON NATIONAL PARKS

Previously, in addition to assuring that tourism development was harmonious with scenery, the Park Service during the Mather era tended to measure its success in leaving the parks unimpaired by the degree to which it restricted physical development. The undeveloped areas (the vast backcountry of the parks) were considered to be in a pristine condition, giving evidence that national park wilderness had been preserved. However, the wildlife biologists perceived preservation differently, emphasizing that impairment involved more than just the visible effects of development and physical intrusion. The scientists asserted that natural resources had been seriously manipulated and altered throughout the parks.

In the fall of 1928, Horace M. Albright (who would succeed Mather as National Park Service director in January 1929) published an article entitled "The Everlasting Wilderness" in *The Saturday Evening Post*, which judged the success of park management largely in terms of limits placed on physical development. Responding to concerns that the Park Service might "checkerboard" the parks with roads, Albright pointed to the relatively small percentage of lands affected by road and trail construction in the parks. He wrote that Yellowstone (where he was superintendent until becoming Park Service director), had more than 300 miles of roads and about 1,000 miles of trails within its 3,348 square miles. And he stressed that Yellowstone's roads affected just ten percent of the park, leaving the remaining ninety percent accessible only by trail–a huge backcountry of "everlasting wilderness" with flourishing wildlife and excellent fishing streams. Comparable statistics were given for Yosemite, Grand Canyon, Mount Rainier, and other parks. All national parks were to be "preserved

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1 *For abbreviations used in the footnotes, see the Appendix.* Transfer of the National Park Service's wildlife biologists to the Biological Survey began in early December 1939, and was made official on January 1, 1940. *Annual Report of the Secretary of the Interior for the Fiscal Year Ending June 30, 1940* (Washington: Government Printing Office, 1940), 165; National Park Service, "National Parks: A Review of the Year," *American Planning and Civic Annual* (1940), 34. The Bureau of Biological Survey had just been transferred from the Department of Agriculture to the Department of the Interior. In 1940 the Survey would be merged with the Bureau of Fisheries to become the Fish and Wildlife Service, now known as the U.S. Fish and Wildlife Service.

forever in their natural state," and the vast majority of Yellowstone's lands remained as "primeval" as before the area became a park.[2] In this instance, the director evidenced the tendency to judge pristine wilderness according to the absence of physical development.

Albright notwithstanding, virtually the entire scientific effort within the National Park Service during the 1930s contradicted such reasoning. A clear and concise statement of the scientists' perceptions came in a 1934 memorandum from Ben H. Thompson, one of the Wildlife Division's biologists, when he wrote Arno B. Cammerer (who succeeded Albright as director in 1933) in regard to setting aside "research reserves"—supposedly pristine park areas to be used strictly for scientific study. Thompson bluntly declared that no "first or second class nature sanctuaries are to be found in any of our national parks under their present condition." He cited factors such as the parks' limited size, where even a park as large as Yellowstone could not provide "protection and habitat unmodified by civilization" for carnivores and large ungulates.

Thompson then detailed some of the changes that had occurred. He noted that cougar, white-tailed deer, wolf, lynx, and perhaps wolverine and fisher were most likely "gone from the Yellowstone fauna." Rocky Mountain National Park's "carnivore situation" was much the same, except it had also lost its grizzly population. At Grand Canyon, feral burros had "decimated every available bit of range" in the canyon, and domestic livestock had taken a "heavy toll from the narrow strip of South Rim range." Moreover, Grand Canyon's mountain lions were "almost extirpated," and bighorn sheep "greatly reduced," while the "entire ground cover and food supply for ground dwelling birds and small mammals" had been altered by cattle grazing. Yosemite National Park had lost its bighorn and grizzly populations, and its mountain lions were "almost gone." In Glacier the grizzly were "very scarce," the trumpeter swan and the bison were missing, and game species in general were "seriously depleted because of inadequate boundaries." Finally, Thompson commented that there was "no need to repeat the story for the smaller parks."[3]

Ben Thompson's views of park conditions were in striking contrast to Albright's depiction of the parks as being "preserved forever in their natural state." Albright's ideas came from essentially romantic perceptions of the majestic landscapes, with the parks' undeveloped and unoccupied lands equated with unimpaired lands—a perception almost certainly shared by most Park Service leaders and by the public. Through carefully controlled development, the Park Service asserted that it had left the parks largely unimpaired. But the Park Service's new cadre of wildlife biologists perceived the same landscapes in terms of ecology. While roads and other development had not penetrated many areas of the national parks, other activities had—among them, predator control, cattle grazing, suppression of natural fires, and introduction of non-native species.

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[2] Horace M. Albright, "The Everlasting Wilderness," *The Saturday Evening Post,* 201 (29 September 1928), 28.

[3] Ben H. Thompson to Arno B. Cammerer, 23 February 1934, George M. Wright files, MVZ-UC. This statement was later included verbatim in George Wright and Ben Thompson, *Fauna of the National Parks of the United States,* Fauna Series No. 2 (Washington: Government Printing Office, 1935), 124.

And as Thompson indicated, such interferences had seriously altered natural conditions, affecting the backcountry well beyond developed areas.

The wildlife biologists thus became a kind of minority "opposition party" within the Park Service, challenging traditional assumptions and practices–in effect reinterpreting the congressional mandate to leave the parks unimpaired. Urging throughout the 1930s that the Park Service must address ecological issues, they argued that it should concern itself not just with scenery and public enjoyment, but also with careful, research-based management of natural resources so as to leave the parks in as close to a pristine condition as possible. Judgments on the success of Park Service management must include the ecological perception of parks. Events of the 1930s would show how the Park Service responded to this new perception of its mandate.

PARK SERVICE DIRECTORS OF THE 1930S

The continuity between the administrations of Stephen Mather and Horace Albright has been seen as remarkably strong.[4] Indeed, Mather's constant reliance on Albright's support and advice resulted in a virtually seamless transition between the two directorships. And while director, Albright greatly expanded the park system and managed the parks to assure public enjoyment, much as his predecessor had done. Albright's directorship was brief–January 1929 to August 1933, when he resigned to become an executive of the United States Potash Company.

Throughout the rest of his long life, Albright kept exceptionally close watch on Park Service activities, continually passing judgment on its operations and speaking out with firmly held opinions. As director, he supported the survey and the Wildlife Division–yet he may have failed to anticipate the management implications that would arise from the wildlife biologists' efforts. He would remain steadfastly loyal to many traditional management practices of the 1920s, frequently placing him at direct odds with the wildlife biologists' recommendations. At such times, he proved one of their strongest adversaries and critics.

Albright could criticize with authority. Not only had he been superintendent of Yellowstone and the Park Service's second director, but also he had been one of the principal founders of the bureau and Mather's closest confidant. After joining U.S. Potash, Albright relocated from Washington to another hub of power, with his offices in mid-town Manhattan, high up in the new complex known as Rockefeller Center. There he maintained a close friendship with national park benefactor John D. Rockefeller, Jr.–a relationship of much value to National Park Service interests.

Albright's successor, Arno B. Cammerer, had been in the Service's directorate since 1919. Although much less dynamic than Mather or Albright (and less prominent in the annals of Park Service history), Cammerer very effectively led the bureau during a period of rapid change and expansion. His tenure as director lasted until 1940, when for reasons of poor health (probably exacerbated by his continuing difficulties with Secretary of the Interior Harold L. Ickes) he stepped down to become regional director in the Richmond, Virginia, office. But as Park Service director during the New Deal era, Cammerer took advantage of many opportunities, using New

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[4] Donald C. Swain, *Wilderness Defender* (Chicago: University of Chicago Press, 1970), 192; and Swain, "The National Park Service and the New Deal, 1933-1940," *Pacific Historical Review*, 41 (August 1972), 313, 316.

Deal money and programs to move the National Park Service much further along in the direction established by Mather and Albright.[5]

THE PROPOSAL FOR A NATIONAL PARK WILDLIFE SURVEY

Formation of the Service's scientific research program during the Albright administration marked an important break in continuity from the Mather era. Yet the program emerged only in a fortuitous and opportunistic way—there is no indication that Park Service leadership had seriously considered the need for in-depth scientific studies prior to 1928 when George Wright proposed to fund a survey of wildlife in the national parks. With all its many programs and expenditures the Park Service had not felt it necessary to obligate funds for improving its basic knowledge of natural conditions in order to improve park management. Moreover, throughout the history of the National Park Service, wildlife biology has surely been the only management program to be initiated as a privately funded endeavor within the bureau.

Wright, who was independently wealthy, had studied forestry and zoology at the University of California, and had joined the Park Service in 1927 as assistant park naturalist in Yosemite. With his supervisor, biologist Carl P. Russell, Wright frequently analyzed Yosemite's varied and complex natural resource problems. Keenly aware of the lack of information needed to manage national park wildlife, Wright offered to pay for an extensive wildlife survey. The survey would include all large natural parks, and, in Horace Albright's words, would secure a "vast amount of important scientific data regarding the wildlife of the national parks." After some deliberation the Park Service accepted the proposal.[6]

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[5] Mather, who died in January 1930, willed Albright and Cammerer $25,000 each, partly because he hoped the money would assure their independence of thought as Park Service leaders. Swain, *Wilderness Defender,* 193. In "National Park Service and the New Deal" (p. 316), Swain depicts Cammerer as a "relatively weak director," whom Secretary Ickes did not care for. However, in contrast to this perception, Cammerer very adroitly used his talented staff to promote Park Service programs under the New Deal, and he oversaw the bureau's exceptional expansion and diversification which occurred during his time. In this regard, George Collins, a long-time, highly placed Park Service employee, recalled that Cammerer "used Mr. Demaray and Mr. Wirth, Ben Thompson, Hillary Tolson and others to his highest and best advantage, and to theirs as well. The service had a growing reputation for efficiency and ability. I think you have to credit [Cammerer] a lot for that." George L. Collins, "The Art and Politics of Park Planning and Preservation," interview by Ann Lage, 1978 and 1979, Regional Oral History Office, University of California, 86, typescript, HFLA. As much as anything else, the irascible Ickes seems to have been put off by Cammerer's quiet, bureaucratic ways. He was also irritated by the director's habit of chewing gum with open-mouthed smacking during meetings with the secretary. Ickes' frustrations with Cammerer are discussed in Thomas H. Watkins, *Righteous Pilgrim: The Life and Times of Harold Ickes, 1874-1952* (New York: Henry Holt and Company, 1990), 552-555.

[6] Ben H. Thompson, "George M. Wright 1904-1936," *The George Wright Forum* (Summer 1981), 1-2; Horace M. Albright to the Director, 11 October 1928, Entry 17, RG79.

Had Wright not proposed the survey and offered to fund it, the Park Service might well have waited years before initiating its own science programs. And in fact, the Park Service's response reflected to a degree its traditional approach to natural resource matters. For instance, Assistant Director Arthur E. Demaray (acting for Mather) suggested that the survey be done not by the National Park Service but under the auspices of the Biological Survey (at that time in the Department of Agriculture)—in keeping with the Park Service's established practice of using other government bureaus to do "special work of this kind," as Demaray phrased it. And, following established practice, Demaray began informal talks with the head of the Biological Survey to implement the proposal.[7] However, the Park Service directorate was persuaded otherwise, most likely by George Wright, who strongly believed that the Service itself should assert primary responsibility. Horace Albright also opposed Demaray—and Albright used this issue to express reservations about the Park Service's overall cooperation with the Biological Survey which, he suspected, would "not overlook any opportunity to enhance its prestige" through national park work.[8]

Also in keeping with traditional concerns, some Park Service leaders emphasized the benefits Wright's wildlife survey would bring to national park educational programs. By providing information for educational activities (later known as interpretation), the survey would enhance public enjoyment and appreciation of the parks, one of the Park Service's highest priorities. Indeed, the bureau's initial venture into natural history research (an unprogrammed effort conducted mainly by interested park staff when they had the time) had focused not on resource management, but on improving educational programs to assure public enjoyment of the parks. Interest in interpreting the parks' natural history had prompted the Park Service to create "park naturalist" positions in several parks to oversee educational programs, and to establish in 1925 a Division of Education, initially headquartered in San Francisco.[9]

Further evidence of interest in the survey as a means of bolstering park educational activities came after the secretary of the interior (at the instigation of the Park Service) created the Committee on [the] Study of Educational Problems in the National Parks in 1928. During its deliberations on educational needs, the committee, a group of prominent scientists, supported the proposed wildlife survey. However, in a formal report it asserted that the "primary function" of the National Park Service was the parks' "inspirational and educational values." And overall, the committee emphasized the educational benefits to be derived from natural history research, with little reference to

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[7] Arthur E. Demaray to Horace M. Albright, 21 September 1928, Entry 17, RG79.

[8] Albright to The Director, 11 October 1928. In this memorandum Albright mentions Wright's belief that the survey should be conducted under Park Service direction. A stronger statement, that Wright was "very anxious" that it be a Park Service project, is found in Joseph Dixon to Horace M. Albright, 7 March 1929, Horace M. Albright files, MVZ-UC.

[9] John C. Merriam to Ansel F. Hall, 21 February 1929, Entry 18, RG79; Joseph Dixon to H.C. Bryant, 7 March 1929, Harold C. Bryant files, MVZ-UC; Barry Mackintosh, *Interpretation in the National Park Service: A Historical Perspective* (Washington: National Park Service, 1986), 13.

wildlife management needs—a predictable response given the committee's chief focus.[10]

Also, in March 1929, two months after becoming director, Horace Albright reported to the secretary of the interior on the need for scientists—that they be "attached to the educational division," which could "gather data for museums, for all other educational activities, and for the other divisions as needed." In addition, the new director reported that there were no funds for scientific research—but he did not ask for funds for this purpose. Like the committee on education, Albright saw the national parks as being valuable to the nation mainly for their "inspirational and educational features," a perception maintained long after he left the directorship.[11] Still, he approved of the scientific survey which Wright was funding, as did Ansel Hall, head of the Education Division, who saw the survey as an urgent need for both education and wildlife management.[12]

THE WILDLIFE BIOLOGISTS AND JOSEPH GRINNELL

With its focus on interpreting natural history in the parks, the Education Division had become the keeper of scientific knowledge in the Service—a fact very likely at the heart of George Wright's wish to associate his wildlife survey with the division.[13] As a naturalist in Yosemite, Wright had worked with Ansel Hall and a forester, John Coffman, also in the Education Division. Equally important, the Park Service had moved the division to the University of California campus in Berkeley—where Wright and the wildlife biologists had well-established ties, assuring strong support. Wright's mentor, Joseph Grinnell, who was head of the university's Museum of Vertebrate Zoology and a long-time proponent of scientifically based management of the national parks, was there, as were other teachers and colleagues. With the encouragement of Mather and Albright (themselves University of California alumni), the university was becoming a center of Park Service activity that included wildlife management, education, forestry, and landscape architecture.[14]

Moreover, Joseph S. Dixon and Ben Thompson, the biologists who along with Wright constituted the

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[10] Committee on [the] Study of Educational Problems in National Parks, "Reports with Recommendations," 9 January 1929, HFLA; "Park System to be Equipped for Education," *National Parks Bulletin*, 9 (April 1929), 2; Mackintosh, *Interpretation in the National Park Service*, 15.

[11] Horace M. Albright to Ray Lyman Wilbur, 5 March 1929, Entry 6, RG79. Albright had earlier stated to Stephen Mather that two important benefits from the survey would be "widening the scope of our educational work . . . and [securing] material for the development of our museums and general educational activities." Albright to the Director, 11 October 1928.

[12] Ansel F. Hall to the Director, 17 October 1928, Entry 17, RG79; and Ansel F. Hall to Horace M. Albright, 23 November 1928, Entry 17, RG79. However, negotiations on the survey were stalled briefly in the winter of 1929 due to the proposal being "unduly emphasized as a special achievement" of the Education Division. The division apparently sought too much credit. Dixon to Albright, 7 March 1929.

[13] Dixon to Albright, 7 March 1929.

[14] The ties between the U.S. National Park Service and the University of California at Berkeley are discussed further in Richard West Sellars, "The University of California—Present at the Creation," *Courier: The Newsmagazine of the National Park Service*, 35, No. 2 (February 1990), 4.

wildlife survey team, were also graduates of the university and had studied under Grinnell. Dixon had joined the Museum of Vertebrate Zoology staff in 1915 and developed a strong professional reputation as assistant curator and economic mammalogist. He, too, had taught Wright; and in the summer of 1926 Wright accompanied Dixon on a study of wildlife in Mount McKinley National Park.[15] Thus the survey's biologists not only shared institutional and intellectual ties, but they were also good friends.

Particularly interested in Yosemite and the other Sierra parks, Joseph Grinnell, the chief mentor for the incipient biological effort in the Park Service, was an important figure in the emerging use of ecological science as a means of understanding the national parks. In September 1916 (shortly after passage of the National Park Service Act) Grinnell had co-authored an article with biologist Tracy I. Storer advocating minimal disturbance of the parks' flora and fauna, and maintenance of the "original balance" of nature in the parks.[16] In 1924 they elaborated on these ideas in an article entitled "The Interrelations of Living Things," stating that the more they studied the parks the more they were aware that "a finely adjusted interrelation exists, amounting to a mutual interdependence" among species. They perceived that each species "occupies a niche of its own, where normally it carries on its existence in perfect harmony on the whole with the larger scheme of living nature." In managing wildlife, the Service needed to take into account such habitat-related matters as food supply, shelter from predators, and secure breeding places.[17] Throughout his life, until his death in 1939, Grinnell championed an ecological approach to national park management based on such concepts, and he kept in regular contact with the wildlife biologists, as well as the Park Service directorate.[18]

Grinnell's ecological thinking reflected the evolving concepts of nature and natural systems, which would mark a significant scientific advancement during the period when Wright, Thompson, and other Park Service biologists were launching their careers. Increasingly, biologists were becoming aware of the role of habitat in the survival of species. An understanding of the importance of the overall environ-

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15 Thompson, "George M. Wright," 1; Lowell Sumner, "Biological Research and Management in the National Park Service: A History," *The George Wright Forum* (Autumn 1983), 6-7; George M. Wright to Joseph Dixon, 26 April 1926, George M. Wright files, MVZ-UC.

16 Joseph Grinnell and Tracy I. Storer, "Animal Life as an Asset of National Parks" *Science,* 44 (15 September 1916), 377.

17 Joseph Grinnell and Tracy Irwin Storer, "The Interrelations of Living Things," in *Animal Life in the Yosemite* (Berkeley: University of California Press, 1924), 38-39.

18 On Grinnell's influence on Wright, Carl P. Russell commented in 1939 that "because of the preparation that [Grinnell] gave George Wright and through the warm friendship that existed between Dr. Grinnell and Mr. Wright, we have a Wildlife Division and a defined wildlife policy." Carl P. Russell to E. Raymond Hall, 17 November 1939, Carl P. Russell files, MVZ-UC. Grinnell's career and his influence on the ideas of George Wright and other Park Service biologists are discussed in Alfred Runte, "Joseph Grinnell and Yosemite: Rediscovering the Legacy of a California Conservationist," *California History,* 69, No. 2 (Summer 1990), 173-181.

ment in which different species lived led to a greater melding of animal and plant ecology, and attempts to comprehend food chains, predator-prey relationships, and other interrelationships of animals and plant life.[19] The new ecological thinking underlay a growing academic interest in game management; and, largely through Grinnell and his students, the new theories began to be applied in national parks. The wildlife survey funded by George Wright marked the first effort to infuse ecological thinking into the specific land management practices of the National Park Service—a distinction of great significance. The survey established a new voice in national park affairs, to contend with the Service's already deeply entrenched management traditions.

FAUNA NO. 1

Following preparatory work, Wright, Dixon, and Thompson began their field studies in May 1930. By May 1932 the team had completed a report of more than 150 pages, covering most of the large mammals and the major natural parks. Official publication came in 1933, under the title *Fauna of the National Parks of the United States; A Preliminary Survey of Faunal Relations in National Parks* (referred to as "Fauna No. 1," as it was planned as the first in a series of wildlife studies). Fundamentally, the biologists recognized the inherent conflict in national park management—that efforts to perpetuate the parks' natural conditions would have to be "forever reconciled" with the presence of large numbers of people in the national parks. They observed that this set of circumstances (seeking to preserve natural areas while accommodating large numbers of people) had "never existed before." Yet the scientists' ultimate goals went beyond preservation. They proposed not only to perpetuate existing natural conditions, but, where necessary and feasible, to *restore* park fauna to "its pristine state." This proposal, also unprecedented, would require, as stated in Fauna No. 1, "biological engineering, a science which itself is in its infancy."[20]

In their survey, the biologists observed a "very wide range of maladjustments" among park fauna, which they attributed to three cardinal influences. To begin with, human manipulation of the areas prior to park establishment had caused significant changes in the natural conditions. Then, once parks were established, conflict occurred between humans and wildlife occupying "the same places at the same time"—even though the stated ideal was to maintain park wildlife in a "primitive state unmodified by civilization." In addition, the survey team noted the "failure of the parks as independent biological units" since the parks did not include vital year-around habitat for many animals.[21]

To correct the faunal "maladjustments," the scientists proposed a number of actions. For example,

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19 See, for instance, Thomas R. Dunlap, *Saving America's Wildlife* (Princeton: Princeton University Press, 1988), 70-74; and Susan L. Flader, *Thinking Like a Mountain: Aldo Leopold and the Evolution of an Ecological Attitude Toward Deer, Wolves, and Forests* (Lincoln: University of Nebraska Press, 1978), 28-33.

20 George M. Wright, Joseph S. Dixon, and Ben H. Thompson, *Fauna of the National Parks of the United States; A Preliminary Survey of Faunal Relations in National Parks*, Contributions of Wildlife Survey, Fauna Series No. 1 (Washington: Government Printing Office, 1933), 4, 5, 21.

21 Wright, Dixon, and Thompson, *Fauna of the National Parks* (1933), 19-22.

those species extirpated from certain parks should be restored when feasible. And the species whose populations had been reduced to the "danger point" should receive management's special attention. Similarly, where park habitat had been seriously altered, it should be restored. The survey team placed particular emphasis on range depletion, noting that many park areas had been overgrazed by livestock before 1900. In confronting the impacts of public use of the parks, the team remained loyal to prevailing Park Service management attitudes by noting that public use "transcends all other considerations." Still, they stressed that park development should be undertaken with full consideration for wildlife and habitat, which, as with their other solutions, required research to gain substantive knowledge of the parks' complex natural resources.[22]

Of all their proposed solutions, the survey team most frequently emphasized the need to expand the parks to include year-round habitat necessary for major wildlife species. It was, they stated, "utterly impossible" to protect animals in an area they occupy only part of the year. Repeatedly, the biologists stressed that arbitrary park boundaries had been drawn without consideration of annual migration patterns. In such cases, the parks were, in the biologists' words, like houses "with two sides left open," or like a "reservoir with the downhill side wide open."[23] The most critical park boundary problem was the exclusion of adjacent lower-altitude winter ranges from the high mountain parks, which meant that wildlife migrating out of the parks for the winter encountered other, often conflicting, land uses, and were usually subject to hunting.

In seeking to establish an "orderly development of wild-life management" in the national parks, the team employed a four-stage approach: For each park they (1) sought to determine wildlife conditions before the arrival of Euroamericans; (2) studied the effects of Euroamericans upon wildlife; (3) studied the current wildlife conditions in the parks; and (4) recommended plans for managing wildlife in the parks they had studied. This systematic approach the biologists proposed for subsequent and more intensive studies of wildlife in individual parks.[24] Their report concluded with a series of recommendations entitled, "National Park Policies for the Vertebrates." The preamble to the recommendations embraced management of both animals *and* plants in the parks, stating that:

> Every tenet covering the vertebrate life in particular must be governed by the same creed which underlies administration of wild life in general throughout the national parks system,

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[22] Wright, Dixon, and Thompson, *Fauna of the National Parks* (1933), 23-28, 33-36, 71.

[23] Wright, Dixon, and Thompson, *Fauna of the National Parks* (1933), 37-38, 44, 94, 132. For example, since many large predators are wide-ranging and therefore subject to hunting on lands adjacent to the parks, the survey team proposed to prevent extirpation of predator species from parks by enlarging the parks as necessary to include more of the predators' habitats. (p. 44) Mostly though, their concern was for inclusion of more habitat for the grazing animals. Other instances where enlargement of the parks was proposed for wildlife management purposes are found in Wright, Dixon, and Thompson, *Fauna of the National Parks* (1933), 37, 114, 121, 126, 131, 132.

[24] Wright, Dixon, and Thompson, *Fauna of the National Parks* (1933), 9-18.

namely: That one function of the national parks shall be to preserve the flora and fauna in the primitive state and, at the same time, to provide the people with maximum opportunity for the observation thereof.[25]

A landmark document, Fauna No. 1 was the Park Service's first official declaration of comprehensive natural resource management policies, and it introduced management concepts substantially different from those of the Mather era. The major policy statement of the Mather years, the "Lane Letter" (Secretary of the Interior Franklin K. Lane's May 1918 directive to Mather) had placed heavy emphasis on accommodating public use of the parks. Significantly, this early "interpretation" of the Park Service's congressional mandate mentioned wildlife management only in passing—and then only as a responsibility which should be handled by experts borrowed from other government bureaus.[26] Under Mather, the Park Service had evolved policies aimed at preserving park scenery and presenting idealized versions of nature. Using traditional natural resource management strategies, the Park Service manipulated resources such as forests, fish, bears, and certain predators in essentially a utilitarian way—largely to ensure public enjoyment of the parks.[27]

In contrast, Fauna No. 1 emphasized preserving the "primitive state" in national parks through the use of scientific research and guidance, marking a truly radical departure from earlier policies. More than any other document in Park Service history, this study, prepared by George Wright and his fellow biologists, shifted emphasis from managing natural resources chiefly for public enjoyment to managing for ecological purposes. The Park Service would resist both the explicit and implicit meanings of Fauna No. 1 for decades, but nevertheless the document stands as the threshold to a new era in national park thinking. And in the 1960s, when Park Service resistance to scientifically based management would finally begin to diminish, the management directions taken were very much akin to those which Fauna No. 1 had advocated three decades before. Recommendations for research-based management, protection of predators and endangered species, reduction or eradication of non-native species, and acquisition of more ecologically complete wildlife habitats were among the many far-sighted aspects of this report.

EMERGING NATURAL RESOURCE POLICIES AND PROGRAMS

Even though he would later take serious issue with some of their proposals, Director Albright supported the early work of the wildlife biologists and showed a growing awareness of their concerns. His policy limiting predator control in the parks, announced in May 1931, reflected pressure from outside the Park Service—but also it almost cer-

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25 Wright, Dixon, and Thompson, *Fauna of the National Parks*, (1933), 147.

26 Franklin K. Lane to Stephen T. Mather, 13 May 1918, Entry 17, RG79. The Lane letter is reprinted in Horace M. Albright, as told to Robert Cahn, *The Birth of the National Park Service: The Founding Years, 1913-1933*, (Salt Lake City: Howe Brothers, 1985), 69-73.

27 For a discussion of natural resource management practices during the Mather directorship, see Richard West Sellars, "Manipulating Nature's Paradise: National Park Management Under Stephen T. Mather, 1916-1929," to be published in *Montana The Magazine of Western History*, 43, No. 2 (Spring 1993).

tainly reflected the wildlife biologists' influence. At the time Albright issued the new predator policy, the biologists were doing field work for Fauna No. 1, which would flatly recommend against predator control. And very likely the biologists themselves drafted such detailed commentaries as Albright's 1932 "Game Conditions in Western National Parks," an account of various wildlife problems confronting the Service.[28]

In an article appearing in *The Scientific Monthly* in June 1933 and entitled "Research in the National Parks" (again, probably drafted or at least heavily influenced by the biologists), Albright stated that it had been "inevitable" that scientific research would become part of national park management. Research, he noted, served not only education in the parks, but was "fundamental" to the protection of their natural features, as required by national park legislation.[29] With this statement, Albright endorsed science as a necessary element in the Park Service's efforts to meet its congressional mandate. Probably due in large part to the biologists' influence, the director was giving science much more importance than just a means to improve educational programs, as he had earlier suggested.

Furthermore, Albright began to provide fiscal support for the scientists. In July 1931, two years after the wildlife survey had gotten underway, the Park Service undertook to fund half the survey costs, the other half still funded by George Wright.[30] And another two years later, on July 1, 1933, Albright formally established the Wildlife Division, with Wright as division chief and Dixon and Thompson as staff biologists. At this time the Service began to pay all costs. The division was headquartered in Hilgard Hall on the University of California campus, and was made part of the newly created Branch of Research and Education—successor to the Education Division. Harold C. Bryant, another California graduate and student of Joseph Grinnell's, headed the new branch.[31]

Earlier, in the fall of 1928 when George Wright's wildlife survey proposal was being considered, Ansel Hall, the Park Service's chief naturalist, had recommended that "field naturalist" positions be established in each park to assist with biological resource management. As Hall proposed, these positions would be filled with highly qualified professionals, who would be involved with extensive research and resource management.[32] Hall's suggestion would not be realized until New Deal money came the Park Service's way, allowing the Wildlife Division to place academically trained biologists in the parks. However, in 1932, as Fauna No 1 was nearing completion, Albright instructed the superintendents to appoint a ranger to co-

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[28] Horace M. Albright, "The National Park Service's Policy on Predatory Mammals, *The Journal of Mammalogy*, 12 (May 1931), 185-186; and "Game Conditions in Western National Parks," 23 November 1932, typescript, YELL.

[29] Horace M. Albright, "Research in the National Parks," *The Scientific Monthly* (June 1933), 489.

[30] Wright, Dixon, and Thompson, *Fauna of the National Parks* (1933), 5.

[31] At this time, a branch was administratively higher than a division and usually included several divisions. Harold Bryant had come into the Park Service as a result of his efforts to promote education in the national parks and his interest in training park naturalists.

[32] Hall's draft description of the field naturalists' duties is attached to Ansel F. Hall to the Director, 17 October 1928, Entry 17, RG79.

ordinate wildlife management in each park—"preferably [a ranger] with some biological training and native interest in the subject," as he put it.[33] The Park Service was formalizing its operational field support for biological management.

After Albright left the Service in August 1933, Arno Cammerer indicated strong continuing support of the wildlife survey with his endorsement of Fauna No. 1's recommendations as official National Park Service policy. In a March 1934 directive to the superintendents, Cammerer committed the Park Service to make "game conservation work a major activity," and admonished the superintendents that the recommendations from Fauna No. 1 (quoted verbatim in the directive) were "hereby adopted and you are directed to place it in effect."[34] Fauna No. 1 and its recommendations had become the manifesto for the Service's biological programs, affecting national park policy, organization, and day-to-day park operations.

Cammerer's March 1934 directive also reiterated Albright's instructions that the superintendents appoint rangers to coordinate wildlife management. They were to conduct a "continual fish and game study program" in each park and to assist the wildlife biologists when they were in the field.[35] Support for the wildlife biologists fell increasingly to the rangers, with the park naturalists assisting whenever possible. The naturalists had very limited time to devote to natural history management, given the demands of the Park Service's growing educational activities, such as lectures, guided hikes, and museum programs. While some did conduct research, especially by collecting plant and animal specimens, many found themselves confined to strictly educational work.

In addition to their direct support for the wildlife biologists, the rangers' natural resource management efforts involved such programs as addressing predator, rodent, and mosquito problems, assisting the foresters with insect and fire control, and working with fishery experts to stock park waters.[36] It is important to note, however, that these ranger activities represented traditional natural resource management practices, aimed at assuring public enjoyment of the parks, rather than at preserving natural conditions. Allied with the foresters, the rangers would find many of their traditional practices strongly opposed by the wildlife biologists as being ecologically unsound.

BUILDING A WILDLIFE BIOLOGY STAFF

The emerging interest in wildlife management in the national parks gained momentum with the advent of President Franklin D. Roosevelt's New Deal emergency relief programs which made money and manpower available to the Park Service. The bureau obtained increased support for park development from several relief programs, including the Works Progress Administration, Public Works Administration, and the Civilian Conservation Corps (CCC). Of these, the

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[33] Horace M. Albright to Wild Life Survey, ca. early 1932, Entry 35, RG79; Horace M. Albright, Office Order No. 234 to Superintendents and Custodians, 29 February 1932, Central Classified File, RG79.

[34] Arno B. Cammerer, Office Order No. 226, 21 March 1934. Entry 35, RG79.

[35] Cammerer, Office Order No. 226.

[36] Victor H. Cahalane, Memorandum on General Procedure of the Wildlife Division, Branch of Research and Education, National Park Service, 28 July 1936, 6-7, Research Division Archives, YELL.

CCC most affected the Wildlife Division and the national parks themselves. Authorized by the Emergency Conservation Act of March 1933, the CCC put unemployed young men to work on public land conservation and reclamation projects. Soon becoming one of the New Deal's most acclaimed programs, it remained very active until World War II.[37]

By 1933 Horace Albright was a veteran of the constant competition among Washington bureaus for funds and staffing. Quick to see the potential of the New Deal programs, he aggressively and successfully sought CCC money and manpower for the parks. However, the resulting increase in development brought many changes to the national parks. Projects such as road and trail construction, administrative and visitor facility construction, and water and sewage development caused extensive alteration of park landscapes. And the CCC crews, living in camps of 200 or more men, brought localized changes through increased vandalism and harassment of park wildlife. In June 1933, Albright cautioned his superintendents that CCC crews must "safeguard rather than destroy" the resources of the national parks. He warned against allowing the CCC to build roads and trails through wilderness areas or to reduce too much the food and cover for wildlife when removing fire hazards such as snags and underbrush in the forests. The "evident dangers to wild life" resulting from conservation work might, he suggested, be kept at a minimum through consultation with the Wildlife Division.[38]

Indeed, much of the CCC work conflicted with the wildlife biologists' ideas about park management. The CCC crews undertook many specifically natural resource projects, most of them highly manipulative, such as mosquito control, removal of non-native species, or removal of fire hazards–but as much as anything else they were involved in extensive park development. Under these circumstances, and at George Wright's urging, the Park Service used CCC funds to hire wildlife biologists to monitor CCC and other work in the parks. By 1936 the number of wildlife biologists had grown nine-fold, from the original three-man survey team to 27 biologists. Most were stationed in the parks or in the newly created regional offices–and in essence were the Service's response to Ansel Hall's 1928 recommendation for placing academically trained, professional biologists in the field. Expanding its operations to include fish management, the Wildlife Division in 1935 hired a "Supervisor of Fish Resources," with offices in Salt Lake City.[39]

Overall, though, commitment to the wildlife biology programs was limited. Just as the Park Service had begun its scientific research efforts only when Wright provided money

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37 Albright, *Birth of the National Park Service,* 289; John Ise, *Our National Park Policy: A Critical History* (Baltimore: The Johns Hopkins Press, 1961), 359-36. A detailed history of the Park Service's involvement with the CCC is found in John C. Paige, *The Civilian Conservation Corps and the National Park Service, 1933-1942* (Washington: National Park Service, 1985).

38 Albright's comment that the superintendents might seek advice from the Wildlife Division was put in the form of a request: He wrote the superintendents that, "Should technical advice be desirable I hope you will call upon the Wild Life Division." Horace M. Albright, Memorandum For Field Officers, 7 June, 1933, Harold C. Bryant files, MVZ-UC.

39 Sumner, "Biological Research and Management," 9.

from his personal fortune, the bureau also built up its science programs primarily through funding obtained through New Deal emergency relief work. Special funding, rather than the Park Service's regular annual appropriations, financed most of the wildlife biology programs in the 1930s—support for the programs did not arise from any determination by the Service that research and preservation of the parks' natural resources needed greatly increased attention and funding, regardless of the availability of special funds. Of the 27 biologists, the Park Service's annual appropriations (which gradually increased during the Depression) paid for only four of these positions—the rest were funded with CCC money.[40] Also, since most of the money and positions accrued to the division came from the CCC, the bulk of the Park Service's increased scientific programs was directly tied to park development, which brought considerable alteration to the natural conditions the wildlife biologists sought to preserve.

In 1935, given the growing complexity of the division's work and its need to coordinate activities with other Park Service operations, Director Cammerer transferred the Wildlife Division to Washington. Wright and Thompson made the move while Dixon remained in the Berkeley office. Headquartered in Washington, and with an expanded force of biologists located in key parks, the Wildlife Division reached its apex of influence by the mid-1930s. Then, in February 1936, the Service's wildlife management programs suffered a severe setback with George Wright's tragic death from injuries received in a head-on automobile accident east of Deming, New Mexico. Although not fully apparent at that time, the loss of Wright's impressive leadership skills marked the beginning of the decline of National Park Service science programs. Through the remainder of the decade the number of wildlife biologists would decrease, thereby diminishing their influence even before they were transferred to the Biological Survey in January 1940.

THE BIOLOGISTS' PERSPECTIVE ON NATIONAL PARK DEVELOPMENT

The "conservation" aspects of the Civilian Conservation Corps were strongly utilitarian, oriented toward what was in effect "wise use" (in the historical sense of the term) of the parks' scenic resources through accommodating public use and enjoyment. Virtually all of the CCC's park development and much of its direct manipulation of natural resources was in one way or another intended to address such utilitarian concerns. Thus the CCC and other New Deal programs represented a continuation of the Park Service's traditional emphasis on promoting public use and enjoyment of the national parks. And with funds available in unprecedented amounts, it was possible to implement much of the park development envisioned in master plans prepared during Mather's and Albright's directorships. By one estimate, during the New Deal the Park Service was able to advance park development as much as two decades beyond where it would have been without Roosevelt's emergency relief programs.[41]

For the first time, wildlife biologists became involved in decisions on development, which previously had been the responsibility of landscape architects, engineers, superin-

40 Sumner, "Biological Research and Management," 9.

41 The estimate is found in Harlan D. Unrau and G. Frank Willis, *Administrative History: Expansion of the National Park Service in the 1930s* (Denver: National Park Service, 1983), 75.

tendents, and the Washington directorate. Yet the biologists were limited mainly to an advisory role. They reviewed and commented on details such as alignment of roads and trails and placement of facilities, and they calculated the impacts of development on fauna and flora, recommending means of keeping impacts at a minimum.

Moreover, the wildlife biologists had only limited involvement in updating the key management and development documents, the park master plans. Writing Cammerer in February 1934 on the need to include wildlife management in master plans, George Wright argued that such inclusion would help "more than any thing else" to focus attention on wildlife issues.[42] And in late 1935, just as the biologists' influence was reaching a peak, Wright reiterated to the director the need to have master plans include natural resource information—rather than "contemplated and completed physical development only." Wright noted that, for example, Mount Rainier's plan should include a "fish sheet," describing the "kinds and distribution of native fishes" before their being affected by modern human activity, the advisability of stocking fish (possibly exotic species), and whether or not the park truly needed a fish hatchery. This kind of information would, Wright asserted, provide help "which the master plans could, but do not, give," and thus would protect against the "honest but sometimes misguided zeal" of superintendents who had to manage the parks without such information.[43] But despite Wright's pleas, there is no indication that the biologists gained substantial involvement in the Park Service's master planning process.

Projects which the scientists reviewed in the 1930s ran the gamut of park development. For instance, reporting from Death Valley National Monument in September 1935, biologist Lowell Sumner recommended approval of a variety of proposals, including road and trail construction, campground expansion, and water well and water pipeline development. He consented to a proposed road construction project by noting that it did not appear to endanger bighorn sheep, and urged that the biologists conserve their energy for "curbing less desirable projects." In the same report, Sumner recommended that biologists not only review project proposals, but also closely monitor project implementation whenever natural resources were particularly vulnerable.

Among the less desirable projects was the proposed road improvement in Death Valley's Titus Canyon, which Sumner strenuously objected to because it would threaten wildlife habitat—rare plants grew in the canyon and an important watering hole for bighorn sheep lay at the end of the existing primitive road. Sumner also claimed that it was unsafe for humans to frequent the canyon, and pleaded that it remain "unvisited and undisturbed." Claiming that Death Valley was being developed at a rate which "has never been paralleled by any national park or monument," he warned that the park could lose its remaining pristine areas. Instead of road improvement, he urged that the Titus Canyon area be designated a "research reserve," to be set aside for research purposes only—a recommendation which seems to have been ignored.[44]

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42 George M. Wright to the Director, 28 February 1934, Central Classified File, RG79.

43 George M. Wright, memorandum for the Director, 13 December 1935, Central Classified File, RG79.

44 E. Lowell Sumner, "Special Report on the Sixth Enrollment Period

In a similar report from Glacier National Park in 1935, biologist Victor Cahalane opposed the park's sawmill operation, used to dispose of dead trees that were considered fire hazards. In his recommendation against the sawmill, Cahalane argued for adhering to the Service's stated policies rather than to "a purely utilitarian viewpoint." He concluded with a rhetorical question and a blunt injunction: "Is it not more in keeping with our ideals to leave the dead trees standing than to instigate a logging operation in a national park? The project is not approved."[45] The Wildlife Division regularly received strongly worded field reports such as Sumner's and Cahalane's. Following review by Wright and his Washington-based staff, the reports were forwarded to the directorate with comments, some of which did not concur with the field scientists' recommendations.[46]

The biologists' need to monitor the CCC crews extended to the crews' off-duty activities near the camps where they were housed and fed. Complaints about molesting of wildlife and vandalism to other park resources by CCC personnel occurred periodically.[47] For instance, biologist Charles J. Spiker wrote to George Wright in late 1934 of the need for much greater control of the CCC, especially in Acadia National Park where he believed the "havoc wrought" by the crews surpassed that in any other park in the eastern United States. The destruction of forests to allow for development at the top of Cadillac Mountain was only part of the "mutilation" of Acadia which concerned Spiker.[48]

Inevitably, sharp conflicts arose, likely exacerbated by the fact that the wildlife biologists were newcomers to the project review process, and were entering traditional territory of the superintendents, landscape architects, and engineers. Responding to Victor Cahalane's objections to construction of a shelter

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Program Posed for Death Valley National Monument," 10 September 1935, Entry 34, RG79. Titus Canyon almost certainly did not become a research reserve. It was not mentioned in a list of such reserves compiled in 1942–see Charles Kendeigh, "Research Areas in the National Parks," *Ecology*, 23, No. 2 (January 1942), 236-238. And the natural resource management office at Death Valley has no record that the canyon ever received this designation. Today, the improved and maintained dirt road up Titus Canyon is probably the most popular and heavily traveled four-wheel-drive road in the park. But a current bighorn management plan calls for closing of the Titus Canyon Road during the hotter season so that bighorn will have undisturbed access to the spring. Personal communication with natural resource management specialist Tim Coonan, 30 September 1991 and 6 January 1993.

[45] Victor Cahalane to A. E. Demaray, 14, September 1935, Entry 34, RG79.

[46] Examples of non-concurrence are Victor Cahalane, Memorandum for Mr. Demaray, 14 September 1935, Entry 34, RG79, relating to CCC projects in Glacier; and Cahalane, Memorandum for Mr. Demaray, 23 September 1935, Entry 34, RG79, relating to projects in Grand Canyon.

[47] See Paul McG. Miller, Memorandum to be posted on bulletin board, 1 June 1935, Entry 34, RG79; and A.E. Demaray to Park Superintendents and Custodians, 4 May 1936, Central Classified File, RG79.

[48] Charles J. Spiker to the Chief of the Wildlife Division, 13 November 1934, Entry 34, RG79.

for campers at Grand Canyon's Clear Creek, Superintendent Minor Tillotson wrote Director Cammerer in October 1935 that Cahalane's views were "not only far-fetched but picayunish." Tillotson argued that since the trail had been built, provision should be made for use of the primitive area to which the trail leads: "objections to the development as proposed . . . should have been voiced before all the money was spent on the trail." Stating that he was "always glad" for the wildlife biologists' advice, the superintendent chided that in this case they had "gone considerably out of their way" to find something to object to.[49]

POLICY CONFLICTS OVER PARK ROADS AND DEVELOPMENT

Similar to the disagreements over development in Death Valley and Grand Canyon, improvement of the Tioga Road through Yosemite's high country sparked conflicts in the 1930s (as it would again in the 1950s). During realignment of the road in the mid-1930s, Lowell Sumner objected to plans to use a small unnamed lake along the road as a borrow pit, undiplomatically depicting the plans as an example of the tendency of road builders to "slash their way through park scenery." Engineers, he wrote, wanted to straighten roads and reduce grades "to spare the motorist . . . the necessity of shifting out of high gear." Such practices resulted in more cuts and fills and therefore more borrow pits.[50] In this instance, Sumner objected as much to the disfiguration of park scenery as to the alteration of natural resources.

R. L. McKown, Yosemite's resident landscape architect, reacted angrily to Sumner's barbed comments, writing to top Park Service landscape architect Tom Vint that such remarks were "derogatory of our Landscape Division," and that Sumner was "misinformed" as to the division's principles. McKown claimed the division went out of its way to prevent slashing through scenery. The pressure to straighten park roads came, he believed, not from the landscape architects but from the Bureau of Public Roads responding to the people's desire for "high speed motor ways in our national parks" similar to what they find elsewhere. McKown also noted that if the lake were not used for borrow, the materials would have to be found at least 4,000 feet farther along the route, and to him the added cost seemed unwarranted.[51]

Sumner apologized to McKown, granting that the Landscape Division was actually seeking to reduce the road's intrusion. The division was, in Sumner's words, "the prime guardian of the natural in our parks"—a remark that seemed to contradict the role the Wildlife Division was assuming for itself. He then commented that "even the most skillful camouflaging in the interest of landscaping cannot altogether prevent it from being an intrusion on the wilderness"—a suggestion that he may have believed the landscape architects' work indeed mostly amounted to camouflaging. Indeed, Sumner recognized that control of visual intrusions into wilderness ar-

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[49] M. R. Tillotson to the Director, 18 October 1935, Entry 34, RG79. See also Victor H. Cahalane to A. E. Demaray, 23 September 1935, Entry 34, RG79. Since plans for the trail may have been drawn up for some time (or the project may have been an afterthought to building the trail, a kind of incremental development) it is possible that the biologists had no opportunity for an earlier review.

[50] Lowell Sumner to George Wright, 12 September, 1935, Entry 34, RG79.

[51] R. L. McKown to Thomas C. Vint, 8 October 1935, Entry 34, RG79.

eas did not necessarily mean that the areas' natural resources would remain free from serious harm.[52]

The effect of roads on national park wilderness deeply concerned Sumner. Reflecting on the construction of the Tioga Road, he wrote in October 1936 that it illustrated the "complex, irrevocable, and perhaps partly unforeseen chain of disturbances" that results from roads. The Sierra Club would later describe road development in national parks as being "like a worm in an apple," and Sumner himself characterized park roads as an "infection," bringing on further, gradual development of an area, with gasoline stations, lodges, trails, campgrounds, fire roads, and sewage systems–until the "elusive wilderness flavor vanishes, often quite suddenly." This he feared was happening along the Tioga Road and in other park areas where the superintendents were under unrelenting pressure to develop.[53]

In fact, the potential for greater use of an area following road improvements was clearly indicated in a final construction report on a portion of the Tioga Road. The report anticipated that the Tuolumne Meadows, through which the road passed, would soon become one of the park's more heavily used recreational areas, particularly attractive for hiking, nature study, fishing, and horseback riding. With each summer season, the report stated, more people had used the area and a "large increase of cars pulling trailer houses has been especially noticed." Furthermore, the road improvements were likely to attract a substantial amount of transcontinental traffic simply intending to cross the mountains.[54]

Quite representative of the wildlife biologists' attitudes, Sumner's remarks on the Tioga Road revealed a cautious, pessimistic view of development. He feared widespread park development stemming from New Deal relief and conservation programs, believing that such improvements could ultimately lead to the national parks' ruin. In early February 1938, Sumner wrote to his mentor, Joseph Grinnell, expressing concern that true wilderness in the parks would soon vanish if the Park Service did not halt development. He lamented that although the Park Service

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52 E. Lowell Sumner to R. L. McKown, 10 October 1935, Entry 34, RG79.

53 E. Lowell Sumner, "Special Report on a Wildlife Study of the High Sierra in Sequoia and Yosemite National Parks and Adjacent Territory," 9 October 1936, YOSE. The Sierra Club quote is found in Michael P. Cohen, *The History of the Sierra Club, 1892-1970* (San Francisco: Sierra Club Books, 1988), 86.

54 W. J. Liddle, "Final Construction Report on the Grading of Section A-1 of the Tioga Road, Yosemite Park Project 4-A1, Grading, Yosemite National Park, Mariposa and Tuolumne Counties, California," 6 May 1937, typescript, YOSE. The idea of the Tioga Road serving as a convenient means of crossing the mountains had also received support from a special executive committee of the Sierra Club, which studied the road proposal in 1934. The committee reported that "The function of the Tioga Road must be not only to enable travelers to reach the Tuolumne Meadows and the eastern portion of the park readily and with comfort, but also to care for those who desire to use this highway as a trans-Sierra road." "Relocation of Tioga Road: Report of the Executive Committee of the Sierra Club on the Proposed Relocation of the Tioga Road, Yosemite National Park," *Sierra Club Bulletin*, 19, No. 3 (1934), 88.

should be the leader in wilderness preservation, it "has been more at fault than many other agencies" in destroying such natural values.[55]

In a document prepared also in 1938, entitled "Losing the Wilderness Which We Set Out To Preserve," Sumner warned against exceeding the "recreational saturation point" in parks, with roads, trails, and development for winter sports and other activities. Concerned about modifications to natural resources, he argued that ground impaction affected even minute soil organisms, active in maintaining porosity and soil nitrogen.[56] The thinking of Park Service scientists had moved well beyond traditional preoccupation with scenic landscapes or even the larger species—still, the biologists remained a minority voice in national park affairs.

In the early months of Albright's administration, the Park Service had sought, but failed, to have the 1932 Winter Olympics held in the Yosemite Valley; and throughout the 1930s it promoted winter sports in the parks, particularly in Yosemite and Rocky Mountain—further indications of encouraging recreational uses of the parks which would require development.[57] But of all national park development, roads (both their initial construction and their improvement to allow increased use) most clearly represented change, real and symbolic. Likely, most of the new park roads constructed during the 1930s were primitive, intended to provide access for fire fighting only—but were, in fact, available for improvement as tourist roads later on. They intruded into the backcountry, inviting further development and diminishing wild qualities and biological integrity, much as Sumner believed. Thus roads became a major focus of the debates over development in the parks.

Conflicting attitudes toward national park roads began to crystallize during the 1930s, attitudes which would typify Park Service thinking for decades. Sumner and other scientists represented the more conservative approach, concerned that roads would infect park areas well beyond the immediate vicinity of pavement, altering natural conditions throughout broad corridors of the parks. But the dominant view came from national park leaders more committed to development. And with the wildlife biologists questioning traditional practices, Park Service leaders made a greater effort to justify national park development than they it had in the past—most frequently using park preservation as the principal justification.

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55 E. Lowell Sumner to Joseph Grinnell, 3 February 1938, E. Lowell Sumner file, MVZ-UC.

56 E. Lowell Sumner, Jr., "Losing the Wilderness Which We Set Out to Preserve," 1938, typescript, HFLA.

57 Albright's enthusiastic advocacy of the Winter Olympics proposal is indicated in Horace M. Albright to James V. Lloyd, 13 February 1929, Entry 17, RG79. The Olympics proposal and the opening of Yosemite's Badger Pass ski facility in the winter of 1935-36 are discussed in Alfred Runte, *Yosemite: The Embattled Wilderness* (Lincoln: University of Nebraska Press, 1990), 152-153. For winter sports promotion and development in Rocky Mountain National Park (inspired in part by that going on in Yosemite), see Lloyd K. Musselman, "Rocky Mountain National Park Administrative History, 1915-1965" (Washington: National Park Service, 1971), 171-188. Musselman (p. 172) quotes Albright's promotion in 1931 of winter resort facilities in Rocky Mountain: "It has been done in other parks, and we will have to find a place for the toboggan slide, ski jump, etc., where it will not mar the natural beauties of the park."

For instance, Arno Cammerer asserted in a 1936 article for the *American Planning and Civic Annual* that park roads could be used as an "implement of wilderness conservation." Noting that the Service opposed grazing, mining, hunting, and lumbering in parks, the director wrote that the "core" national park idea is "conservation for human use"—thus, he asked, what forms of park use *should* the Service permit? His answer was to build sufficient roads so the public could use and enjoy the parks as called for in the Organic Act. Espousing a utilitarian rationale for preserving national parks, Cammerer stated that the Park Service must provide an "economically justifiable and humanly satisfying form of land use, capable of standing on its own merit in competition with other forms of land use."

Cammerer strongly opposed allowing roads to penetrate all areas of a park, but by building roads in a "portion" of a park area so the public could enjoy it, the Park Service could save large undisturbed areas for the "relatively few who enjoy wilderness." He commented perceptively that unless "bolstered by definite, tangible returns" such as public use and enjoyment made possible through roads, the preservation of national park wilderness would fall before the onslaught of pragmatic, economic needs. Cammerer added that roads were a "small price" to pay; and that they could potentially "make many friends" for remaining park wilderness because the public does not "know what a wilderness is until they have a chance to go through it."[58]

Thomas Vint made arguments similar to Cammerer's. In 1938, with the national wilderness preservation movement underway, Vint published an article (also in the *American Planning and Civic Annual*) which clearly tied park development to backcountry preservation. In "Wilderness Areas: Development of National Parks for Conservation," he wrote that the time comes when "it is worthwhile, as a means of preservation of the terrain, to build a path." And with increased traffic, a path must be "built stronger to resist the pressure." There followed a progression of development and improvement. Vint depicted this progression, beginning with paths for foot traffic, then for horses and wagons, ultimately leading to paths for automobiles, which in turn "develop through various stages of improvement."[59]

Vint then asked a question fundamental to national park management: At what point does park development "trespass on the wilderness or intrude on the perfect natural landscapes?" Closely restricted development, he believed, was the key to preventing trespass of park wilderness—development that would accommodate people and at the same time control where they went. The lands remaining untouched (in Vint's words, "*all* of the area within the boundaries of the park that is not a developed area") would be saved as wilderness.[60] Similar to Albright's earlier assertions about roads and wilderness in Yellowstone, Vint's comments evidenced the tendency to equate undeveloped areas with adequately preserved wilderness—a perspective which Ben Thompson had challenged years before, and which differed substantially from Lowell Sumner's view of

[58] Arno B. Cammerer, "Standards and Policies in National Parks," *American Planning and Civic Annual* (1936), 13-20.

[59] Thomas C. Vint, "Wilderness Areas: Development of National Parks for Conservation," *American Planning and Civic Annual* (1938), 70.

[60] Vint, "Wilderness Areas," 70, 71.

roads as "infections," ultimately contaminating large corridors of the parks.[61]

From 1916 on, Park Service leaders had overseen the initial construction or improvement of hundreds of miles of park roads, often through the heart of primitive lands. Yet they also opposed road construction in instances when they believed, as Vint put it, that the "trespass on the wilderness or [intrusion] on the perfect natural landscapes" was excessive. A primary example of this came in the 1930s with Superintendent John White's protracted opposition to the "Sierra Way," a road proposed to cut through Sequoia National Park's high and remote backcountry.[62] Giving strong support to White, Acting Director Demaray in 1935 wrote Secretary of the Interior Harold Ickes (himself not a national park road enthusiast) that the proposed road was "an unjustifiable and destructive invasion of a great national resource, the primitive and unspoiled grandeur of the Sierra." The highway, he continued, would "destroy the seclusion and a large part of the recreational value of every watershed, canyon, valley, and mountain crest which it traversed"; the proposal was "psychologically wrong and physically wasteful."[63] These words sounded much like Lowell Sumner's, and indeed the planned Sierra Way was defeated. Yet such a position stood in contrast to the Park Service's aggressive support for building other roads, like the Blue Ridge Parkway, Glacier National Park's Going-to-the-Sun Highway, Rocky Mountain's Trail Ridge Road, Shenandoah's Skyline Drive, and Mt. McKinley's road system, or for improving such routes as the Tioga Road in Yosemite.[64]

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61 Also worth noting are Vint's earlier comments about the Yosemite concessionaire's proposal for a ropeway (or tram) to be built to take visitors from the valley floor to Glacier Point. An extended debate, which took place in the early 1930s, focused mainly on how much the ropeway would intrude on park scenery, rather than on its potential impact on natural resources *per se*. Vint summed up his comments on the ropeway by noting the acceptability of roads as an alternative–that "roads have precedents in national parks while ropeways do not." Roads would "not be a new type of development. We know something of the effect of roads and can predict or visualize the result more easily." To Vint, the ropeway was a mechanical intrusion, different from that generally accepted in national parks. Given the park superintendent's adamant opposition to the ropeway proposal, a road was built, but not the ropeway. See Thomas C. Vint to the Director, 21 November 1930, Entry 17, RG79. Superintendent G .C. Thomson's objections to the ropeway are found in Thomson to the Director, 17 November 1930, Entry 17, RG79.

62 Lary M. Dilsaver and William C. Tweed, in *Challenge of the Big Trees: A Resource History of Sequoia and Kings Canyon National Parks* (Three Rivers, California: Sequoia Natural History Association, 1990), 157-196, discuss Superintendent White's efforts to protect Sequoia from certain kinds of development, including backcountry roads.

63 A. E. Demaray, memorandum to the Secretary of the Interior, n.d. (ca. spring, 1935) Entry 34, RG79.

64 See, for example, the extended discussion of road proposals in Mt. McKinley National Park during the 1930s, in William E. Brown, *A History of the Denali-Mount McKinley Region, Alaska* (National Park Service: Santa Fe, New Mexico, 1991), 171-184, 194-196. Brown writes (p. 173) that: "Responding to the drumbeat

In a broader sense, the Mather administration had urged that parks must be developed as a means of saving them—Mather would make them accessible and thereby increase public support for the basic national park concept. Park Service leaders of the 1930s such as Cammerer and Vint agreed; and, also like Mather, they used this argument to justify specific kinds of development, such as roads and trails, reasoning that development of certain park areas helped assure preservation of other areas.

The wildlife biologists' more cautious approach to park development was in accord with ecological thinking, but threatened to inhibit spending large amounts of New Deal funds to develop the national parks. With park development funds available at a time when wilderness preservation concerns were increasing, the rationale that development fostered preservation appears to have been particularly useful to Park Service leaders. This rationale would resurface in the 1950s as an important justification for Director Conrad L. Wirth's "Mission 66" park development program—at a time when concerns for wilderness preservation were intensifying.

It is important to note that the idea that national parks must be made accessible for public use in order to secure public support was not without legitimacy. As Mather understood, it was highly unlikely that the public would have supported undeveloped, inaccessible national parks. National parks were originally intended to be public pleasuring grounds. And proponents of the National Park Service Act of 1916 evidenced an unmistakable interest in public use and the aesthetics of park landscapes—as reflected in the Act's wording, then amplified in, for example, Secretary Lane's policy letter of 1918. And, in a clear indication of support for the Park Service's emphasis on recreational tourism in the parks, Congress provided millions for roads and other park development, with funding reaching unprecedented levels during the New Deal era.

The perception of development as a means of ensuring preservation provided the Park Service a rationale for believing it could meet Congress' mandate to provide for public use while leaving large portions of the parks unimpaired. Yet the arguments for development presented by Cammerer and Vint in the mid- and late 1930s came at a time when the wildlife biologists' influence had begun to weaken. While development continued apace, the number of wildlife biologists available to provide a professional ecological perspective on national park management diminished; and dissenting opinions of the remaining wildlife biologists faced formidable, entrenched Park Service traditions.

This the first of a three-part series, excerpted from Richard West Sellars' forthcoming history of natural resources management in the U.S. national parks. Part II will analyze natural resource management during the 1930s. Part III will discuss the biology programs in the context of Park Service growth and expansion during the New Deal era.

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of development and tourism boomers . . . Park Service policymakers and planners envisioned a conventional Stateside park with a lodge at Wonder Lake, more campgrounds, and an upgraded road to accommodate independent auto-borne visitors."

Appendix: Abbreviations Used in the Footnotes

BL	Bancroft Library, University of California at Berkeley
GRSM	Great Smoky Mountains National Park Archives
HFLA	Harpers Ferry Library and Archives, National Park Service
Kent Papers	William Kent Papers, Yale University Library
MVZ-UC	Museum of Vertebrate Zoology, University of California
RG79	Record Group 79, Records of the National Park Service, National Archives
YELL	Yellowstone National Park Archives
YOSE	Yosemite National Park Archives

About the GWS . . .

The George Wright Society was founded in 1980 to serve as a professional association for people who work in protected areas and on public lands. Unlike other organizations, the GWS is not limited to a single discipline or one type of protected area. Our integrative approach cuts across academic fields, agency jurisdictions, and political boundaries.

The GWS organizes and co-sponsors a major U.S. conference on research and management of protected areas, held every two years. We offer the FORUM, a quarterly publication, as a venue for discussion of timely issues related to protected areas, including think-pieces that have a hard time finding a home in subject-oriented, peer-reviewed journals. The GWS also helps sponsor outside symposia and takes part in international initiatives, such as the Global Biodiversity Conservation Strategy.

Who was George Wright?

George Melendez Wright (1904-1936) was one of the first protected area professionals to argue for a holistic approach to solving research and management problems. In 1929 he founded (and funded out of his own pocket) the Wildlife Division of the U.S. National Park Service–the precursor to today's science and resource management programs in the agency. Although just a young man, he quickly became associated with the conservation luminaries of the day and, along with them, influenced planning for public parks and recreation areas nationwide. Even then, Wright realized that protected areas cannot be managed as if they are untouched by events outside their boundaries.

Please Join Us!

Following the spirit of George Wright, members of the GWS come from all kinds of professional backgrounds. Our ranks include terrestrial and marine scientists, historians, archaeologists, sociologists, geographers, natural and cultural resource managers, planners, data analysts, and more. Some work in agencies, some for private groups, some in academia. And some are simply supporters of better research and management in protected areas.

Won't you help us as we work toward this goal? Membership for individuals and institutions is US$35 per calendar year, and includes subscriptions to both the Forum and the GWS newsletter, discounts on GWS publications, and reduced registration fees for the GWS conference. New members who join between 1 October and 31 December are enrolled for the balance of the year and all of the next. A sign-up form is on the next page.

The George Wright Society

Application for Membership

Name: _____

Affiliation: _____

Address: _____

_____

ZIP/Postal Code: _____

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Fax: _____

Please ✔ the type of membership you desire:

- ❒ Patron *$500/year*
- ❒ Life Member *$350/life*
- ❒ Regular Member *$35/year*
- ❒ Student Member *$25/year*
- ❒ Institutional Member *$35/year*
- ❒ *Here's an additional contribution of $*_____.

Dues and contributions are tax-deductible in the USA.

Note: Except for Life Memberships, all dues are good for the calendar year in which they are paid. New members who join between 1 October and 31 December will be enrolled for the balance of the year and the entire year following (this applies to new members only). *Special Note to Canadian Applicants:* You may pay either with an international money order in U.S. dollars, or with a cheque for the equivalent amount (using the current rate of exchange) drawn in Canadian dollars, plus 25% to cover bank fees.

Optional: Please name your profession or occupation and any specialty or expertise:

_____

_____

Mail to: The George Wright Society, P.O. Box 65, Hancock, MI 49930-0065 USA. Thank you!

Submitting Materials to The George Wright FORUM

The editorial board welcomes articles that bear importantly on the objectives of the Society–promoting the application of knowledge, understanding, and wisdom to policy making, planning, management, and interpretation of the resources of protected areas and public lands around the world. The FORUM is now distributed internationally; submissions should minimize provincialism, avoid academic or agency jargon and acronyms, and aim to broaden international aspects and applications. We actively seek manuscripts which represent a variety of protected-area perspectives, and welcome submissions from authors working outside of the U.S.A.

Language of Submission Current readership is primarily English-speaking, but submissions in other languages will be considered; in such cases an English summary should be prepared.

Form of Submission We no longer accept unsolicited articles that are not also accompanied by a computer disk. Almost any 3.5-inch disk can be read in its original format (please indicate whether your disk is formatted for IBM or Apple, and note the version of the software). A double-spaced manuscript must accompany all submissions in case there are compatibility problems.

Citations The FORUM contains articles in varied fields, e.g., history, geology, archeology, botany, zoology, management, etc. We prefer citations be given using the author-date method, following the format laid out in *The Chicago Manual of Style*. However, in some instances we will accept other conventions for citations and reference lists.

Editorial Matters Generally, manuscripts are edited only for clarity, grammar, and so on. We contact authors before publishing if major revisions to content are needed. The FORUM is copyrighted by the Society; written permission for additional publication is required but freely given as long as the article is attributed as having been first published here.

Illustrations Submit line drawings, charts, and graphs as nearly "camera-ready" as possible. If submitted in a size that exceeds the FORUM'S page dimensions, please make sure the reduction will still be legible. The preferable form for photographs is black-and-white (matte or glossy) prints. Medium contrast makes for better reproduction. Color prints and slides may not reproduce as well, but are acceptable. We particularly welcome good vertical black-and-white photos for use on the cover. Half-tones from newspapers and magazines are not acceptable. Please secure copyright permissions as needed.

Correspondence Send all correspondence and submissions to:

The George Wright Society
P.O. Box 65
Hancock, MI 49930-0065 • USA

☎ (906) 487-9722. Fax (24 hours a day): (906) 487-9405.