The George Wright

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The George Wright Society

Dedicated to the Protection, Preservation and Management
of Cultural and Natural Parks and Reserves
Through Research and Education

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The George Wright Society was founded August 18, 1980 by Drs. Theodore W. Sudia and Robert M. Linn, both former Chief Scientists of the U. S. National Park Service. The Society is chartered in the State of Delaware, in accordance with the laws of the State of Delaware and of The United States of America, as a nonprofit educational and scientific organization dedicated to the protection, preservation and management of cultural and natural parks and reserves through research and education.

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Culture, Science, Nature ...and the Beringian Connection

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Panel Presentation at the George Wright Society meeting in Tucson—November 1988

I start with a premise succinctly stated by Ruth Hubbard, Professor of Biology, Harvard University:

«The nature that the sciences – which means scientists – tell us about is a nature scientists invent so as to provide the kinds of explanations of it, and uses of it, that the society requires. Societal intentions toward nature are what shape scientific descriptions of it; the descriptions, if you will, are intention-laden.....What I am getting at is that science and the conceptualizations of nature that scientists explain by means of it are no less cultural products and social productions than are economics, political science, and philosophy.»

...*The Nation*, 24 October 1988...

In historical perspective, science is a product of cumulative cultural knowledge. And scientific theory is generally applied only in a context of cultural readiness, which is of two kinds: technological or tool kit; ideological or acceptance.

Two recent books, Hawking, *A Brief History of Time*, and Rhodes, *The Making of the Atomic Bomb*, trace the accumulation of cultural knowledge through necessary stages over hundreds of years leading to the two dominant revolutions in physical science in the 20th Century: the special and general theories of relativity and quantum mechanics, which gave access to understanding of both the macro and micro universes.

Now, two examples that illustrate cultural readiness, or the lack thereof:

First, technological or tool kit—Leonardo designed a flying machine, based on observations of the flight of birds, that could have served, almost, as a working drawing for the Wright Brothers 400 years later. Lacking motive power, Leonardo's plan languished as a notebook curiosity.

Second, ideological or acceptance—A Century after Leonardo, Galileo, using the recently invented telescope (that's tool kit), validated the Copernican heliocentric theory, thus challenging Catholic dogma, which placed the Earth at the center of the universe. Galileo had to recant, and his ideas only slowly percolated into a new world view.

Now let's take these themes into the modern world. As model I use the Manhattan Project, which produced the atomic bomb—not because bombs are my object, but because that project, instrument of social purposes of the most compelling kind, illustrates in its original impulse and intent the complete welding of culture, science, and nature. An urgent societal need—beating the Nazis to the bomb—met the exiled European scientists who had created the theoretical basis for exploiting the ultimate energy of the universe. When President Franklin Roosevelt endorsed the proposal of Albert Einstein and his colleagues he fused accumulated knowledge and cultural readiness to produce the bomb and shape world history. The mixed applications and results, with us to this day and into the future so long as half lives keep halving, are not the subject of this discourse. But the model of mobilized social and natural energy bears on this discourse, as we shall see.

Conclusion: We need not strain to see the connections, the total integration of culture, science, and nature. We see also that culture and science, in a kind of shell game of chicken and egg, synergize to drive each other. In the modern homogenizing world, the major fields of science, arrayed in their sub-disciplines, come together to further the objectives and rightly or wrongly validate prevailing, culturally determined world views. Science as the interpreter and manipulator of nature is a powerful cultural phenomenon.

Now let's move toward Beringia

The immediate context is the rising public awareness and concern over global trends—those hints and harms resulting from biospheric changes caused by the accumulating by-products of 200 years of industrialized human society, a society growing in numbers and per capita consumptive potency with each passing hour.

For example, the global warming trend—among many possibilities: ozone, acid rain, toxic wastes, you name it.

The Union of Concerned Scientists in its Fall 1988 *Nucleus* describes the nature of the greenhouse effect and some of its predictable results over the next century. Some highlights:

- Five of the hottest years of the past century have occurred in the 1980s.
- The Earth is 0.5 degrees C. warmer than 100 years ago.
- Measurements taken in Alaska

permafrost imply that temperature in polar regions has gone up 2 to 4 degrees C. in the same period.

• Air trapped in fossil arctic ice indicates that carbon dioxide levels have risen 25 percent since pre-industrial times.

• Climate models predict that greenhouse gases, to date, have committed the Earth to a general warming of 1 to 2.5 degrees C., and more in polar regions.

• The trendline in Alaska has persuaded many formerly skeptical climatologists that the greenhouse effect is now upon us.

• Lacking concrete steps and controls by governments worldwide, the average temperature will rise 5 degrees C. by mid-21st Century, vs. 1 degree with stringent controls; polar region changes will be two to three times as great as the average, or, worst case, 15 degrees of change in polar regions, with a potential rise in world sea level of 6 or 7 meters.

For historical perspective, the Ice Ages of the Pleistocene resulted from changes of only 2 to 4 degrees C. from previous averages.

The list of imponderables and synergisms resulting from such wrenchings of world climate has led some people to counsel no action—"It's beyond us," they say. But the logic of self-preservation argues that monitoring and measuring such changes, controlling the sources of potentially greater changes, and planning for adaptation to those changes that are already inevitable may well become the most urgent business of the world's governments in the future—setting us apart, it is hoped, from the dinosaurs.

It is not only the Union of Concerned Scientists ringing the warning bells. We daily see articles clustered in our newspapers; every week studies and alarming predictions from normally conservative institutions are reported. Public awareness and political response *are* coming into focus. *Cultural readiness is building.*

This brings us to the National Park System in Alaska and elsewhere. From the founding vision of pleasuring grounds—places for esthetic, intellectual, and physical inspiration and adventure—the national parks have evolved into the Nation's premier universities and laboratories for understanding and propagation of the environmental ethic. This has been a two-fold but completely integrated adaptation of our mission: on the one hand to broadcast to the public at large, for general societal purposes, the saving message of the ethic; on the other to influence general environmental health, which in the long run determines the fate of the parks. Both of these concerns, in the light of recent indicators, are more urgent than ever before.

In these circumstances the historic decision to set aside parklands for the benefit of the people has created a pragmatic treasure of the utmost current significance. The parks have held in trust relatively unaltered ecosystems in which, belatedly, we can attempt to discover the workings of this world, in which we can measure environmental and cultural changes that threaten the environmental solvency and sanity of this world.

From such studies in the parks can come the communications—scientific and popularized reports, lectures, campfire and school programs, films—that can inform decision and move the public at large to those reforms of social and individual behaviour that may yet save us and the parks that give us inspiration.

By serendipitous congressional mandate the national parks today are positioned for transcendent contribution to this society and the larger world. The very conservatism of the National Park Service, its being a kind of model of cultural lag, finding solace in the past, has fortuitously been its greatest strength. Because of it the System stands today relatively intact for the great social purpose of the coming decades.

Now opportunity beckons

In this expansion of the meaning and purpose of the National Park System—with its evolving bureaucracy trying to catch up with the evolving world ecosystem—the older mission cannot be lost. Rather, we build upon the founders' philosophy, as a tree grows and extends its branches in maturity. This is no new planting. It is the growth of the original institution.

From the beginning the parks have been a mosaic of values and functions. These parks, these cultural creations can and should—through enlightened zoning and land-use dedications—combine traditional public access to beautiful and instructive parklands with scientific utility for compelling social needs. Environmental standards and aspirations gained from parkland experiences—along with scientific knowledge derived from parkland study zones—can help guide the larger decisions and reforms that our society must make in the coming decades.

Now, finally, to Beringia

In the past 2 years the United States and the Soviet Union have loosened the grip of the Cold War and entered upon a new era of cooperation. The joint effort, ranging from arms control to technical and cultural exchanges, has incidentally breathed new life into a bilateral environmental protection agreement signed in 1972 during an earlier détente. One of the new projects under this revived agreement bears the title, *Research, Conservation, and Management of the Beringian Heritage*.

The concept of the Beringian Heritage project was adopted in a 1987 protocol following reciprocal visits that year by U.S. and Soviet delegations dealing with a broad range of natural and cultural heritage initiatives. Lead agency on the U.S. side is the National Park Service. Representatives from several ministries and institutions comprise the Soviet delegation. The subject matter of seminars and field visits in both countries ranged from architecture to zoology, from urban amenity and old-city restoration to wilderness preservation.

The latent opportunities residing in the natural and cultural affinities of eastern Siberia and Alaska struck a strong chord in both delegations, across the field of disciplines and topical concerns. It was recognized that the ancient land-bridge connection that made Alaska a peninsula of Asia endures to this day in the fields of physical, biological, and anthropological sciences.

With similar environments, shared migratory resources, and intertwined human histories from earliest times, the U.S. and Soviet segments of Beringia form an intellectual, esthetic, and utilitarian entity. Recognizing these joint interests the Beringian Heritage project would open the way for joint scientific research, actively sponsored by the benefitting nations. From that science would come knowledge for cooperative preservation and enlightened utilization of the region's many treasures. And from this model could come larger visions of mutually respectful unity and interdependence.

A proposal for an international heritage park has been endorsed in principle by both sides. The frame would be: designation of separate but proximate protected areas established under the laws of procedures of each national authority. The park would have potential as proving ground for broader fields of cooperation throughout the Beringian region and beyond. It would offer a concrete project and a physical locale where scientists, technicians, and managers from U.S.-Soviet agencies, ministries, and academic institutions could perfect working networks and procedures to carry on good work. Given different historical experience and emphasis in protected-area mission and management, the two nations could here mesh their respective strengths in new syntheses for mutual benefit.

Let me now review and conclude

1. There is growing public and political awareness of the need for international biospheric science to measure and help reverse potentially catastrophic global trends.

2. Arctic regions show particular sensitivity to those trends, hence are valuable as monitoring stations.

3. The National Park Service manages a vast and diverse land-base in Alaska of international scientific value.

4. The U.S.-Soviet Beringian Heritage project—envisioned as an international park supported by neighboring Biosphere Reserves, such as Noatak and Denali in the U.S. side and similar units on the Soviet side—provides a starting point for comparative studies that could and should become circumpolar in scope.

In broader perspective, the National Park System comprehends a spectrum of natural and cultural areas reaching from the tropics to the high arctic, from Maine to the Marianas. Unless the global trends warnings we have so far received prove unreal—an unlikely event—it is inevitable that our government, in concert with others, will be forced to mount Manhattan Project equivalents to stem the rising waters, control energy emissions, curb the poisons that Nature has finally refused to absorb. In pursuit of these massive tasks, key sites within our National Park System and allied conservation units, and in equivalent reserves of other nations, surely will function as monitoring, research, and experimental centers. They will record levels and changes, pinpoint sources, and provide the scientific knowledge that can translate into reform and restructuring of current destructive practices. In this international mosaic of sites, the national parks of the United States will be critical benchmarks, standards by which deviations from or recovery toward healthy environments can be measured. As steward of these natural laboratories and data bases, the National Park Service must begin now to prepare itself for a key leadership role in scientific and social affairs, nationally and internationally, based on the geographies of hope that it is privileged to manage.

Given all this, and with regret that grim necessity is its cause, I yet believe that this institution may be on the brink of resuscitation. Lord knows we need it. We need a cause that will restore and requite the bruised idealism of this honorable Service. We need to be valued again in our own society. We've always measured that value by the service we could render. I believe we'll have the opportunity to render more service than we've ever rendered before.

First Asian School on Conservation Biology —A Trip Report—

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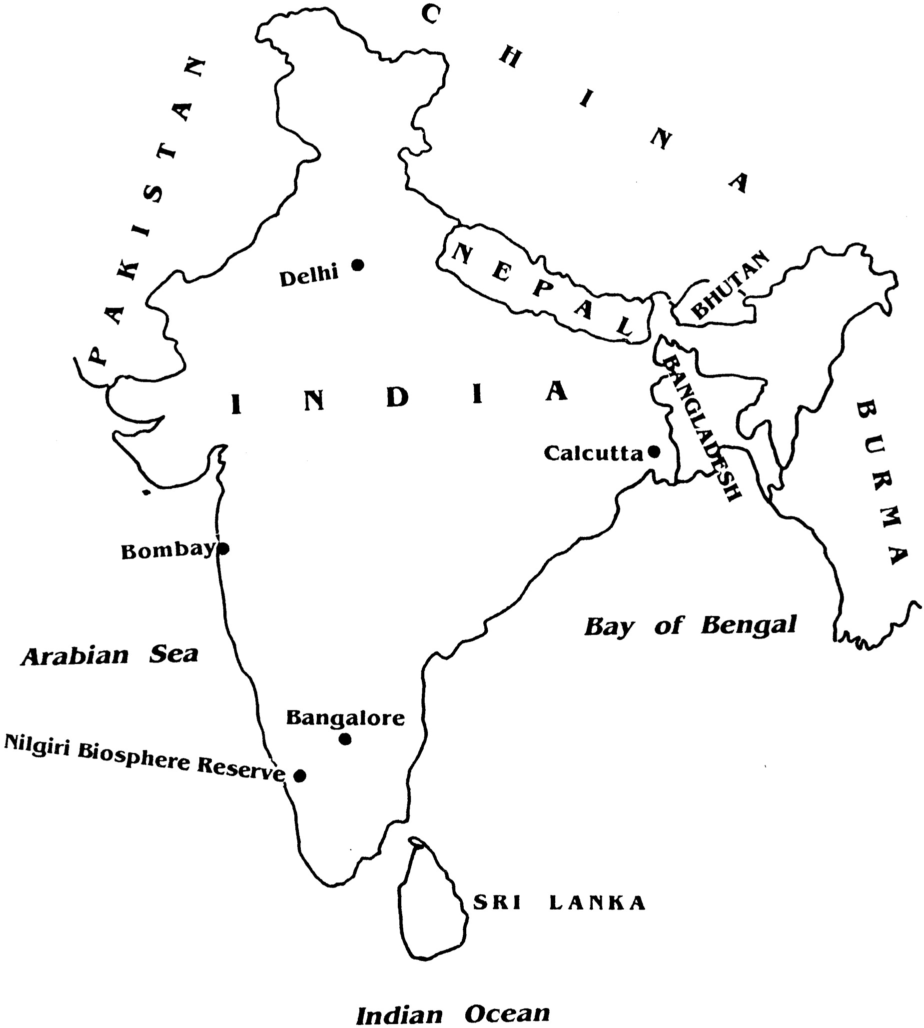
A report prepared by the author to the Director, U. S. National Park Service, in January 1988. The report covers a course in which author Hawkins participated in Bangalore, India, 14-31 December 1987.

How does one encapsulate an experience in words, or create a narrative so true to the subject as to transport those reading it to the event? The dilemma is timeless, and each attempted solution unique. I will no doubt try often, over the next few months, to capture the experience of India for those who may never go. I won't succeed completely, for, like any other place, India contains dimensions far wider than words or even pictures on flat paper can portray.

Events of *getting* to India alone constitute a tale. Even with no delays, the trip is of duration sufficient to remove awareness of time and place, and almost of identity; sufficient to invoke the transition from one world to another. Entry to the country through the airport in Delhi confirms the transition; this truly is another world.

My initial impressions of India, and those which will endure longest, are of contrasts, vivid color, and raw, "unpolished" life. There is a vitality throughout India which stands in defiance to her areas of poverty. There is rich, *intense* color in garment, which, perhaps once an afterthought, is now purpose; it appropriately complements the rust and green landscape. And there is life unmatched by any save the ocean's—constant motion, and constant change.

It was into this world that I stepped as a representative from the (U.S.) National Park Service (NPS) to the First Asian School on Conservation Biology. Organized by Professor Madhav Gadgil, Dr. Raghavendra Gadagkar, and Dr. R. Sukumar, the course was held at the Indian Institute of Science in



India and surrounding area—indicating the location of Bangalore, site of the Indian Institute of Science where the First Asian School on Conservation Biology was held, and the Nilgiri Biosphere Reserve where the four day field trip took place.

Bangalore, India. There were approximately 60 participants; all, except Christine Schonewald-Cox and myself, were from Asian countries, including Afghanistan, Nepal, Indoesia, Sri Lanka, Malaysia, Japan, China, Pakistan, Bangladesh, and India.

The course began with a four day field trip to India's first biosphere reserve (established in 1986), in the Nilgiris, South India. The Bandipur Tiger Reserve, Nagarhole and Silent Valley National Parks, Mudumalai, Wynaad and Upper Nilgiris Wildlife Sanctuaries are included in the Reserve. Problems in managing these areas include fire, loss of habitat due to shifting cultivation and erosion, intensive livestock grazing, crop damage (from elephants), manslaughter by animals (tigers and elephants), and poaching. We traveled into the Reserve through teak, coffee, and tea plantations, past terraces growing cabbage, carrots, potatoes, and cauliflower, and finally to Avalanche, an area of evergreen montane forest (shola). In Bandipur and Mudumalai, we were fortunate to see wild elephants, sambar, spotted deer, gaur, bonnet macaque monkeys, flying squirrels, and boar, etc., as well as very different and very diverse bird life including the pariah kite, drongo, doel, and yellow wagtail.

The next ten days were spent in a classroom setting, receiving instruction from Institute faculty and hearing presentations by course participants. The sessions were inaugurated on December 21, by S. Shyam Sunder, Chief Conservator of Forests, State of Karnataka. Oddly enough, Sunder's opening quote was taken from a plaque at the Epcot Center in Orlando, Florida, stating that man shall "cultivate earth as a garden for the human good." He emphasized that protection will only be possible if basic human needs are met. This was a point clearly demonstrated during the field trip, and repeated in countless examples discussed in presentations. Sunder challenged scientists to discover ways to "provide more" on one hand, while protecting on the other.

Core lectures during remaining days addressed diversity from the genome level, to that of species, population, and community. Effects of immigration, emigration, extinction, inbreeding, and outbreeding on population and community stability were also discussed. These lectures emphasized basic genetic concepts, and were important in establishing "equal footing" for all participants. Yet, I found it interesting to note that here, in a conference held halfway around the world, a source of consternation among some attendants was the same as at similar meetings held in the U.S. That is, core lectures were delivered by academicians, and many participants, as field managers of wildlife reserves or forest areas, were frustrated by the apparent gap between theory and application.

Later sessions helped to "close the gap" with topics such as setting priorities for conservation, practical problems in conservation, and human cultures and conservation. Christine Schonewald-Cox gave well-received talks on landscape ecology, and boundary theory as it applies to conservation in nature reserves. Additionally, poster sessions, accompanied by 15-minute presentations, furnished "real world" examples of conservation efforts. Topics of the posters included acid rain studies in Malaysia, Asiatic lions (Gir Lion Sanctuary), mangrove studies in Sri Lanka, biological diversity in the Western Ghat (mountains) of India, and wildlife conservation in northeastern India.

I spoke on the National Park Service policy regarding exotic species management, and presented a poster illustrating the mountain goat issue in Olympic National Park. There was, as far as I could tell, agreement with the NPS approach to exotic species management. However, disparity between management strategies possible in our parks and those available to some Asian nature reserves was evident. During my presentation, I used a slide showing helicopter removal of mountain goats from Klahane Ridge in Olympic National Park. This particular slide received more comment—and astonishment—than any of the presentation's 70 photographs. That the expense of helicopter use could even be considered for such a purpose was unfathomable to most participants.

Final sessions of the conference involved open discussion on future directions for conservation of biological diversity on the Asian continent. A likely outcome of the meeting will be preparation of a textbook on conservation biology using Asian examples, and publication of a special issue of the journal, *Conservation Biology*, with profiles of cases from Asian countries.

An outcome of the conference for me personally was a considerably broadened perspective on worldwide conservation needs, and on the role of the NPS in conservation efforts. In particular, my thinking regarding biosphere reserves was "fine tuned." Biosphere reserves, as I see them, embody simultaneously one of the greatest potentials and greatest challenges to the conservation community.

In core, and multiple use zones of many biosphere reserves, inventories of resources are incomplete. Nevertheless, managers of these areas are working to complete resource inventories and generally have clear objectives and set operating procedures. Management of these areas follows a plan; in other words, a working "road map" exists to direct operations within these areas.

The challenge yet to be addressed in many reserves (again, from my perspective), is to prepare a "road map" for cooperative management within the reserve as a whole. Included areas may be of varied purposes, including traditional use, rehabilitation, experimental research, and/or multiple use zones. Some core area reserve managers are actively working with adjacent reserve area managers to develop mutual management objectives specifically to meet goals of the biosphere reserve program (e.g., Glacier or Great Smoky Mountains National Park Biosphere Reserves). However, many reserve managers, I feel, are not yet to this point. Of those who are, most are operating upon personal initiative; no instituted methodology exists to direct such cooperative management.

Core areas of at least 24 designated biosphere reserves are within the [U.S.] National Park System. Regarding management principles, these areas usually operate under rather "generic" agreements with adjacent reserve areas. The NPS, through managers of these areas, could contribute to world conservation efforts by taking the next step; that is, development of plans of mutual management objectives *specific* to the biosphere reserve concept.

Biosphere reserves offer potential for conservation of natural diversity in "core zones," and of cultural heritage and traditions in "traditional use areas." Traditional use areas, in particular, present a challenge. For example, within traditional use areas, what defines "appropriate" and "inappropriate" behavior for ethnic communities? Natural processes are perpetuated within reserve core areas; these areas continue to change and evolve. Indeed, allowance of natural change in these areas is a management objective. Yet, in traditional use areas, how much, and what type of "natural change" within ethnic communities can be allowed? In the Nilgiris Biosphere Reserve, how much will traditional agricultural practices be permitted to evolve?

Awareness within the NPS of the need for ethnographic resource conservation programs is increasing. A contribution to world conservation efforts could be made by NPS areas in which preservation of contemporary traditional "lifeways" (Douglas Scovill article, *Trends* magazine, 1987, Vol. 24, No. 4) is a concern. Ethnographic resources conservation programs for these areas (whether of biosphere reserve status or not) developed to be consistent with natural resource preservation policies, would provide useful models for similar efforts worldwide.

Thus, through fashioning cooperative management programs, *specific* to biosphere reserve objectives, and developing ethnographic resources conservation programs, I feel the National Park Service has additional contributions for worldwide conservation. I also feel we can learn much from other countries. Following my presentation, one of the participants from India commented that in conservation "the U.S. is one or two hundred years ahead of us." I had been thinking about this perception quite a bit; I felt it misguided, and told him so. Conservation efforts in the U.S. necessarily begin at a different point from those of long-inhabited countries, and so, have different objectives. These are neither better, nor worse, ahead, nor behind. In uses of technology, the United States may be ahead of developing Asian countries. But in many respects, the problems now faced in these "third world" countries bear lessons for conservationists in the United States.

In both situations, education of people to the need for conservation is a critical issue. As noted in the session's opening address, basic subsistence requirements must be met; only then will broad scale protection be a possibility. However, subsistence *requires* conservation, although often the connection between the two is not direct, and therefore is not realized by a vast majority of the public. Inhabitants of industrialized countries are generally removed, in day-to-day life, from the land that supports them. People of developing countries are largely agrarian; they understand nature as the basis of their survival. While industrialized populations may not discern the link between conservation and survival, developing populations may not understand conservation practices. In both industrialized and developing countries, health of the people is inextricably tied to health of the land. To make that connection clear is a challenge that faces us all.

Having now represented the National Park Service in an international assignment, I feel a bit more qualified to comment on the value of such activities. Personally, of course, the experience was of great benefit in broadening my perspective; that influence will last throughout my life, and will doubtless shape my work according to a wider context.

Professionally, I very much support National Park Service participation in worldwide conservation activities; indeed, I feel it is our *responsibility* to participate. Communication and cooperative management are genuine struggles between organizations within a single country, and certainly between those of different countries. Yet, such cooperation is more than courtesy or polite protocol; it is duty, as stewards of the land, and it may be long-term survival. In *Science 86*, Susan Aritt says:

> *«There exists a fundamental dichotomy within us—a dynamic tension between our technological development and its regulatory restraint. We share the planet with animals of remarkable speed, strength, and agility: birds of soaring flight and extraordinary vision, insects of amazing adaptability and fecundity. Only one species, known as* Homo sapiens, *depends on technology for survival. Working together in complex, communicating social groups, we make things, revamping the world to our own specifications. Making judgments about what those specifications should be remains a relatively underdeveloped but increasingly important ingredient in human survival. Learning how to worry together as a species may well be our next essential evolutionary turning point.»*

There is wide latitude in what constitutes "conservation" in different world communities. In National Parks and other publicly owned lands of the United States, we have agreed upon some specifications for conservation. Whether the world community can judge and agree upon specifications for broader areas remains to be seen. We must participate in order to contribute and to learn.

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The Appalachian National Scenic Trail
A Neverending Story

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Editor's Note: *The following paper, given at the November 1988 George Wright Society Conference on Science in the National Parks in Tucson, Arizona, could be considered as a follow-up to the Superintendent's Corner by Robert L. Arnberger (Everglades National Park), carried in the Winter 1988 issue of Park Science. Arnberger's thesis was that the old 'custodial management' is no longer valid as a way of dealing with today's park problems. This case study of a new approach – in line with Arnberger's «strategic management» position – was thought by science conferees to be worthy of wider distribution.*

Last year the Appalachian Trail, along with Superman and others, celebrated its 50th anniversary. For the A.T. (as it is fondly referred to by its friends and users), it was the 50th anniversary of a continuous footpath—2100 miles from Maine to Georgia. This remarkable 1937 accomplishment was brought about by an unprecedented volunteer effort; 50 years later volunteers are still its most outstanding feature.

The story of the Appalachian Trail, from its inception in 1921 to the present, is one filled with good fortune, good will, and almost miraculous accomplishments. The people who populate the pages of this story have been men and women of determination and vision. As this story unfolds, future managers and hikers will make it a never ending story.

But if this is to be true, an

unusual cooperative management system, one that respects the unique history and traditions of the Appalachian Trail, must prove successful.

By way of background....

Credit for the concept of an «Appalachian Trail» goes to Benton MacKaye, a forester and regional planner from Massachusetts. He conceived of the Trail in 1921 as a continuous way for travel on foot through the wild, scenic, wooded, pastoral, and culturally significant lands of the Appalachian Mountains. Today the Appalachian Trail stretches some 2,100 miles, from Springer Mountain, Georgia, to Katahdin, Maine.

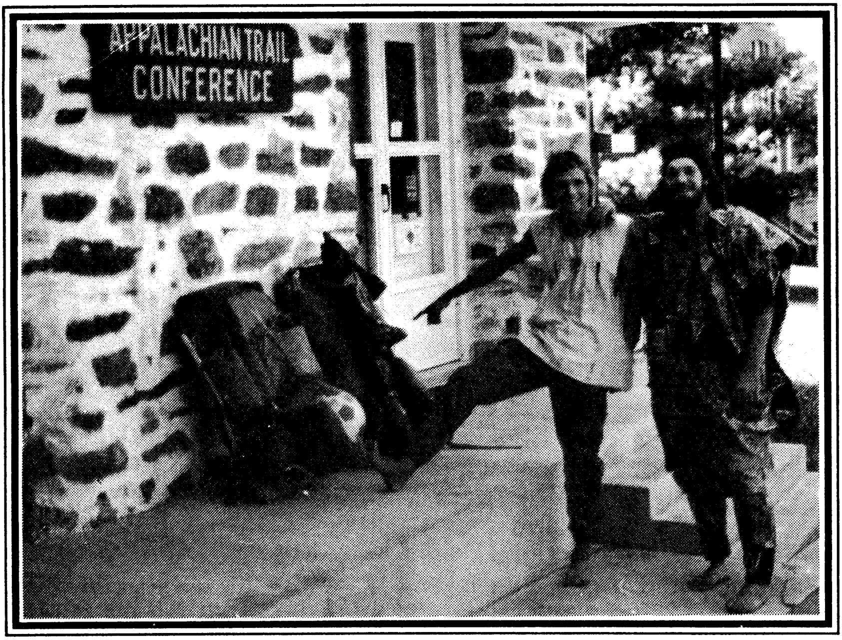
Volunteers began marking and cutting the Trail shortly after 1921. By 1937, a continuous trail had been laid out and blazed from Maine to Georgia. The route corresponded to the ridge line of the Appalachian Mountains and connected existing trail systems where possible. The Trail was routed through public lands where they existed. Handshake agreements with landowners, often when landowners spotted hiking groups crossing their property, were the primary means of establishing the Trail across private property. A unique foundation of good will, upon which the A.T. continues to rest today, was begun at this time.

In 1925 the Appalachian Trail Conference (ATC) was formed to unify and coordinate the efforts of volunteers and hiking clubs. The Conference was and is a nonprofit organization dedicated to the preservation and management of the Appalachian Trail and to the enhancement of volunteerism. ATC serves as the umbrella organization for the 31 local Trail clubs responsible for day-to-day management of assigned sections of the A.T. ATC and the Trail have grown up together.

In 1938, just a year after the continuous Trail was established, Appalachian Trailway Agreements were signed by the National Park Service (NPS) and the U.S. Forest Service (USFS) with the ATC, to protect lands adjacent to the footpath. This was an important shift. The agreements established a zone extending one mile on either side of the Trail in National Parks and Forests where no new paralleling roads or other incompatible development would take place. Similar agreements were signed with all Trail states in 1939 providing protection to a zone extending one half mile on either side of the Trail on state lands. These agreements marked a new era for the Appalachian Trail, with emphasis shifting from the placement and construction of a physical trail to protection of a conservation zone along the Trail.

Permanent Protection of the Land Base

The idea of a publicly owned Appalachian Trail had been introduced earlier, but it wasn't until 1968 that the National Trails System Act (P.L. 90-543) was passed by Congress, and the Appalachian Trail was designated one of our first two national scenic trails. The Act authorized the NPS to administer the A.T., but encouraged the states to



Nigerian Hikers on Appalachian Trail

move first to protect it. Unfortunately, the quality of the Trail route deteriorated during this period.

Congress amended the National Trails System Act in 1978, increasing NPS authority to protect the Trail. The authorized acquisition ceiling was increased from $5 million to $95 million, and eminent domain authority was expanded to allow for protection of a 1000 foot wide Trail corridor. The NPS responded quickly to the mandate of the amendment and developed a corridor planning program and a land acquisition capability. Thus began one of the most complex NPS projects ever undertaken.

The principal NPS role has been to assure a permanent, protected route for the Trail for its full length, filling in the gaps between areas where the USFS and the states have assumed Trail protection responsibility. Dozens of relocations, accomplished through NPS acquisition of new corridor lands, were planned and have been implemented since 1978 to improve situations where the Trail was poorly located. A corridor design process was fashioned, providing maximum flexibility in final decisions. Thousands of landowner contacts were arranged to individually tailor every section of the Trail. Landowners, Trail club representatives and others joined in refining the route and adjusting the corridor boundaries. The need to provide adequate protection was balanced against the desire to minimize impact on adjacent properties.

Planning and acquisition became intertwined in a complex, sensitive, yet highly successful land protection program. Creativity ran high, and benefits were duly reaped. Thousands of acres of beautiful mountain land, some containing outstanding natural features, have been brought into public ownership for the Appalachian Trail. Much of this has been accomplished on a willing seller basis and with the involvement and support of local communities. The heretofore inflexible "federal land acquisition process" has learned new limits of flexibility.

We have had our share of angry, unhappy landowners. I think they are unavoidable, but they have been relatively few. The overwhelming majority of land transactions have been negotiated agreements, and the A.T. enjoys excellent relations with neighboring landowners and local communities along most of its length.

It was clear from the beginning that success of the NPS program and ultimately long-term protection of the Trail were closely tied to gaining the support of neighboring landowners and the communities through which the Trail passes. The A.T. could not afford 2000 miles of hostile neighbors if its history and traditions, not to mention its fledgling "cooperative management system," were to survive. The ultimate goal is to have neighbors, communities, and local jurisdictions proud to have the Appalachian Trail as a neighbor and willing to cooperate actively in preserving its values and perpetuating a healthy natural environment. Effective protection of the A.T. depends upon neighbors viewing its presence as a privilege rather than as an imposition.

This approach has been successful. Since 1978, the NPS has acquired an interest in over 78,000 acres of land in more than 50 counties in 11 states, providing permanent protection for over 517 miles of the Trail. Probably **the** major unresolved issue in our land protection program involves determining an appropriate level of protection for the Trail through several New England ski areas. The issue of ski area growth versus preservation of remote or sensitive lands in general is highly controversial and volatile throughout New England; the battle lines have been clearly drawn where the Appalachian Trail is involved. While willing to make some compromise in the interest of being a good neighbor, we are seeking a level of protection that we believe is consistent with what Congress intended in passing the National Trails System Act. This, however, is more than the ski area operators want to convey. I think it is fair to say that the ski area operators do not view the presence of the A.T. as a privilege at this moment. But at this stage in the program, with most of our controversies behind us and with significant Trail resources at stake, we are willing to risk trading some neighborly good will for adequate protection of the Trail. That issue aside, however, Trail protection is 93 percent complete. With over 1700 individual land transactions to date, less than 5 percent have been acquired adversarily through the process of eminent domain.

The status of the Trail protection effort must be measured, however, not only in terms of miles of Trail protected or acres of land acquired, but also in terms of the growth of the cooperative management system that assures its future.

The Cooperative Management System

The Appalachian Trail protection program is a cooperative project involving the NPS, the USFS, the ATC, the states crossed by the Trail, local governments, Trail Clubs, other federal agencies, conservation organizations, and landowners. While responsibility for overall Trail administration lies with the NPS, the goal is to assure adequate management through the existence of a cooperative working arrangement among partners. Appalachian Trail neighbors are encouraged to be active partners in management of the Trail.

The cooperative management system is based on a recognition that:

➡ the existence of the A.T. is largely due to a volunteer effort that began some 60 years ago, and

➡ management of the Trail by a cooperative network of Trail clubs, NPS, USFS, state agencies, and other partners is both cost effective and philosophically appropriate.

The volunteer role in management of the A.T. is unprecedented for a major federally-administered recreation facility, but stems from the long tradition of volunteer A.T. stewardship. This "major facility," the Appalachian Trail, is sometimes said to be a resource with a soul as well as a body. More than just the body of lands that it traverses, the Trail's soul is said to be "in the living stewardship of the volunteers and workers of the Appalachian Trail community." [...quotes from *'Appalachian Trail Management Principles"* (ATC).]

A whole corps of volunteer caretakers, many of them Trail club members from neighboring communities, is out there looking after the Trail. The many local, state and federal employees along the Trail, landowners, and even hikers, also take great satisfaction in their association with the Trail, and lend their support to the management partnership.

These people, collectively, represent the "soul" of the Appalachian Trail. They have in common an infectious and enduring affection for the A.T. They all become part of a community of concern for the Trail which is pivotal to its long term protection and to its management as a national scenic trail.

The NPS completed a Comprehensive Plan for the Trail in 1981. The Plan established the framework of the cooperative management system, a primary goal of which is to preserve and strengthen the existing volunteer-based management system through agreement on division of responsibilities between volunteer organizations and agencies at the local level. The Comprehensive Plan is supplemented by local management plans developed by local Trail clubs and agency partners. These provide more specific policy and program direction for individual sections of the A.T. Plans are further supplemented by various levels of cooperative agreements, which provide clear understandings of the roles and responsibilities of management partners regarding management and protection of the A.T.

A primary cooperative agreement is the one signed between NPS and the ATC in 1970, authorizing the Conference's traditional management activities on the A.T. That agreement was supplemented in 1984 with a landmark "Delegation Agreement" in which NPS conveyed certain management responsibilities for NPS-acquired lands outside of existing federally-administered areas to the ATC and its member clubs. This represented an unprecedented transfer of management responsibility for public lands from a public agency to a private entity, and was important in solidifying neighbor relations.

ATC has risen admirably to the new management challenge, expanding its programs and its professional staff. The local A.T. clubs are well along in the transition from independent Trail maintainers to responsive community-linked managers. The momentum of the protection program has stimulated a maturing of the volunteer effort into a well-organized, responsive network of managers. Many of the clubs have embarked on ambitious programs to identify and meet their Trail neighbors. Local clubs, through the ATC, are provided with copies of deeds for all NPS-acquired lands. Club members familiarize themselves with the terms of easements and reserved uses so that they can effectively monitor corridor lands. Landowners who have sold easements for the Trail are encouraged to continue their stewardship of lands near the Trail, thus joining the monitoring effort. Problems can usually be handled by a discussion between monitor and the adjacent landowner. Local police and fire jurisdictions, backed up by the agency partner, provide law enforcement or fire assistance when that becomes necessary. This broadening of responsibility marks another significant evolutionary step in the history of the Trail and a major innovative effort by government to have organized volunteers manage public lands.

The Challenge of Being a "Good Neighbor"

So now that we have the Trail mostly protected, have accumulated all kinds of plans and agreements, and have channeled an impressive volunteer resource into a system of "cooperative management," how is it working? What are the problems and challenges? Does the future look bright?

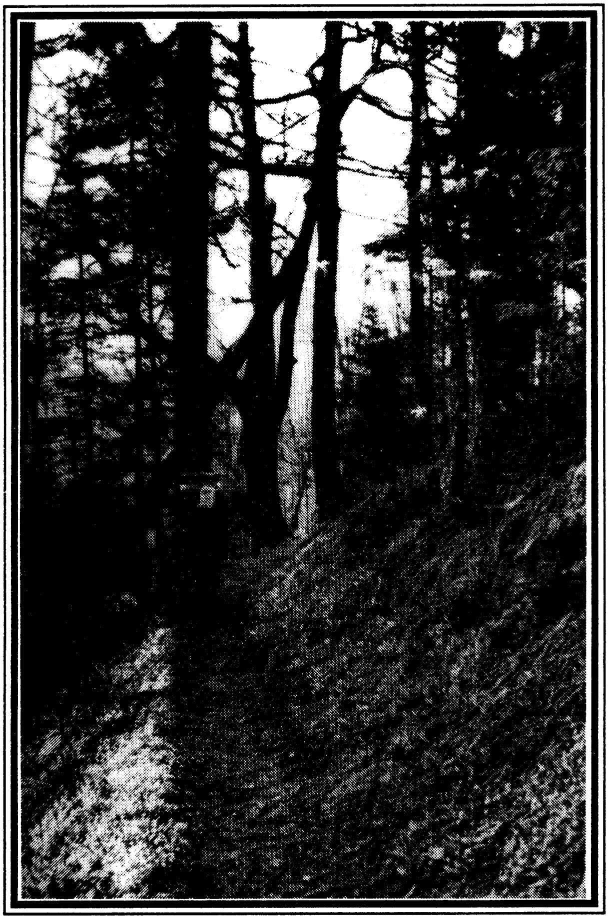
The Appalachian Trail is a long, skinny, vulnerable national park. It has lots of neighbors and involves many jurisdictions. It is more vulnerable than the average park to incursions and external threats, because the boundary to acreage ratio is so high. There is no core, central zone to which you can retreat. Much as the Park

Service likes to buffer its parks, only so much buffer could be bought. A three mile wide corridor can't be purchased. Every vista, every view, can't be protected through land acquisition. Future protection of Appalachian Trail values rests upon the relationships that are established with national forests and parks, state and local agencies, and the people who own land or reside along the Trail. A high degree of communications and an extraordinary amount of coordination work is required to sustain this web of interrelationships and to focus the energies of potential management partners. Trail clubs, the ATC, NPS and USFS alike share in the responsibility for creating a climate of concern for the Trail. It will be critical to the long-term integrity of the A.T. that the Appalachian Trail community develop some ability to influence what happens on lands surrounding the Trail.

And it is working. Awareness of ongoing threats has aroused in the Trail community a sense of concern and vigilance. Threats will continue, but the Appalachian Trail and the experience of hiking it will have to evolve as the world around the Trail evolves. Lands through which the Trail passes are continuously under pressure for different kinds of development. Even in places where the Trail would seem to be securely protected, such as within the boundaries of National Parks and National Forests, proposed activities could adversely affect the Trail. Requests will continue for permission to cross the Trail with power and communication lines, gas lines and roads. They must be carefully considered, for the A.T. cannot become the Great China Wall of the east coast. Where great public benefit is at stake, our objective becomes to control where and how such crossings occur and to impose satisfactory mitigation, rather than to deny the request. Emphasis also must be on integration with compatible land uses, rather than on an attempt to preclude them.

The other side of the coin from threats to the A.T. is the threat to neighbors posed by the A.T. The gypsy moth offers a case in point. Park Service policy dictates that chemical pesticides will not be used on park lands unless necessary to meet management objectives and no other alternatives exist. This policy has not always sat well with State and county governments or adjoining landowners who want to chemically treat their lands adjacent to the Trail and who believe that non-treatment of A.T. lands will jeopardize the success of their efforts. NPS has bowed to pressure more than once to allow treatment of Trail lands, citing continued good will of our neighbors as one rationale.

I believe the future of the Appalachian Trail looks bright. The cooperative management system is well established and expanding. I think the NPS and the many others who have been involved in the protection of the Trail can take pride and satisfaction in the program and the part they have played in preserving the opportunity for an incomparable recreational experience. A foundation has been laid for continued and growing recognition of the Appalachian Trail as a valued resource and a good neighbor. Perhaps it also suggests techniques the NPS can use on neighbor disputes in other situations.



Thru-Hiker in the Great Smoky Mountains Section
[Photo © by Don Fortunato]

Tandem Tracking for Research & Resource Management

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«.....For Natural Resources it was agreed that linkage between expenditures and priorities established in Resource Management Plans as communicated in the Natural Resources Assessment and Action Plan (NRAAP) was important, and that a strong tracking and reporting mechanism was needed.»

..Memorandum from the Director to Regional Directors, 4 February 1988.

«.....The N.P.S. should develop a binding contract between managers and researchers that outlines specific responsibilities at the outset of a research project.»

......Executive Summary, Vol. 2, p. 10, Research in the Parks: An assessment of needs. NPCA.

Those high priority resource management problems requiring research efforts frequently have been identified for a number of years before funds for research are available. A decade or more may elapse from the time a problem is identified until research is completed and management recommendations are made; additional delays in obtaining funding for management action can result in an escalation of the problem and an escalation of the costs to resolve it. (This is perhaps best exemplified by problems associated with feral animals and alien plants.) In the worst case scenario, needed management action is not initiated at all, and recommendations are simply relegated to the files.

The inordinate delays in resolving resource problems also leads to a lack of accountability for their resolution. Park managers identify their own priorities, but they also have other resource problems that were identified long before they arrived at the park. In fact, a Superintendent is fortunate if one or more of his top priority resource problems can be funded, studied, and acted upon during his tenure in a park. Of course the magnitude of the problem and funding required are closely related to the time required for problem resolution.

Consider the following hypothetical example of a resource problem identified by Superintendent "A" and staff in 1972. Funding for research becomes available in 1979 and continues through 1981, at which time management recommendations and alternatives are identified. The new Superintendent "B," who arrived in 1980, follows through in 1981 with a request for funds to implement the recommendations, then transfers to another park in 1983. The new Superintendent "C" receives funding in 1985, but since he and the new staff have little understanding of the ramifications of the earlier problem, a decision is made to conduct a new study with a different approach. The old problem is still not resolved, but all of our jobs are perpetuated.

I would not argue that in some instances a new study might be the best management decision. My point is that irrespective of the management decision, 13 years elapsed from the time of problem identification to the time when management action could begin. With better meshing of research and resource management, action could have started four years earlier while the problem was better understood and before so many personnel changes had occurred. Although this is a hypothetical situation, it is based on a conglomerate of resource problems I am familiar with. I think it is reasonably typical of projects requiring $60,000—$90,000 for research, and perhaps that amount or more for management. It is acknowledged that the kind of problem, its severity, its political visibility, and its priority will all affect the time schedule.

Different sources of funding for research and resource management result in separate priority schedules for each discipline. Research is funded largely through the office of the regional chief scientist, and in some cases through Washington, whereas resource management is funded through parks, regional offices, DSC, Water Resource Branch, and Washington. Research projects funded by Fee Money are not considered here, since it is not known whether such funds will be available in the future. Separate priority schemes for research and resource management help promote delays in implementing the recommendations of research. Merging the two disciplines is not the answer to this problem. Each discipline must have its own priorities, but those resource management problems requiring research should be considered separately and funded separately from resource management projects that do not require research for their resolution.

Lack of accountability for using the results of research in decision making is a major concern (NPCA 1988, *Investing in Park Futures*). Again, delays in the funding for implementation of resource projects exacerbate the human tendency of the manager to give attention only to the most pressing issues of the day; there are more than enough of them to hold his attention. The NPCA report on *Investing in Park Futures* called for the development of a binding contract between managers and researchers that outlines specific responsibilities at the beginning of a research project. This is a vitally important concept, because although researchers may be well equipped to study the problem and derive reasonable management alternatives, they cannot implement those recommendations. If a resource problem is important enough to receive NPS funding for study, we are not keeping faith with the taxpayers nor with ourselves if we do not follow through with the necessary management actions. A resource problem requiring research is not resolved until both the research and the resource management have been completed.

Tandem Tracking is a conceptual framework offering a possible strategy to complete a scheduling and funding linkage between research and resource management projects. The following are conceptual underpinnings of the Tandem Tracking scheme:

1. The NPS can do a better job than it is doing in managing park resources.
2. Management actions should begin promptly following completion of research.
3. A resource problem worthy of NPS research funding cannot be considered resolved until appropriate management action is completed.
4. It is highly desirable to develop a contract between researcher and manager that details specific responsibilities of both parties.
5. Linkage between research and resource management must be strengthened by development of a functional tracking and funding scheme.
6. No manager will ever have 100 percent of the answers about a resource problem. Action frequently must be taken using the best information and judgment available.

Tandem Tracking of research and resource management projects can be implemented by the use of project tracking software. Several commercial programs are available—we use Protracs (Applied MicroSystems, Inc., P.O. Box 832, Roswell, GA 30077, 404-475-0832). This interactive project and item tracking system allows monitoring of a schedule and task activities in up to 200 separate projects. Each project can contain up to 20 tasks, with 256K computer memory, or up to 2000 tasks per project with 512K of memory. Activities are described and displayed in a spread sheet format, which can be modified as required. One of the most useful features of the program is the production of Gantt charts (Fig. 1). These are chronologically oriented, horizontal bar graphs depicting segments of a project. Each task is represented by a horizontal line in the chart. Scheduled dates and actual dates of completion are shown; changes can be made on the chart, or via the Activity Update screen. Graphic presentation of

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-------------------------------------------------------------------
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:Recapture,dra:                    I-I                            :
:Analyze data :                    I----------------I             :
:Coordinate ov:                      I--------I                   :
:Recapture,dra:                           I-I                     :
:Draft report :                                     I-------I     :
:Final Report :                                                  I:
:Assess Mgmt.o:                                                   :
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:             :                       1990                        :
-------------------------------------------------------------------
                      I---I  -  Scheduled date range
                      x===x  -  Actual date range
                        X    -  Actual start and end
                                in same week
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AIRCWILD                   CHRONOLOGICAL ORDER                 11/10/88
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:             :                       1991                        :
: DESCRIPTION : J   F   M   A   M   J    J   A   S    O   N   D   :
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: DESCRIPTION : A   B   R   P   Y   N    L   U   P    C   V   C   :
:             :                       1991                        :
-------------------------------------------------------------------
                      I---I  -  Scheduled date range
                      x===x  -  Actual date range
                        X    -  Actual start and end
                                in same week
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Figure 1. Gantt Charts depicting segments of a single project over a two-year period of time.

project events and deadlines allows more rapid visualization of a project's status. In the Tandem Tracking scheme, a research project would be followed immediately by resource management action.

Most resource problems requiring research have fairly predictable outcomes. Research recommendations frequently lead to recommendations for further study, need for active management, need for monitoring, or some combination of these. Thus, if a study were conducted on the status of a threatened population of animals, it is almost certain that a monitoring scheme would be recommended. The Gantt chart would indicate a year or two of study, followed by, perhaps, yearly monitoring. Yearly costs for the study and for the monitoring could be estimated and added to the chart. This would greatly facilitate planning and budget programming over a five year period. It is axiomatic that changes can be expected in any long-term programming. When changes need to be made in scheduling or funding, commensurate shifts would be made in the rest of the schedule. Some small lags still might occur between research completion and funding availability for management, but this type of tracking would provide better visibility, and accountability, of what had been accomplished and what had not.

In order to program funding for the resource management part of this scheme, a separate pool of money should be designated, either by reprogramming resource management funds or by making a request to Congress for additional funds. By no means should research funds be substituted for resource management funds, since research funds are currently inadequate to meet the needs. Conversely, if a research project ended with recommendations that another aspect of the problem be studied, the regional office should have the flexibility to use the previously budgeted resource funds to fund the research, if that were deemed appropriate. The objective is not to parasitize one program to feed another, but to resolve problems more promptly and in a less expensive manner, and to provide a flexible and responsive tracking scheme that allows researchers and resource managers more opportunities to protect park resources.

The Tandem Tracking scheme, if implemented in each region of the Service could dramatically reduce the time lag between research and management action. An additional benefit of the tracking system is that it would facilitate planning and budgeting while enhancing accountability for management actions. The Tandem Tracking concept is simple, straight-forward, and could be easily implemented. Funding is the immediate challenge, but this can be resolved if there is a commitment to do so. Natural resources of our national parks are the real *Crown Jewels* of the United States. It is our responsibility to expedite any procedures that will enhance their protection and perpetuation.

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Functions of Natural Science Research in National Parks

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Management of natural ecosystems is, at best, a poorly developed art. Scientific research is necessary to develop a basic understanding of ecosystems upon which to base management, to assess natural integrity of ecosystems (health), to identify causes of ecosystem disfunction, and to restore systems degraded by human activity. Conversely, national parks, as naturally functioning ecosystems, provide unique opportunities for advancing scientific knowledge.

Natural Science Research in National Parks

If managed as vignettes of primitive America, national parks can provide a number of values in addition to their classic roles as pleasuring grounds for recreation and emotional retreats from the stresses of modern, urban life. These naturally functioning ecosystems are environmental "miner's canaries," providing early warnings of impending disasters. They are ecological standards, or controls, against which effects of human activities on the biosphere may be measured. They are reservoirs of wild genetic material that protect biodiversity as investments in society's future. They provide opportunities to learn about the structure and function of natural systems and the processes that shape them. Nevertheless, if these values are to be realized, the scientific community must exercise every opportunity to conduct research in parks that utilizes these values or the ecosystems will be altered to provide more recreational experiences at the expense of their natural functions and diversity.

In the near future, national parks may be the only places where human impacts on the biosphere may be detected early enough to prevent catastrophe. This is particularly true in the coastal zone, where 75 percent of the American people will soon reside and where other natural area management agencies are generally restricted to either marine or terrestrial portions of the biosphere. As an example, early detection of DDT contamination in marine food webs in Channel Islands National Park was one of the most important factors in preventing irreversible contamination of coastal ecosystems in general, and more specifically, extirpation of California brown pelicans in the United States.

In altered ecosystems, cumulative effects and synergism of multiple human influences make it virtually impossible to detect discrete causes of change or to evaluate system degradation. National parks can provide ecologically-independent units in which to test hypotheses and develop new approaches for managing and utilizing natural resources. For example, coastal fisheries management based on species-specific approaches to regulations using closed seasons, size limits, and gear restrictions has generally not been successful. Hypotheses regarding sizes and distributions of ecologically discrete management units like national parks need to be tested as ways to improve fisheries productivity and sustain yields.

National parks provide opportunities to study natural genetic variability and the dynamic evolutionary processes that produce and maintain it in the context of predation, competition, and other ecological factors. Parks complement the more static roles of zoological and botanical gardens in maintaining biodiversity, but neither approach alone will suffice to provide the understanding necessary to assure a safe, productive human environment. Research in both kinds of situations needs to be conducted in a compare and contrast mode. As national parks become increasingly isolated pieces of once large-scale natural communities, they will also become even more valuable as places to study the genetics and other attributes of small populations and test hypotheses on population biology and biogeography.

National Park Service Uses of Natural Science Research

In addition to these basic research topics, the National Park Service needs to conduct what may be termed 'applied research' to achieve its mission. The primary natural resource mission of the National Park Service may be described as providing health care for selected examples of the nation's native ecosystems. In many respects, these park ecosystems are analogous to patients' bodies, and the National Park Service is analogous to a health care organization: both of which are designed to assure continued good health of their subjects. However, the present status of knowledge concerning ecosystem structure, function, and dynamics is not much better than the state of knowledge of human physiology in 1628, when William Harvey first accurately described heart function and circulation. A basic understanding of ecosystems must be developed or we will continue to struggle blindly and ineffectively to search for ways to maintain and restore parks and the biosphere they represent.

Like medicine, natural resource management is an art practiced on a scientific basis. It requires a team of scientists working toward the same goal, healthy park ecosystems, with each contributing in their own way. They all follow the scientific method, i.e., hypotheses are formulated, tested, and revised based on test results. It is functionally important to recognize the distinct, but complementary, roles that various National Park Service professionals play in this endeavor. For example, resource managers act as family physicians for park ecosystems. They monitor ecosystem health with regular checkups. They recognize symptoms and diagnose illnesses, sometimes acute, sometimes chronic. They prescribe treatments and evaluate the results of those treatments. However, research scientists act as medical researchers. They develop new techniques for assessing ecosystem health. They identify new diseases and determine causative agents. They develop and test new treatments to cure or to mitigate illness. Park superintendents must also recognize that identifying and solving ecological problems in such extremely complex and poorly known systems as national parks is clearly an art and even management itself must be conducted as a scientific experiment.

As an ecological health maintenance organization, the National Park Service needs to conduct original research to learn how to monitor the health of park ecosystems, diagnose system illnesses, prescribe treatments to restore ailing systems, and seek ways to reduce threats and prevent system degradation. Basic knowledge of ecosystem structure and function is so rudimentary that research is required to: 1) develop methods of selecting and monitoring ecosystem components that will serve as vital signs of system health; 2) determine limits of normal variation for these components in order to identify conditions which warrant management action; 3) develop methods of restoring ecosystems; and 4) identify causes of system dynamics and disfunction. Most agency research is designed to address one or more of these topics.

Ecosystem Monitoring

Several approaches to developing long-term ecological monitoring programs are being tried in national parks. At Channel Islands NP in California, populations were selected as the basic ecosystem component to be monitored. Changes in population abundance, distribution, age structure, reproductive efforts, recruitment, growth and mortality rates, and phenology of over 400 taxa are measured regularly and used as indicators of ecosystem health. These organisms integrate a wide variety of environmental influences such as disturbance, predation, competition, and nutrient availability. They express their responses to these influences as changes in easily measured and readily interpreted parameters of population dynamics. Some of these parameters, such as reproductive efforts and growth rates, are sensitive measures of subtle chronic stress that provide early warnings of impending disaster. Others, like age structure, permit reasonable projections of system health into the near-term future, just as a physician can describe the prognosis of an overweight, hypertensive patient. In addition, management controls frequently operate most effectively at the population level, making application of monitoring results straightforward. Population dynamics appears to be a promising approach to monitoring park ecosystems, but other approaches, such as inventories of biodiversity, and measures of energy flow and nutrient and constituent cycling also need to be more fully developed and tested for applications in national parks. A pilot park program on natural resource inventory and monitoring is currently underway in nine parks, the results of which may shed additional light on this subject.

Determine Normal Limits

Long-term data sets of ecosystem parameters are few and far between anywhere in the world. Without such observations, it is difficult to construct reliable models of system behavior or rationally determine when conditions warrant management intervention. Since it is virtually impossible to fund research projects for periods of time longer than three years within the existing National Park Service administrative system, it is not possible to develop such data sets in individual national parks in the course of normal research activities. Despite these constraints, a few outstanding examples of long-term data sets on populations of selected species have been developed that may be used to establish normal limits of variation for the systems in which they occur. Among these are the wolf and moose data from Isle Royale NP, Michigan, sooty tern information from Ft. Jefferson NM, Dry Tortugas, Florida, and water level, wading bird, and fishery resources at Everglades NP, Florida. On a Servicewide basis, air and water quality monitoring programs have been base funded and are beginning to develop a network of physical and chemical sampling stations and protocols, but no comparable biological monitoring program exists.

Restore Ecosystems

Most research efforts conducted by the National Park Service involve an attempt to restore some aspect of a natural system perturbed by human activity. Many projects seek to identify and develop methods for removing or mitigating effects of alien species introduced by man. Conversely, there are nearly as many efforts to restore extirpated or nearly extirpated native species. It is now clear that fire is a powerful natural process in many ecosystems and has been significantly altered by human activities, but this knowledge is relatively new. Exemplary National Park Service research in the 1950s and 1960s at such parks as Everglades, Sequoia, and Kings Canyon documented the role of fire in forest ecosystems and dramatically changed management policies and actions. Considerable Service research and resource management efforts continue to pursue information on the role and effects of fire in natural ecosystems in efforts to restore and maintain naturally-functioning vignettes of primitive America. Restoration of ecosystems altered by extirpation of native predators, such as wolves and sea otters, requires scientific research to develop socially and ecologically acceptable strategies.

Identify Causes of Disfunction

Frequently park ecosystems are so stressed that serious disfunction is apparent even to the casual observer. In these situations management action seems imperative, but frequently symptoms, not causes, are all that are apparent without extensive basic research on system structure and function. Many management actions are taken to treat symptoms rather than seeking system understanding and conducting controlled experiments to determine causes. Eventually, these expedient, short-term solutions to fundamental ecosystem problems precipitate threat and crisis-oriented 'crash' programs to 'fix' the system. Since the 1980 *Threats to Parks* report, research priorities have been heavily influenced by resource threats and many projects funded from Servicewide programs address one or more threats in one or more parks.

Mitigate Threats

In addition to protecting and perpetuating natural ecosystems, the National Park Service must also protect the visiting public and provide access to parks. This mission frequently requires development of new knowledge to assure safe access without impairing park ecosystems. For example, knowledge of bear behavior and natural history has to be acquired through research before an adequate program of peaceful co-existence can be developed for park visitors and wild bears. This role of research may be described as providing innovative or unique solutions to management issues through the development of new knowledge.

Conclusions

The scientific community-at-large needs naturally functioning ecosystems to use as ecological standards, reservoirs of wild genetic material, and places to learn about the structure and function of natural systems and the processes that shape them. Realization of these scientific values of national parks often conflicts with recreational uses. The scientific community must assert its needs, demonstrate the validity of these needs through use, identify conflicts with other uses, and advocate management policies that will assure protection of naturally functioning ecosystems. The National Park Service needs to conduct scientific research to develop a basic understanding of park ecosystems and to use a scientific approach to park management. It is abundantly clear that laissez-faire management is detrimental to national park ecosystems and that management by blind trial-and-error is expedient but prohibitively expensive in the long-term. Continued treatment of the symptoms of threats to park ecosystems, without attention to underlying causes, will be no more successful than was the common 19th century practice of blood letting in curing the underlying causes of high blood pressure. The present level of scientific staffing and research funding in the National Park Service is sufficient only to identify the most grievous threats to park resources and respond in a reactive mode to a small proportion of them. Overcoming existing deficiencies in the basic understanding of ecosystem dynamics necessary to become proactive and efficient in addressing management issues will require a significant increase in long-term research funds and an agency commitment to excellence in scientific management.

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Let's Bet the Ranch and Learn the Game

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A condensed version of this paper was presented as the *Superintendent's Corner* in the Spring 1989 issue of *Park Science*

Winston Churchill once said, "Play for more than you can afford to lose and you will learn the game." He wasn't talking about park management at the time, but he certainly could have been.

We in the National Park Service have learned much about protecting and preserving our Nation's natural and cultural heritage since being entrusted with it almost 74 years ago. It seems that too often, however, it's been "learn as you go." I don't mean that as an indictment, as some recent authors suggest, but we cannot "afford to lose" those precious national resources in our trust as we continue to learn the rules of the "game." I am concerned as a park manager, however, that it appears we sometimes focus on trying to fix blame rather than learn from past mistakes. Or else, it seems once we learn from experience, instead of applying our newfound knowledge, we try to change the rules. It sometimes makes me wonder.....do we even know what "the rules" are?

Let me offer an example by asking a question: what do Yellowstone, Everglades, and Mammoth Cave have in common? Like all national parks, they are artificially found within ecosystems that surround them, but what resource is it on which all three are absolutely dependent? Give yourself a gold star if you said "water." And give yourself bonus points if you said "ground water."

The relationship is pretty apparent at Everglades. Its ecological health is absolutely dependent on the aquifer that saturates the limestone sponge so that water flows on **top** of the ground. That sheet of water is what creates that "river of grass" we call the Everglades. The understanding of the relationship of water and Mammoth Cave was longer in coming, but no less important. The formation of the 330-plus miles of the cave system was through the action of **under**ground water — literally subsurface rivers—that still flow and slowly create new cave as well as provide a nutrient source for cave life. And Yellowstone? Well, the groundwater there is a lot hotter and the "caves"—that underground "plumbing" that drives the steam engine of geysers—are a lot smaller, but the relationship is similar.

But the resource issues that drive the superintendents of all three of those parks are essentially the same: "competition" by others for the use of water external to park boundaries. It may be tomato growers and increasing urban encroachment outside of Everglades, or energy-hungry developers looking at the geothermal resource at Yellowstone, or at Mammoth Cave the proponents of industrial expansion wanting to use the groundwater system as a cheap and "efficient" means of effluent disposal. That groundwater becomes the Echo River at Mammoth Cave, is loaded with pesticides and fertilizers if it even gets to the Everglades, or is siphoned off for other uses at Yellowstone. But the result—and potential disaster—for each park is the same.

At Mammoth Cave we find ourselves in probably no different straits than most national parks of 50,000-plus acres. We have no complete baseline inventory. Our exotic vegetation program is hampered by the reforestation practices of the CCCs in the 1930s which stressed timber cover rather than native species. We have endangered species, some found only here and nowhere else, that probably are inadequately protected. We have visitors who seem to come all at once and who we know have "an effect" on the natural and cultural resource (but we're not always sure what or how much). We're a Class 1 airshed which seems meaningless while we monitor ever-thickening "haze." In short, we—like **you**—have more problems than an-swers.

But we have made one major discovery: the quantity and quality of our groundwater is absolutely integral to the ecological health of the park. And we came to that conclusion through research. We found that we have subsurface drainage basins that bear little resemblance to surface basins. We found the old saying that the "solution to pollution is *dilution*" is far from true, for when many small sources find their way to underground watercourses, the opposite effect occurs. Eventually the sewage is carried away by water, which may initially disperse, but then coalesces as various sources combine underground in bigger and bigger streams until the pollutants become concentrated in the large underground rivers typical of karst terrain. And that fact seems pretty simple, until you stop to consider that the whole theory behind "percolation tests" that we do for septic tanks and drain fields, is that those pollutants will **disperse**. But the "rules" do not always equally apply.....

Good, solid research gave us that critical information. As a result, Mammoth Cave has become involved in an unprecedented partnership with three other communities to build and operate a regional sewage treatment system. Unprecedented because the Service is part of an "interlocal agreement," has contributed a major portion of the funding, and sits on the board of directors to build, operate, and manage a *regional* system. Once complete, it will go a long way toward protecting the underground water on which the park and surrounding communities are all dependent. The partnership has led to working with the local area development district; active involvement in the location of solid waste disposal sites in surrounding counties; cooperation with agricultural programs to study the effects of fertilizer and chemical applications on water quality; and an enhanced awareness on the part of staff that the park is not an island.

Further, it will allow sustainable economic development to occur, but development that is compatible with and cognizant of those park values that are water dependent. It's the *Man and the Biosphere Program* in **fact**, not theory. Sure, it will allow more water-slides, too! We already have one of those, but more importantly, we can help insure that the development that does occur will not be that which will pollute the groundwater and pose a threat to the subsurface values for which this park was established.

We are not looking beyond park boundaries because a law requires us to, or because of some sort of "good neighbor" policy from Washington, but because good, solid research gave us the right information to make proper decisions in managing park resources.

I don't believe we're being pollyanna-ish. There is already one nearby commercial cave that has been closed since the 1940s due to pollution from raw sewage and improper waste disposal. The odor is especially prevalent anywhere near the cave entrance on a hot August day.....and the cave is located on a downtown street in a community of over 2000 people. They are believers. And in a fifty square mile area of northern Arkansas, hundreds of wells and springs have been destroyed by the disposal of sewage effluent and municipal wastes including those from a poultry processing plant in the small community of Green Forest. The multi-million-dollar costs to rebuild a basic water system we all take for granted are making them believers too.

We know the addition of the Sewer infrastructure may allow development to occur to which we may object in the future. But in terms of basic resource **preservation**, the tradeoff of the disastrous against the potential for increased, but environmentally compatible development, is worth our current efforts. Besides, we now have a "seat at the table" of a basic resource regulating agency of the local power structure that helps allocate resource use. Whatever that future development may be, we will at least have input. We're learning the rules.

How did this all come about? Through good management, good research, or good luck? The basis is good research. Research done by the park's hydrogeologist, Jim Quinlan. "Applied" research in the sense that Dr. Quinlan had the foresight to realize implications long before park management realized the potential ramifications. But "basic" in the sense that it began long before the problem became apparent. Basic research that was done in spite of and, even Dr. Quinlan will occasionally admit, because of the broad view of park management. Basic research that doesn't even have a basic charge in our Service's enabling legislation. Basic research that *had* to occur outside park boundaries—"had to" because that is (like Everglades, Yellowstone, and probably *your* park too) where the *need* was to answer the research question. Basic research for which we only recently have found the application....but that's not the point. It seems most research we do is begun after the problem has become acute, and therefore visible and viable. But that didn't happen in this instance. What occurred is how research in the Service *should* be: the potential is recognized; dollars are budgeted; top minds are put to work; results are achieved.

But there's more: management decisions must be made. You see, management at the park, region and Washington levels had to see that research only pointed out the problem, the potential for disaster, and potential solutions. What also had to happen is what Everglades' Assistant Superintendent Rob Arnberger calls "community resource management." Management also had to work with three surrounding communities, the state, and other federal agencies. But even here at Mammoth Cave what happened was serendipitous. It wasn't until the local communities realized the potential for economic loss the national park represents—on which they are dependent—that it all came together. As much as I'd like to say it was as a result of good research and good management, that is not the case. But that's another *rule*.

Against all odds the park became partners with those communities to work together (for many different reasons, some economic and some environmental) to solve what everyone has come to realize is a common problem. It didn't come cheap. So far $2 million has been expended in our share of a regional system whose cost projections now exceed $13 million, and construction is not even halfway complete. We can bet the ante will increase in this game.

The point is that research is not the **end**...it's the means. We can't just say "spend X percent of the budget on research" and expect park management problems to disappear. Oh, sure, we'll solve problems as yet unknown as we were able to show here at Mammoth Cave. And, in a perfect world, I believe that is how we should manage parks. Any smart industry will put a percentage of its budget into "research and development." That's known as an *investment* in the *future*. But what about our existing problems, the ones we already have more of than answers? Given our current budgetary constraints, 5, 10 or 15 percent of our budget for research is not likely to occur when a similar case could be stated for all our other programs.

Those are the current rules. But we can solve a myriad of existing resource problems if we just play by those rules. But please don't misunderstand: at the same time there's nothing that says we can't work to change the rules. And the rule change needed right now is one giving the National Park Service a basic research mandate. Because we can always point to the obvious—the water at Everglades, or the water at Old Faithful.... Or, we can always appeal to that which *has* appeal—the wolf, bear, or bison.. But in doing so, we will always insure the survival of the "mega-charismatic" to the detriment of whatever it is that isn't.

We need a basic research mandate. But when we go after it, let's go for the research dollar needs as well. That's where we can use the mega-charismatic to justify the need! The fact is, we don't have enough money to study the problems we have now. My fear is that we may get what we want, without the wherewithal to accomplish what we need. Otherwise, a research mandate will be just one more charge to our growing list of responsibilites and we'll end up doing even *more* with less.

As a superintendent perhaps its easier for me to see the backlog in maintenance, the Interpretive Challenge's charge to "double the budget," the crumbling fabric of historic resources and lost artifacts, and the plea for just "X" percent of the budget. But the latter—the "(5, 10, or 15) percent"—could apply equally to any of the former. What that really tells me is that the Service, and the resources in its charge, are all in the same boat....and its leaking.

Each of us, regardless of specialty, whether in research or maintenance, interpretation or protection, could use "just 15 percent." But we won't get it on principle. All our resources need more attention, and none are getting the attention they deserve. But if we can just *learn the rules*.....and play the game—with new rules, or old, we can all win, and be winners.

What's the difference between Everglades, Yellowstone and Mammoth Cave? The water of the first two is *seen*. The underground water of Mammoth Cave is out of sight....and out of mind. Were it not for basic research, park managers' finally realizing the potential for disaster, the support of park neighbors, money to contribute to the solution, and a lot of luck, we might have a whole different story to tell. But is there that much difference between us and you? Isn't our experience just an example of what could happen in similar situations Servicewide?

It seems to me we could follow a similar scenario on a national level to identify park problems, point out the potential, garner support, and change the rules. After all, we have a leaky boat, we're loaded to the gunwales, and the wind's picking up..... We seem to be arguing over whose leak gets fixed first. Maybe we need a bigger boat.

Let's appeal for that which has appeal. "Mega-charismatic.." hey, what's the most charismatic federal agency *you* know?

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Evaluating Science in the National Park Service

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Preface

The following paper was written in 1977 when science program evaluation was considered a high priority item and plans were underway to establish formal evaluation procedures for the National Park Service on a Servicewide basis. Subsequent organizational and functional changes in the Washington Office negated these plans and the paper was set aside and essentially forgotten. It is resurrected here as originally written for what it is—an historical document. Although the concepts presented were conceived over a decade ago they appear to be just as viable today as they were when first written, and as such, may be of use to those persons wishing to scrutinize their own research program(s).

Introduction

The Chief Scientist of the National Park Service (NPS) is the principal assistant to the Director for science and technology. He is responsible for the overall guidance, policy formulation and program evaluation of the Servicewide science program. The program is regionalized so that each Regional Director exerts managerial control over science in his region. The Regional Chief Scientist is the principal assistant to the Regional Director and is responsible for the operational aspects and technical guidance for the program. This includes inhouse research conducted by Service scientists stationed in parks or universities and work contracted out to cooperating universities, etc.

Measuring the performance of such a diverse program requires a system of program evaluation in order to monitor program quality, adequacy and effectiveness. This involves scientific reviews by technically and/or administratively qualified and experienced scientists for determining program status and making recommendations for adjustments as required.

The establishment and conduct of these scientific reviews, the scheduling of site visits and the development of evaluation reports and recommendations become fairly routine once a system is established and fully operational. However, before implementing such a system the program in question must be examined to determine its component parts. Once identified they can serve as the program entities upon which evaluations are based.

Identifying these components and some obvious relationships between them is the subject of this paper.

Attributes of Mission Oriented Science

Mission oriented science concerns the conduct of research and related activities for the purpose of satisfying particular information requirements of management. This 'goal achievement' quality suggests that certain basic attributes may exist which would be common to mission oriented programs in general. These attributes are identified and defined as follows:

Planning—the identification of research needs which are based upon the specific information requirements of management.

Administration—the utilization of available manpower, funding and related administrative resources to develop, implement and operate an effective scientific research program.

Execution —the implementation and conduct of scientific investigations, utilizing existing administrative resources, for acquiring data to meet research needs.

Utilization—the development, reporting, systematizing and distribution of information resulting from research.

Integration—the policy implications of the management actions that are implied by the scientific research findings, depending on the degree to which the actions are consistent with existing policy.

Impact—the implementation and effectiveness of management actions which are initiated as a result of applying information from research findings.

Furthermore, a direct relationship appears to exist between these attributes and it can be represented graphically in a simple flow diagram (Fig. 1).

Components of the NPS Science Program

Assuming that these attributes are fundamentally common to mission oriented programs in general, they can be used as a basis for determining the composition of specific programs. An examination was made of the NPS science program utilizing these attributes to determine its composition preparatory to, and for the purpose of, developing a system of program evaluation. This examination revealed various program elements that could be classified under broad, subject categories corresponding to the attributes discussed above. These categories were identified as follows:

I Research Goals (Planning)
II Research Resources (Administration)
III Ongoing Research (Execution)
IV Research Application (Utilization)
V Policy Implications (Integration)
VI Management Actions (Impact)

The program elements, when classified under these categories, depict the composition of the NPS science program and form the basis for developing program evaluation guidelines.

Outline of Program Elements

The composition of the science program is readily discernible when the program elements (general and more specific) are presented by category in outline form:

The NPS Science Program

I. Research Goals (Planning)

A. **Identification of Descriptive Research Needs.**
An information base called the Resources Basic Inventory (RBI) is utilized for planning and managing park areas. It consists of the compilation of existing information and acquired new information to describe the present status of natural resources, historic resources and the social, economic and demographic characteristics of parks or potential park areas. (National Park Service 1975, p. II-1) These RBI needs must be identified for:

1. **Management Objectives**
Guidelines for developing the General Management Plan (defined under IA-3 below) and park operations (until plan is completed) which are consistent with NPS policies and purposes (National Park Service 1975, p. II-2).

2. **Outline of Planning Requirements**
An information statement of the specific planning tasks needed to meet park management objectives which lists plans, related studies and information requirements.
3. **General Management Plan**
A plan providing for the realization of park purpose, under applicable legislation and management policy, which defines long term park management objectives and provides the strategy for achievement (National Park Service 1975, p. II-2 thru 6).
4. **Specific Management Plans**
Includes Resources Management Plans, Interpretive Plans and Visitor Use Plans (defined under IB-1, 2, 3 below).
5. **Environmental Impact Statements**
Statements required for the environmental assessment of proposed management actions under the National Environmental Policy Act of 1969.
6. **Various Development and Management Actions**
Other proposed actions that may come to need the benefit of an information base prior to implementation.

B. **Identification of Analytical Research Needs**
New information is required when existing information is insufficient for solving a resources management problem or making a management decision. These analytical research needs must be identified for the development of:
1. **Resources Management Plan**
A natural resources studies and management plan for continual protection, management and maintenance of the natural resources to achieve the purpose and objectives of a park area and to appropriately regulate the effects of park use. It identifies and defines the equilibrium condition to be achieved and/or maintained regarding principal ecosystems and specifies actions including alternatives to achieve and or maintain that condition (National Park Service 1971, IV(5) p.1-2).
2. **Interpretive Plan**
A plan for providing a program to communicate an appreciation of park resources and values, a basic understanding of forces shaping the environment, an awareness of the individual as part of the environment, and a human dependency upon and responsibility for environmental quality (National Park Service 1975, p. VII-2).
3. **Visitor Use Plan**
A plan for the development and management of recreational activities which provides for appropriate visitor use and enjoyment without impairment to natural resources and opportunities for authorized activities with a minimum of direction consistent with visitor health, safety and resource protection (National Park Service 1971, V(1) p. 1-12).
4. **Contingency Plan**
An informal, backup plan to accommodate special situations that might arise suddenly and that may require the expenditure of funds and assignment of manpower not covered in the above action plans.

II. Research Resources (Administration)

A. **Program Organization**

The organization of a program must fit the mission to be accomplished. The NPS must effectively utilize its own scientists and those of cooperating universities for accomplishing research goals. Therefore the program must be coordinated regarding:

1. **Science Offices/Personnel**

Science personnel should be in an appropriate organization scheme considering:

a. **Staffing requirements** to insure meeting program needs for inhouse performance of research and administration of contractual research.

b. **Role and function statements** to define the role and function of each organizational unit and each employee within that unit (National Park Service 1971, p. 2).

c. **Personal standards of performance** to describe the results to be expected and obtained when each employee satisfactorily performs his or her functions (National Park Service 1971, p. 2).

d. **Cooperation/coordination with related programs** as required to insure proper scientific assistance for the other programs being served.

2. **University Research Centers**

By means of cooperative agreements, centers of research are established whereby universities are utilized for acquiring data as an adjunct to research performed by NPS scientists duty stationed in parks and/or by contract with other government agencies. Coordination of inhouse capabilities with use of research centers must consider:

a. **University research programs** administered by the Regional Chief Scientists to provide assistance to parks in fulfilling their research needs in the context of overall regional priorities.

b. **Status of master memorandum of understanding** to insure that a valid agreement exists between NPS and the cooperating university for the work to be performed.

c. **Administration of current contracts** by the contracting officer's representative to insure that the terms of the contract are being met including adherence to the work plan upon which the contract is based.

d. **Annual cooperative review** by representatives of NPS and the cooperating university to insure that terms of the agreement are being met.

e. **Five-year termination/renewal review** to determine by scientific review the past performance of the university research center and to determine the adviseability of renewing the agreement for another 5 year period.

f. **Cooperation/coordination between region, university and the parks served** to insure that an appropriate relationship exists for meeting designated research goals.

B. **Program Development**

The operation of a program involves meeting certain administrative requirements in order to properly support program activities:

1. **Programming**

The process of requesting adequate funds to meet research needs through the established programming procedures (Norwood 1974) considering:

a. **Conformance to research goals** during the programming process to insure that approved priority needs are met.

b. **Cooperation/coordination in program preparation** between science and programming offices to insure timely and accurate submission and consideration of requests in the programming cycle.

2. **Budget (Funding)**

The funds available through the programming process for meeting research needs considering:

a. **Allotment of funds** in a timely manner.

b. **Identification of funds** throughout the allocation process for clear records on how the funds are being disbursed and for what purpose.

3. **Finance (Accounting)**

The process of recording actual expenditures of science funds as opposed to those which were allotted considering:

a. **Monitoring of research expenditures** in a manner that insures an accurate accounting at all program levels.

b. **Procedures for financial reporting,** which accurately report expenditures appropriate program levels in a timely manner.

4. **Contracting**

The act of having research performed by outside (of NPS) sources considering:

a. **Conformance to rules/regulations** regarding negotiation, sole source requirements, etc. (Tidwell and Metrinko 1975).

b. **Timeliness of issuing contracts** once funds are allotted, to insure meeting research needs promptly.

c. **Monitoring of contracts** by the contracting officer's representative to insure conformance quality of work and adherence to work plan (contract objectives).

5. **Personnel**

The placement of well qualified people in available positions to meet science program needs considering:

a. **Manpower requirements** adequate to meet staffing needs.

b. **Position classification** in accordance with the demands of the job and qualifications of incumbent scientists.

c. **Recruitment procedures** that provide proper review of applicant qualifications by scientists before positions are filled.

C. **Program Quality Control**

The performance of individual scientists and the conduct of scientific research and related activities must be systematically monitored through:

1. **Research Grade Evaluation**

The measurement of research personnel performance utilizing the generally accepted guidelines (Civil Service Commission, 1964; and Walker 1973) including:

a. **Establishment/utilization of scientific peer review system** to properly perform research grade evaluation on scientific personnel and positions on a routine basis.

b. **Directory of positions/personnel** to insure proper monitoring of all science personnel and positions for use in the continual research grade evaluation process and for overseeing the filling of vacancies with qualified applicants.
c. **Schedule of reviews** to provide research grade evaluation for each research scientist/position on a routine basis.
d. **Implementation of review recommendations** by the responsible office to provide research scientist with appropriate job status or to grade the position accordingly.
e. **Utilization of reviews in recruitment** for filling vacancies to insure that qualified applicants are considered for the job.

2. **Science Program Evaluation**

The monitoring of the conduct of the science program to insure the quality, adequacy and effectiveness of scientific research and related activities in meeting the needs of park management by:

a. **Development/use of scientific peer review system** to evaluate science program status (as per elements in this outline) through site visits on a routine basis.
b. **Directory of sites (programs)** to be evaluated in order to insure the review of all significant programs on a continual basis.
c. **Schedule of site visits** by peer review panels to provide science program evaluation on a routine basis.
d. **Implementation of peer review recommendations** by the responsible office to insure the highest quality of program performance.

3. **Research Review**

The measurement of the excellence of research which is conducted to meet research goals considering:

a. **Degree natural science studies at standard** regarding the classification, inventory and analysis of the natural resources as prescribed by NPS Standards (National Park Service 1971, IV(S) p. 20-4).
b. **Conformance to science policy** of ongoing research to insure meeting the science mission of providing information for the decision making process (National Park Service 1975 p. IV-2; and Walker 1974c).

D. **Program Guidelines**

Appropriate procedures in the form of handbooks (National Park Service 1965), directives, etc., must be adhered to for uniformity of conducting the various aspects of the science program considering:

1. **Conformity to Accepted Procedures**

The utilization of currently accepted guidelines in the day to day operation of various aspects of the science program.

2. **Monitoring of Performance**

The systematic review by the responsible science administrators of the implementation and use of program guidelines to assure the uniformity of operation on a Servicewide basis.

III. Ongoing Research (Execution)

A. **Identification of Present Needs**

The determination as to whether or not existing research activities properly conform to present management problems, as expressed in existing action plans or not, such that the research needs are being implemented for:

1. **General Management/Operations**
   The studies required for solution of current management/operations problems.
2. **Planning, Design, Construction**
   The studies required for planning design and construction when environmental matters are involved.
3. **Natural Resources Management**
   The studies required to support present natural resources management needs.
4. **Natural History Interpretation/Education**
   The studies required for supporting the present natural history interpretation and environmental education program needs.
5. **Environmental Monitoring**
   The base line studies required to determine existing environmental conditions and the measurement of changes periodically to determine future trends.

B. **Adequacy of Research**

In the context of ongoing research (above) a determination must be made on its adequacy as judged in its relation to:

1. **Objectives**
   The purpose of each study must be properly defined in accordance with the problem to be solved.
2. **Study Design**
   The design of each study must meet the needs of the work to be accomplished by insuring the adequacy of:
   a. **Methods** for conducting the study.
   b. **Logistics** for coordinating the use of manpower and equipment to properly conduct the study.
   c. **Equipment** for making the necessary measurements, etc.
3. **Results**
   The adequacy of study results must be determined in relation to:
   a. **Data acquisition** being accomplished in an efficient and appropriate manner.
   b. **Data analysis** being conducted with accuracy and objectivity.
   c. **Conclusions** being drawn from adequate data of sufficient quality in an objective manner.
4. **Recommendations**
   The information derived from new research data must be placed in useable form for consideration by management during the decision making process regarding:
   a. **Alternative actions** that can be taken to alleviate the management problem under consideration.
   b. **Recommended action** that is proposed as the best alternative action for management to pursue, based on objective scientific review of the situation in question.

IV. Research Application (Utilization)

A. **Reporting of Research Findings**

The information derived from new research data must be reported in a timely manner by various means:

1. **Oral Reports**

   An immediate form of communication for alerting the manager and other scientists of new information as soon after its derivation from research data as possible.

2. **Preliminary Written Progress Reports**

   The presentation in some printed form of tentative research findings as a follow-up to the oral report (above).

3. **Annual Progress Reports**

   The yearly compilation, by the Regional Chief Scientists, of status reports on ongoing research and summaries of work completed in park areas during the calendar year including work funded by NPS and other sources.

4. **Publication in Scientific Literature**

   The making available of new information in its formal, printed form through the appropriate scientific journals, etc.

5. **Distribution of Unpublished Reports and Publications**

   The making of new information available in various forms of printed documents including:

   a. **Inhouse** distribution to NPS managers and scientists for information and/or use.

   b. **Other** distribution to outside managers and scientists for information and/or use.

B. **Information Management Systems**

In order to provide for intensive and widespread use of research findings by scientists and managers alike the data must become part of a computerized information system(s) for storage, retrieval, analysis and manipulation considering:

1. **Standardization of Data Elements**

   The utilization of appropriate Servicewide standards on data gathering, format and treatment thereof to insure the uniformity of inputed data and its usability regardless of where or why it is collected.

2. **Ecological and Environmental Management Information System**

   In order to be effective, this system for handling information (U.S. Congress H.R. 1972; and National Park Service 1972) must have the benefit of continual input of new data from various sources in a standardized form and provide outputs for:

   a. **Research** to determine what information already exists on certain subjects before recommending actual research needs for any given management problem.

   b. **Natural resources management** to determine what information is available before taking specific management actions and/or developing management programs.

   c. **Natural history interpretation/education** to develop accurate and up-to-date informational programs.

   d. **Planning, design and construction** to use in the planning process and follow-up stages of park development.

C. **Information Exchange**

The concept of exchanging information in various forms with cooperating organizations, including the interchange of knowledge through computerized information systems including:

1. **Smithsonian Science Information Exchange**

   A clearinghouse for scientific information on current research actually in progress, involving government and non-government agencies with major research programs which furnish timely information on current research programs and projects.

2. **Cooperating Federal, State and Local Agencies**

   All research findings of the NPS should be readily available to other agencies for their information and use and vice versa.

3. **Cooperating Universities**

   Because the NPS relies heavily on cooperating universities for acquiring research data there must be free and efficient exchange to support NPS research and management programs.

4. **Cooperating Countries**

   As with domestic agencies, the NPS should freely exchange information in its relationship with foreign countries (Russia, Spain, Mexico, Australia, Japan, and Canada) regarding research on and management of natural areas, etc.

V. Policy Implications (Integration)

A. **Status of Management Actions which Research Findings Imply**

The purpose of a mission oriented science program is to provide information for use in the decision making process. The decision on a proper course of actions, based on the specific information provided, must be made in light of existing policy allowing:

1. **Management Acceptance and Implementation if Implied actions are Consistent with Existing Policy**

   No conflict exists if management actions which the research findings imply are consistent with existing policy, thus allowing the actions to be accepted and implemented by management, or

2. **Rejection and/or Alternative (below) if Implied Actions are Inconsistent with Policy**

   A conflict exists if management actions which the research findings imply are inconsistent with existing policy, causing the implied actions to be summarily rejected or an alternative taken.

B. **Analysis/Status of Policy if Implied Actions are Inconsistent with Existing Policy**

If management actions which research findings imply are inconsistent with existing policy and the implied actions are not summarily rejected then an analysis of the existing policy is required, leading to one of the following alternatives:

1. **Suspension of Existing Policy for Implementation of an Implied Management Action (when warranted)**

   Depending on the situation (political, etc.) the existing policy may have to be suspended so that the implied management action can be implemented.

2. **Modification of Existing Policy to Accommodate Implied Actions**
   The situation may be such that a simple modification of existing policy may be desirable in order to accommodate the implied management action.
3. **Formulation of New Policy (if required)**
   If neither a suspension or modification of existing policy is acceptable then the remaining alternative is to abolish the existing policy and formulate new policy in order to accommodate the management actions which the new research findings imply.

VI. Management Actions (Impact)

A. **Implementation of Management Plans**
Basic to the proper management of natural area parks is the implementation of action plans that institute management programs and provide for the identification, programming and budgeting for research needs through:

1. **General Management Plans]**
   (See under IA3 above)
2. **Resources Management Plans**
   (See under IB1 above)
3. **Interpretive Plans**
   (See under IB2 above)
4. **Visitor Use Plans**
   (See under IB3 above)

B. **Effectiveness of Management Programs**
The impact of research findings on management of the natural resources of park areas can be determined by measuring the effectiveness of the programs that result from implementation of the management plans by considering:

1. **Degree Natural Resources Management at Standard**
   The adequacy of management of the natural resources of park areas should be periodically determined with regard to (1) implementation of management plans, (2) maintaining an alert on threats to ecosystems, (3) encouragement of resource studies by outside scientists, (4) implementation of regional planning and wildlife management, (5) public awareness of NPS objectives for resources management, and (6) exercising an overview as to condition and effectiveness of the management of the natural resources as prescribed by NPS standards. (National Park Service 1971, IV(5) p. 1-2).
2. **Conformance to Management Policies**
   The adherence to management policies with regard to preservation of heritage, resources management, park use, etc. in accordance with NPS Management Policies (National Park Service 1975).

C. **Updating/Development of Management Plans**
Based on present resource problems and environmental conditions of natural area parks the various existing action plans must be updated periodically, and/or new plans developed for new areas, to insure proper management planning and to allow for implementation of proper management programs considering:

1. **Identification of Management Problems/Actions**
   The best professional advice available from within and/or without the NPS should be sought for the identification of resources management problems and courses of actions to be taken for preserving, maintaining and restoring natural resources.
2. **Determination of Need for Research**
   It must be determined if the management problems identified can be solved through use of existing information, whether research is required to obtain new information, or a combination of both. If new research is required then these needs must be specifically identified and overall research goals formulated for achieving these needs.

Discussion

Thus, various elements of the NPS science program have been identified and classified under subject categories that correspond to the six suggested attributes of mission oriented science. These categories of program elements have the same relationship to one another as the attributes of mission oriented science they represent (Fig. 2).

Other properties of the NPS science program are revealed when certain combinations of categories are made (Fig. 2). Combined, the categories of Research Goals, Research Resources and Ongoing Research represent program elements involving efforts that lead up to and include making scientific information available. These then represent the "input" aspects of the science program. Similarly, the combined categories of Research Application, Policy Implication and Management Actions represent program elements involving efforts toward application of the information by management. These represent the "output" aspects of the program.

The overall effectiveness of the science program not only depends on the quality and adequacy of the data being acquired (input) but also on how the information derived from this data is used (output), or influences, the decision making process of management. Furthermore, there must be proper feedback back into the science planning process to keep the whole program tuned to current management needs as time passes. This interdependence of deriving information, its use, and the feedback of results from management actions must be fully understood by managers and scientists alike. Otherwise, an organization's scientific efforts will not be able to serve the best interests of the overall mission.

Summary

Basic attributes of mission oriented science were suggested and defined during examination of the NPS science program to determine its composition. The examination resulted in the identification of various program elements, which can be classified under broad subject matter categories that correspond to these attributes. These results are presented in an annotated outline, which depicts the composition of the program and

which can serve as guidelines during the process of program evaluation. Relationships between subject categories and the program elements they represent also are explored.

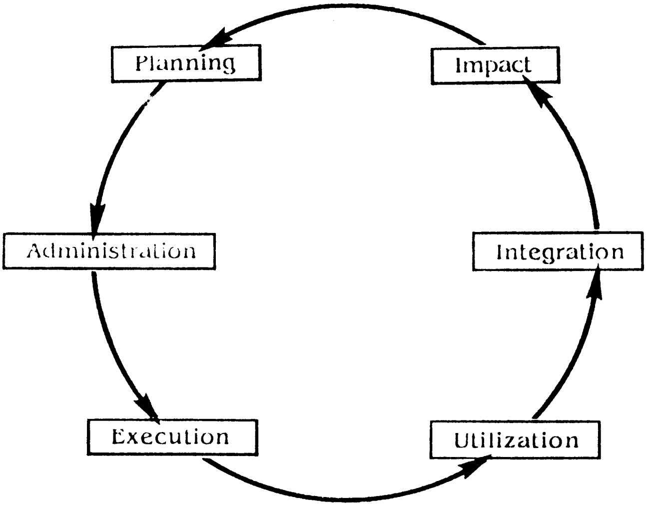

Figure 1. The relationships between the basic attributes of mission oriented science.

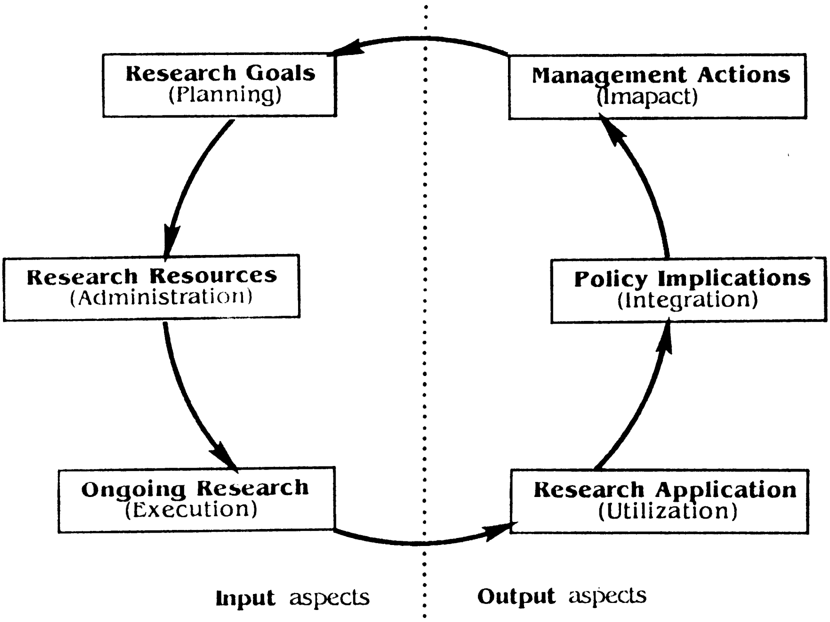

Figure 2. The relationships between the categories of program elements which comprise the National Park Service science program.

Society News and Notes

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Triennial Election Results

As this issue goes to press, results of the recent election have been tallied—in fact, we held-off publication for several days because the results had two candidates running for board positions who were neck-and-neck. Finally a one-vote margin was achieved; however, the voting was quite close in all contested "races."

To avoid giving first-named candidates an advantage, each candidate's name appeared 1st, 2nd, 3rd, etc. an equal number of times (i.e., there were six different ballot sequences in equal numbers).

It was apparent from almost the beginning that a sufficient amount of information about each candidate was not given. When the Society was in its infancy everyone knew nearly everyone else; we've grown considerably and we'll have to shift gears on that aspect for the next time.

The officers and board directors for the triennium 1989 through December 31, 1991 are:

President: Melody Webb

Vice President: Gary E. Davis

Secretary: Stephanie Toothman

Treasurer: Lloyd L. Loope

Directors on the Board:

Jonathon W. Bayless

Susan Bratton

Kheryn Klubnikin

Stephen D. Veirs

Election Committee (Vote Counters): R. Stottlemyer and R. Linn, 25 July 1989.

Sixth Conference on Research in the National Parks and Equivalent Reserves

El Paso, Texas

November 1990

Co-Chairmen:

Thomas M. Gavin
Western Region, US NPS
450 Golden Gate Ave.
San Francisco, CA 94102
[415-556-1866]

Franklin G. Smith, Superintendent
Chamizal National Memorial
1364 Backus
El Paso, TX 79925
[915-534-6277]

The Co-Chairmen will select session chairmen, committees, etc., in preparation for this conference, as well as arrange meeting facilities and services. They'll welcome any support we can give them.