

The Future of Science in the National Parks Positive Directions, New Opportunities

**A Report on the
1986 Conference on Science in the
National Parks**

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The 1986 Conference on Science in the National Parks was the fourth in a sequence of conferences co-sponsored by the National Park Service and the George Wright Society. Held on July 13-18, 1986 at Colorado State University, Fort Collins, Colorado, the Conference focused on:

- ✧ The unique role of science in supporting the understanding, management and preservation of park resources;
- ✧ The special relationship between research and resource management and how that relationship must develop to maximize the use of scientific information in the NPS decision-making process; and
- ✧ The short-term issues that are of concern to park managers today and the longer-term issues that are equally, if not more, important.

Through the use of poster presentations, the Conference highlighted the active science programs of the Regions and displayed the results of many effective and well-presented research projects.

Some statistics are available to characterize the Conference. There were over 400 attendees who made 325 poster presentations in 28 symposiums. Two plenary research panels were held to discuss the role of research in the national parks, and 12 plenary presentations were given on topics of importance to park researchers and resource managers. The Conference was attended by NPS directorate, superintendents, researchers (from the natural, cultural and social sciences), resource managers and interpreters. Representatives of universities and other agency research organizations, officials from six other countries, and the general public also attended.

Positive Directions: A Forecast for the Future

Perhaps the real essence of the 1986 Conference on Science in the National Parks extended beyond the usual scientific objectivities and quantifications. Indeed, the prevailing mood of the gathering—among scientists and resource managers alike—was marked by a deep seated, mutual concern about the proper relationship of science to the management decision-making process employed in national park systems. What is so special about this relationship? What is the proper role of science within this relationship? And how can it be improved to meet the park management challenges of the decades ahead, to the year 2000 and beyond?

The Conference served as a catalyst for productive discussions of these questions. Just as significantly, it provided an opportunity for many important discussions and considerations, too long delayed, about the issues and directions we should be addressing. In some areas we have substantial knowledge and must learn how to apply it to our problems, while in others we are ignorant and require new research directions. Most answers lay beyond the Conference, but the seriousness of the dialogue among the attendees was provocative and encouraging. The following represents the perceptions of the author regarding these discussions and is not necessarily a consensus of Conference participants.

Many of the attendees recognized the need to be innovative. They support innovation in science now, as we live in a society where the driving forces are scientific and technological. Accordingly, society at large is beginning to recognize how vulnerable it is to environmental change. Of all government agencies, National Park services everywhere need to ensure a management system based on adequate science, if they are to meet their preservation mandate for future generations.

Some of the issues that emanated from the Conference suggest short-term attention. The recommended solutions to these issues should, by the year 2000, be employed as new principles and understandings affecting park management. Thus, current attention should be applied to the concepts of landscape ecology; better understanding of biogeochemical cycling; visitor expectations and behavior; the preservation of our national heritage, both cultural and natural; the relationships of species within ecosystems; the preservation of genetic diversity; ecosystem functions and processes; parks as a global resource; data management, evaluation and use; methods of long-term research; and global interactions. All of these concepts need to be considered within the realm of the new economic and resource realities as they increasingly become a part of the public's shifting values.

Another concept also worthy of mention—that of the Earth as a system—has immense opportunity for National Park services. Three organizations have programs related to this global Earth science effort which are presently being publicized: the Global Geosciences Program (National Science Foundation); the Earth Systems Science Program (National Aeronautics and Space Administration); and the International Geosphere Biosphere Program (National Academy of Sciences). By pursuing an active role in this global effort, the USNPS can advance from the era of the Leopold Report toward a program incorporating a holistic approach to study and understand the climate, geosphere, hydrosphere, biosphere, and biogeochemical cycles of the Earth; in other words, the study of the Earth as an integrated system to better understand the component parts through an increased knowledge of their roles relative to the whole.

Some thoughts for our consideration as we look towards the future are gleaned from the presentations of the plenary speakers (Herrmann and Craig, Eds., 1987):

William Penn Mott, Jr.:

- ✧ Applying scientific knowledge is full of inherent risk.
- ✧ The scientific programs of natural area management in the US National Park System will always be based on incomplete information. Our job is to push the frontiers of knowledge outward.
- ✧ Our concepts of science in the parks are still evolving and will continue to do so. However, we must hold out for the long view.
- ✧ Parks are forever and we must manage them accordingly.
- ✧ It is not enough for us to gather knowledge. It is not even enough for us to apply that knowledge. It is essential that we share our knowledge with the people of the nation and this world.

George Pring:

- ✧ The great forces that shape our thinking—what are they and what will they be? Understanding these is important in shaping our actions.
- ✧ There are no primary or secondary resources in nature. The first lesson of ecology is that all facets and features of an ecosystem are equivalently important and indispensable because they support one another.
- ✧ Develop and provide more accurate, authoritative information.

Boyd Evison:

- ✧ We must learn about park resources and how park ecosystems function.
- ✧ Look to the long-term and employ all of our knowledge and expertise wherever it exists.
- ✧ Encourage baseline data collection and long-term monitoring and entice researchers to implement **relevant** long-term research.

Theodore W. Sudia:

- ✧ Direct management of resources, or more properly their manipulation, requires a great quantity of detailed information.
- ✧ Even if parks are managed properly they alone will not provide for the protection of genetic diversity.
- ✧ No park is big enough to be a self-sustaining island.

W. James Judge:

- ✧ Research provides the foundation for management and interpretation.
- ✧ Research in the USNPS must include in its planning and thinking the cultural resources disciplines (anthropology, archaeology, etc.).
- ✧ For research to be carried out at the public expense, we must define our questions carefully and strive to ensure that the activities are not trivial.

- ✧ Keep the public, as well as long-term research interests, in mind as we undertake the research necessary to enlighten management and interpretation.
- ✧ Identify what we can and move forward with long-term research.
- ✧ Question and seek alternative paths to existing goals, or even offer alternative goals.

Chuck Odegaard:

- ✧ The social needs and political realities of the urban setting require that we develop analytical skills for leisure.
- ✧ Understand carrying capacity in order to manage and to restore.
- ✧ Understand regional-scale influences that affect how we manage our resources (i.e., the Great Lakes).
- ✧ Learn how to restore damaged resources—but first we must understand our healthy or natural resources.
- ✧ We need to organize our leadership to accomplish our preservation goals.
- ✧ Recognize the similarities as well as the differences between our disparate resources.

Tom Lovejoy:

- ✧ The minimum size for a protected area is very much defined by the conservation goal involved.
- ✧ Fragmentation and isolation of once continuous wildlands is a ubiquitous phenomenon with major implications for national parks. Newmark's work on western U.S. national parks shows considerable loss of mammalian species since the parks were established.
- ✧ Studies similar to "the minimum critical size of ecosystems project" in central Amazonia are very much needed in other biomes.
- ✧ When the available pristine habitat is below minimum size, there is every reason to try to protect a larger area to encourage the return of natural vegetation. This could save a lot of the diversity which otherwise might be lost.

Richard Forman:

- ✧ Landscape ecology explores how a heterogeneous combination of ecosystems—such as woods, meadows, marshes, corridors and villages—is structured and how it functions and changes. Some promising guidelines for landscape planning and management emerge for: (1) identifying the spots requiring highest protection priority in any landscape; (2) managing for disturbance and change; (3) managing natural landscapes; (4) managing remnants of natural landscapes; and (5) evaluating a proposed change.
- ✧ Landscape ecology poses different questions and provides different answers than traditional areas of ecology. It is particularly useful in parks, where research and resource management deal explicitly with the assemblages of

ecosystems and with the humans present, and where park interpretation requires a framework readily understood by the public.

John R. Kelly:

- ✧ For understanding we need to deal with fragmentation, information overload and obscurantism. To improve our knowledge base, we need to work toward synthesizing disciplinary efforts and overcoming our tendencies toward disciplinary elitism.
- ✧ Understand our park visitor—who are they, what are they doing, what do they want? Knowledge and understanding of the diversity of visitor expectations and responses can guide how we manage.
- ✧ Keep in touch and keep your eyes open. Sometimes the best observation requires that we follow along for a while to see how acts are linked into activity.

Joseph K. Berry:

- ✧ Emerging computer technology provides advanced analytic capabilities that enable managers and researchers alike to address complex issues in entirely new ways (scales are larger, times are shorter).
- ✧ Changes and improvements in map processing have provided the means to fully integrate spatial information into the decision-making process, thus enhancing resource understanding for management.

Ray Dasmann:

- ✧ Trends require understanding of and involvement in regional issues.
- ✧ As an organization we must continue to learn as well as to teach.
- ✧ We need a concerted effort to learn about species in parks if we wish to protect and maintain biological diversity.
- ✧ Look to the new approaches of other countries—there is much we can learn from them.
- ✧ Fully develop interagency coordination.
- ✧ Conservation is a global issue.

Jay M. Hughes:

- ✧ The US National Park System, as an institutional focus for scientific inquiry, is distinctly larger than that implied by the level of research funding received by the NPS.
- ✧ Pay attention to the training and education needs of new professionals.
- ✧ Pay attention to the development of a sound scientific effort to address troubling management and policy issues.
- ✧ Cooperation between universities and the NPS on research goals has worked, is working and will continue to work with some effort from both sides.

Bob Beeton:

- ✧ The researcher can assist the manager in the process of problem bounding. He may evaluate the problem and generate alternatives and predictive models in which to test the alternatives. The final decision, however, is always owned by the manager. The process must support this model.
- ✧ The most effective and efficient research model is based on solid networking, not a hierarchical chain of command.
- ✧ The research organization (and researcher) has an additional role to play, often neglected, and that is the continued evaluation of our actions to assess whether the response to an action is as expected.

New Opportunities: Improving the Role of Science in the National Park Service

It was proposed by many in attendance at the Conference, from both inside and outside the USNPS, that we need to forge new opportunities—at this time and over the next few years—to greatly improve the scientific basis of national park management.

The history of science in the US National Park Service has been constantly marked by questions concerning its effectiveness and utility to park management. Over the years many park managers have said, "The research programs as they are structured are not meeting our needs." While it is easy to identify deficiencies in a program, it is more difficult to change or restructure it to eliminate the deficiencies **and**, at the same time, increase its capability for producing solutions to perceived needs.

At this point, it might be helpful to reflect on some things that research cannot do:

- ✧ Research does not make NPS policy. But it can support that policy.
- ✧ Research cannot manage. But it can support or not support management decisions (in either case, the research information must be available in an **unbiased** fashion).
- ✧ Research cannot remain unbiased if it is incorporated too closely into the management structure.

Research in the US National Park Service has been accomplished through various ways and means over the years, with mixed results as viewed by management. Often these programs have been reactive rather than proactive. While it is important to be proactive and look toward the future, it is just as important to remind ourselves to look back at what we have done in the past, and note the successes that have been accomplished. These successes include:

- ✧ The development and use of Cooperative Park Studies Units. CPSUs have been an extremely successful and cost-effective means of acquiring research over the years. Some coordination is needed, however, and proper staffing is critical.
- ✧ The development of regional interagency and interinstitutional 'clustered research' groups, both in the parks and at universi-

ties, to respond to multiple park needs. The Southern Appalachian Research and Resource Management Cooperative (SARRMC), Rutgers University or University of Wyoming, for example, have been proven very helpful in providing the research, funds and tools needed for success.

- ✧ The development of a few national research units with generic responsibility to support multiple park, regional, and Servicewide research needs. Examples include the Water Resources Field Support Laboratory (now the Applied Research Branch of the Water Resources Division at Colorado State University) and the archaeological research centers, where efficiencies and capabilities are achieved through a single focused support group.
- ✧ The development of regional base science funds—i.e., the 'cyclic science program.' These funds support park-specific research projects that meet regional priority needs.

Despite these successes, much more still remains to be done. During the Conference, numerous approaches were suggested for restructuring the USNPS organization to improve and optimize the scientific basis of resource management in the parks. In response to these discussions and to those of the two plenary research panels, a three-part process for developing an appropriate, responsive, and well managed research program is suggested to further the debate:

- ✧ First, deal theoretically with the role that research can and should play in the USNPS administrative and management process;
- ✧ Second, reiterate the values of quality research, properly organized (vis-à-vis the physical, biological, social and cultural sciences) to park management; and
- ✧ Third, implement a structure that fits within the management system of the US National Park Service that will directly recognize, utilize and support research.

Four structural issues are identified as important to this discussion: (1) who is responsible for research, (2) the relationship of research to resource management, (3) the nature and structure of resource management, and (4) the organizational role of research.

First, research must be responsible to research. In other words, the principal investigator or field researcher must be responsible to a research organization—this is absolutely necessary for continued project and program support, review and evaluation. This has been reiterated at all levels of government and holds true in the USNPS. As the researcher should be held accountable for project success, so too the research administrator must be held accountable for program success. Thus, research responds to two masters: peer review (a quality research product) and management review (the program must meet NPS needs, both long- and short-term). In short, the USNPS **must** have a responsible and technically qualified research administration. The research administrator would then be responsible to USNPS management at the appropriate level for structuring a program that

meets the information needs of management. Research is not a line function and this relationship (separation of responsibilities) should not be distorted nor forgotten.

Second, it is again stressed that research and resource management are separate and distinct functions. This does not mean that researchers and resource managers cannot talk to one another or work together. But it does mean that research should develop, evaluate and provide information, and offer expert consultation, to both planning and operations. Resource management on the other hand, is a line activity that acts on the information supplied. It follows, then, that both organizations must be technically able and that there will be some overlap and some conflict. This is not necessarily bad; it can be minimized by establishing clearly defined and agreed-to organizational responsibilities. While it is theoretically possible for one person to do both jobs, (research and resource management), this expectation often creates an impossible personal dilemma and should be avoided. (It should be noted that strong individual feelings exist on both sides of this issue.) The present tendency to combine these two functions has too often confused and disrupted both research and resource management activities.

Third, resource management—as a line function—should be structured, staffed and funded to ensure the operational capability to deal with resource issues. The role of research is one of assistance and can be either active or passive. The importance of capable research support is not diminished, however.

Fourth, any redefinition of organization roles is always risky as 'someone's turf will probably be stepped upon.' Nevertheless, an improved research structure **can** be implemented within the existing USNPS management structure and with minimal organizational disruption or change by establishing:

1. Clear and definitive role and function statements;
2. A clear policy statement on research. Under present conditions, this would require a research group that includes USNPS senior scientists working with top USNPS management and possibly the 'Blue Ribbon Panel' to set long-term goals and objectives;
3. A clear-cut separation of research including research budgets from other management activities (this does not absolve responsibility and accountability);
4. A strengthening of the base funding for research (effective research cannot be accomplished with uncertain year-to-year funding);
5. Provide standards for all researchers and research administrators and **enforce them**;
6. Establish functional ties between research levels (to ensure proper direction and evaluation at each level); and
7. Re-establish the Chief Scientist (or equivalent) position in Washington, D.C. This position should consist of a technically

qualified professional research administrator with a knowledge of the USNPS.

If we recognize the realities of the above organizational need, we have an excellent chance to more fully develop a professional, responsive and competent science program for the National Park Service. Such a program will not solve all problems and conflicts, but it will produce scientific products of better quality and credibility—and provide them in a more timely, cost-effective fashion to result in improved resource understanding, management, and interpretation.

Relationship of Research to the US National Park Service 12-Point Plan

The application of scientific information to the US National Park Service's 12-Point Plan (NPS, 1986) was discussed in many settings at the Conference. The following is not meant to be a stand-alone research action plan, although it could certainly serve as the basis to develop one. The format is consistent with and supportive of a number of action items in the 12-Point Plan. Many of the issues identified by the conferees are aggregated into the following 24 actions that relate to each of the 12 points. Much of the discussion of research roles, futures, and strategies can be viewed as supporting the objectives of actions contained in Point 1. A broader view, however, is presented and provides for important research linkages to all 12 points.

Plan	Related Research Action
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| 1. | Develop a Long-Range Strategy to Protect our Natural, Cultural and Recreational Resources. |
| a. | Develop, design, assess progress, and provide quality control to park resource inventories. |
| b. | Develop a 'national research program plan' to identify the types of research needed by the USNPS as an integral part of the strategic management program in order to obtain resource knowledge and understanding and to develop and implement a long-term research initiative. |
| c. | Provide data as required to identify and describe hazardous waste problems. |
| d. | Plan and implement appropriate programs of research to provide the needed data for improved wilderness management research. Provide results in usable form to training, management and interpretation to support the application of ecological principles. |
| e. | Develop broadly-based cooperative research programs that take advantage of the expertise of other agencies and institutions to strengthen in-house research capabilities. |
| f. | Include cultural resources research needs in an integrated fashion as a part of USNPS science and research planning. |

2. Pursue a Creative, Expanded Land Protection Initiative.
 - a. Assist in the development of at-risk criteria (resources-based) for assistance in establishing acquisition priorities.
 - b. Assist in land protection reviews.
3. Stimulate and Increase our Interpretive and Visitor Service Activities for Greater Public Impact; and
4. Share Effectively with the Public our Understanding of Critical Resource Issues.
 - a. Develop an information transfer and technology transfer program to ensure (a) the public is provided accurate information to assist in understanding the nature of the park resource; (b) the flow of up-to-date, accurate research results to public affairs, interpretation, management and training, in usable form; and (c) the development of an information transfer capability (a new group or emphasis of responsibility) to provide information developed by research in usable form (relates also to #3);
5. Increase Public Understanding of the Role and Function of the National Park Service.
 - a. Provide timely research results on the status of park resources in usable format to park management.
 - b. Ensure the cooperative development of future cultural, natural and social science research efforts to maximize the utility of information available to managers of diverse park areas.
 - c. Develop research that takes advantage of park similarities to reduce redundancy, but does not become too simplistic by not acknowledging individual differences.
6. Expand the Role and Involvement of Citizens and Citizen Groups at all Levels in the National Park Service.
 - a. Participate actively and broadly in the NPS Blue Ribbon Panel effort to incorporate the broadest possible consideration of divergent views into these deliberations in order to ensure a positive and improved future role for park research.
7. Seek a Better Balance Between Visitor Use and Resource Management.
 - a. Develop a consistent and focused research plan, to be implemented now and followed in the future, that will provide greater understanding of the expectations and behavior of park visitors and assist park management in dealing more positively with the public. (This program must provide more than "visitor use statistics" and should incorporate elements of both applied and basic sociological research.)

- b. Provide quality data on all-terrain vehicle (ATV) resource issues and use conflicts, where data is lacking. Make existing data available (relates also to #3 and #4a).

8. Enhance Our Ability to Meet the Diverse Uses that the Public Expects in National Parks.

- a. As an outcome of the President's Commission on Americans Outdoors, develop a future research strategy to respond in a timely fashion to the issues forecast by the Commission.
- b. Provide useful research information for the Service's outreach program, to educate people about parks, park resources and the agency's preservation and conservation philosophy (see also #3, #4a. and #7a.).

9. Expand Career Opportunities for our Employees.

- a. The development of research expertise often works against mobility. However, there are occasions when personnel change is required. We should look at this in a rational fashion. Who are our researchers? What do they do, really? Where are they? How and where can we use their talents to maximum advantage?
- b. There is an established career ladder for researchers in the USNPS. For the most part, the opinion is that the Research Grade Evaluation Process (where in place) is working. There is always room for improvement, however. Issues that need to be dealt with include career crossover opportunities, advancement into research administration, supervision of researchers by persons other than those in the research organization, and the supervision and recruitment of supervisors for researchers and the research organization.

10. Plan, Design, and Maintain Appropriate Park Facilities.

- a. Basic resource inventories need to be provided to planners up-front and the most knowledgeable consultation provided. The research organization should develop an up-front link to this process to avoid conflicts in the review of planning documents, environmental assessments (EA), and environmental impact statements (EIS).

11. Develop a Team Relationship Between Concessioners and the National Park Service.

- a. As in #10a., resource data, when made available in the proper form, can assist in formulating management decisions involving critical resources and the location of new facilities. This is an important consultative function of research.

12. Foster and Encourage More Creativity, Efficiency, and Effectiveness in the Management and Administration of the National Park Service.

- a. The research organization, as a user and developer of information, must continue to seek innovative ways of handling the current data overload, make available state-of-the-art analytical techniques, and look toward future developments in this area (an example would be to develop an effective program to take advantage of new GIS methodologies).
- b. As with any other organization, research should always strive to improve its creativity, efficiency, productivity and effectiveness through the innovating application of new methods, different approaches, and alternative scenarios. Research should also pursue all available avenues for greater information sharing and new cooperative liaisons to develop more accurate forecasts of future information needs. The establishment of a new Forecasting Futures group will assist research with these synthesizing endeavors; it will also share the knowledge gained with other NPS functions to support their strategic planning efforts.
- c. The possibility of user fees supporting NPS research activities requires that we clearly identify the nature and scope of our present efforts (personnel, funds, and objectives). In so doing, the program should be articulated and justified to meet our present, and most importantly, our future needs. This effort should be related to resource management, interpretation and other management expenditures as clearly as possible. Costs should be estimated accurately and presented in a straight-forward fashion.

Conclusions

The 1986 Conference on Science in the National Parks focused on many important issues regarding science and its relationship to resource decisions or management in the US National Park Service. The discussions ranged far and wide. They covered research roles; the future of research; new areas of research; newly developed concepts and applications; the nature of a science-based organization; research networks; information transfer and communication of research results; the need for multidisciplinary cooperation in research planning; some concepts for integrating research into future NPS planning; and, current use of available research results.

This presentation only scratches the surface in its attempt to summarize the deliberations that emanated from the Conference. Indeed, the enthusiasm displayed by the conferees—and the seriousness of their dialogue in calling for positive directions and new opportunities for the USNPS science program—should not be overlooked. The Conference's success in focusing discussion on many important science issues should be viewed as an important part of the dialog that will determine the future role of research in supporting the

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Development of Significant Cultural Resources to Promote Economic Revitalization: A Case Study in Western Pennsylvania

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In 1985 the US National Park Service (NPS) conducted a reconnaissance survey¹ in the southern Allegheny region of western Pennsylvania. Responding to a 1984 Congressional mandate for such a report, the NPS evaluated natural, scenic, recreational, and cultural resources in this region. The agency found that nationally significant cultural resources could serve as a focal point for a regional tourism framework. The NPS recommended that a combination of local, state, regional, and national interests could collectively promote the development of visitor-oriented programs, interpretive exhibits and waysides, and access to significant sites described in its report.