Protecting Our Diverse Heritage

The Role of Parks, Protected Areas, and Cultural Sites

Proceedings of the George Wright Society / National Park Service Joint Conference
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edited by
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Cover photos (top to bottom): girls planting trees in a park in the Bronx, New York (National Park Service photo); kayaker at Selby Lake, Gates of the Arctic National Park and Preserve (National Park Service photo); Calumet & Hecla Public Library (now the Keweenaw History Center), Keweenaw National Historical Park (National Park Service photo). Thanks to Gillian Bowser, Steve Ulvi, and Tom Baker for providing the photos.

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The lineage of the George Wright Society (GWS) biennial conferences on research and resource management in parks stretches back almost to the beginnings of the organization itself. In 1982, just two years into its existence, the GWS took over sponsorship and organization of a national-level science conference focused on U.S. national parks. There had been two of these meetings, in 1976 and 1979, both sponsored by the National Park Service (NPS). When the GWS took over the event in 1982, it expanded its scope to include cultural resources as well as parks outside the National Park System. Nonetheless, the GWS conferences have always been done in close coordination with NPS.

The 2003 conference was no exception. "Protecting Our Diverse Heritage: The Role of Parks, Protected Areas, and Cultural Sites" was billed as a joint conference between GWS and NPS because it merged the GWS biennial conference with NPS's national-level cultural resources conference (which had been revived, after a long hiatus, in 2000). The result was that the GWS/CR2003 conference had the highest amount of cultural resources content ever for a GWS event. Thanks to an expanded number of sessions, the natural resource content was not thereby diminished, and in addition there were numerous sessions that could not be easily pigeonholed as one or the other. All of this is well in keeping with the GWS's interdisciplinary mission.

Despite the war in Iraq and its attendant budgetary consequences for the federal government, over 850 people attended GWS/CR2003, which was held in San Diego in mid-April. This was the highest attendance since the GWS began its involvement. The next meeting, the 13th in the series, will be March 2005 in Philadelphia.

By prior arrangement, several wilderness-related papers from the conference have been published in the GWS's quarterly journal, THE GEORGE WRIGHT FORUM, and are therefore not included here. The papers, guest-edited by David J. Parsons and David N. Cole, were published under the title "The Challenge of Wilderness Stewardship" (volume 20, number 3, September 2003). They are:

- The Challenge of Wilderness Stewardship / *David J. Parsons and David N. Cole*
- Agency Policy and the Resolution of Wilderness Stewardship Dilemmas / *David N. Cole*
- Ecological Restoration in Wilderness: Natural versus Wild in National Park Service Wilderness / *David M. Graber*
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- Selecting Indicators and Understanding Their Role in Wilderness Experience Stewardship at Gates of the Arctic National Park and Preserve / *Brian Glaspell, Alan Watson, Katie Kneeshaw, and Don Pendergrast*
- Computer Simulation as a Tool for Developing Alternatives for Managing Crowding at Wilderness Campsites on Isle Royale / *Steven R. Lawson, Ann Mayo Kiely, and Robert E. Manning*

- Cultural Resource Management in National Park Service Wilderness Areas: Conflict or Cooperation? / *Gary F. Somers*
- Securing an Enduring Wilderness in the National Park System: The Role of the National Wilderness Steering Committee / *Wes Henry and Steve Ulvi*

As with all back issues of The George Wright Forum, this one can be downloaded from the GWS website (www.georgewright.org) as a series of PDF files. Hard copies of that issue can be purchased from the GWS, as can this proceedings volume (paperback or CD). Contact details are on the copyright page.

Many people worked hard behind the scenes to make the conference a reality. In an event of this size, there are too many to name individually, but the GWS and the conference committee extends its sincere thanks to all who helped. We are especially grateful to our co-sponsors (the National Park Service, U.S. Geological Survey, and California Department of Parks and Recreation) and our supporting organizations (Eastern National and the Environmental Careers Organization). Their financial and logistical support are vital to the success of these conferences.

Using State Laws and Regulations to Protect Parks from Adjacent Development Impacts: A Case Study from Hawaii

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Introduction

Although federal laws, regulations, and management policies govern the management of national parks, parks have little control over surrounding lands. The parks most often affected by surrounding development are small parks and those in urbanizing areas. This paper provides an example of how development outside of a park might affect park resources and how a park can use state and local land use processes to help protect those resources. Kaloko–Honokohau National Historical Park, located on the island of Hawaii, formally intervened in an administrative hearing before the Hawaii Land Use Commission (LUC) regarding a proposed industrial development upslope of the park. In this specific case, the park entered into a contested-case hearing with TSA Corporation, which sought to have the classification of 102 acres of land changed from "Conservation" to "Urban" for the expansion of Kaloko Industrial Park.

Setting

Kaloko–Honokohau National Historical Park was established to "provide a center for the preservation, interpretation and culture, and to demonstrate historic land use patterns as well as provide needed resources for the education, enjoyment, and appreciation of ... traditional native Hawaiian activities and culture by local residents and visitors...." The park encompasses an area rich in native Hawaiian sacred places and traditional practices. Located on the west coast of Hawaii Island, the park consists of 564 acres of terrestrial and 596 acres of marine ecosystems. It contains 11 endangered, threatened, and candidate species and over 230 archeological sites. Three lava flows from Hualalai Volcano dominate the landscape, as do invasive plant communities.

The park's cultural resources include Kaloko Fishpond, Aimakapa Fishpond, and Aiopio Fishtrap, all of which historically provided fish for Hawaiian families. Kaloko Fishpond is one of the most significant cultural features in the Park. The fishpond could produce up to 5,000 pounds of fish per year. The park waters are a central element in many Native Hawaiian practices and rituals performed within the park boundaries. These traditional practices rely heavily on the quality of the water, including groundwater, in the national park.

The park is located on the leeward, or dry, side of the island in the rain shadow of Hualalai Volcano and receives 15 to 20 inches of rainfall a year. However, orographic convection produces between 40 and 60 inches of rain upslope at elevations ranging from 1,000 to 6,000 ft. The porous nature of the lava allows rainfall to seep quickly underground; consequently there are no permanent streams on the west side of the island. Groundwater eventually emerges as slightly brackish anchialine pools along the coast as the lighter freshwater lens rides over the heavier seawater. Freshwater springs are also found offshore. As this water flows downslope to the park it passes beneath development and can carry nutrients and contaminants produced or discharged there. The purpose of the park's intervening in the land use change process was to have this and future developers minimize or eliminate potential contamination of the groundwater, thus reducing potential effects on park natural and cultural resources.

Hawaii Land Use Commission

State law created the LUC in 1961 and Hawaii was the first to have a land use law. Significant revisions to the law were made in 1974. There are nine governor-appointed commissioners, one from each of the four counties and five from the public at large. Commissioners are generally a mix of lawyers, developers, and union leaders. The original organizing principles of the LUC were efficient urbanization and the preservation of agricultural and conservation lands. By law, the decision-making process of the LUC is quasi-judicial in nature to ensure that those who are affected by the decision are accorded due process before an action is taken. The park's case was strengthened by two recent Hawaii Supreme Court decisions that reaffirmed the state's constitutional requirement to protect native Hawaiian traditional and customary rights exercised for subsistence, cultural, and religious purposes. In one of those cases, the Supreme Court specifically found that the LUC had run afoul of its obligation to uphold such rights.

Land Use Classification

The LUC recognizes four categories of land classification: Urban (4.7% of the state) Conservation (48%), Agriculture (47%), and Rural (2.3%). In Hawaii, counties have exclusive administration over land uses within the Urban district. Once classified by the state as Urban, county zoning laws and regulations apply. One reason the park intervened at the state level is that we believed the state was more likely to impose additional and stricter conditions on the developer than Hawaii County.

Procedures and Proceedings

In April 2000, the park received an environmental impact statement (EIS) preparation notice from TSA Corporation for the expansion of Kaloko Industrial Park as part of a petition to the LUC to change the property's land use designation from Conservation to Urban. The park responded to the notice, voicing our concern for water quality and concern with the current development. Specifically, contaminants had been found in park wells, fishpond sediments, and fish tissue, and some waters were showing evidence of nutrification. We felt that these impacts could be attributed to the use of cesspools for wastewater disposal and dry wells for stormwater runoff in the first phases of Kaloko Industrial Park. TSA Corporation published its draft EIS for comment in August 2000. The park again commented, noting the inadequacy of scientific study to show that there would be no impact to the park from upslope development. TSA stated that they would upgrade wastewater disposal to a standard septic tank. The park argued that standard septic tanks and dry wells were inadequate methods of water treatment. The LUC held a hearing in November on the TSA EIS. The National Park Service (NPS) attended and, asserting that the EIS was inadequate, requested that the commission reject it. However the commission voted to accept the EIS.

Once the commission accepted the EIS, the park's only recourse was to become an intervening party in the LUC hearing process. The park was also encouraged to intervene by the State Office of Planning, which was concerned that the proposed development would adversely affect the environment but did not have access to the high level of expertise as did NPS. The park's desire was not to stop development but rather to ensure that it would not adversely affect park resources, primarily those dependent on good water quality. We requested four broad conditions be placed on the developer: (1) enhanced wastewater treatment to reduce nutrients; (2) stormwater runoff containment and treatment; (3) monitoring of water quality; and (4) a pollution prevention plan specific to the types of businesses that could be located within the development.

As an intervener, the park enjoyed the same standing as the other parties in this hearing: the petitioner (TSA Corporation), State

Office of Planning, and Hawaii County. We could enter and present evidence, and cross-examine and call witnesses. Legal representation is not required before the LUC. The park started the first hearing without an attorney but after having a commissioner point a finger and shout, "Park Service, get a lawyer!" we knew we needed one.

From March 2001 to February 2002 the LUC held eight hearings on the TSA petition. Perhaps the most significant event for the park came early in the hearing process when the LUC conducted a site visit to Kaloko–Honokohau. All nine commissioners and parties were present. None of the commissioners had visited the park and prior to their visit viewed the area as an unproductive lava field. Once commissioners saw and understood the significance of park's cultural and natural resources, they were much more sympathetic to the our position.

Beginning with the petitioner, each party called its expert witnesses. The petitioner had experts in groundwater, marine resources, pollution prevention, botany, wildlife biology, cultural resources, and wastewater engineering and stormwater management. State and county experts were engineers with comments on wastewater and stormwater management.

The core NPS team consisted of Nicole Walthall, an assistant field solicitor from the San Francisco Field Office; Stanley Bond, integrated resource manager; Sallie Beavers, marine ecologist; and Roy Irwin from the NPS Water Resources Division. The team pulled together information that questioned the developer's findings of no effect on the park and contacted individuals who could provide relevant information and serve as expert witnesses. The park assembled an impressive list of expert witnesses from throughout the NPS, Department of the Interior, and other public and private organizations.

Needless to say there were significant disagreements between the developer's experts, who claimed that the development would have no impact, and NPS experts, who demonstrated that the developer's studies were flawed. The weakness of the petitioner's studies and its inability to support a claim of no impact to the park was the focus of NPS' case. Testimony from state and county witnesses showed that county, state, and federal laws did not protect groundwater, except in the case of drinking water. Even the LUC members were incredulous over some of the developer's testimony, and the high point was when one commissioner, after hearing that a 10,000-gallon gasoline spill would not reach the park, stated (in Hawaiian Pidgin): "So far today I never hear anybody say it's not going to happen. All I been hearing 'it could not happen.' So you no need to be a rocket scientist to figure this out. Your spill in the area, especially on the Kona side with all the lava tubes and the cracks, you going to contain a spill in that area? I get only 12 grades of education, but I not dumb."

Outcome

Following the public hearings, each party prepared a draft Findings of Fact, Conclusions of Law, and Decision and Order. Ultimately, the LUC "supported [the precautionary principle] as applied to National Parks and determined that, for all proposed development adjacent to or near a National Park that raises threats of harm to the environment, cultural resources, or human health, precautionary measures should be taken to protect the National Park cultural and natural resources, even if some cause and effect relationships are not fully established scientifically" (Finding no. 165). The LUC adopted much of the language that was in the NPS version. As to the adequacy of the Findings on impacts to the park, the LUC stated: "For this petition, there was a lack of scientific study and research as to the potential adverse impacts from the proposed development. No risk assessments as prescribed by the NPS have been done to determine that no harm will come to the resources of the National Park, including anchialine ponds, the coral reef, and endangered and threatened species that rely on the health of those systems for habitat, and are considered sacred to native Hawaiians. Contrary to petitioner's position, a lack of scientific inquiry is cause for caution" (Finding no. 171). "There is an absence in the evidence of competent and reliable studies showing that the proposed industrial development would not adversely impact the National Park's resources" (Finding no. 294). "Contamination of groundwater, increased nutrient load in the groundwater, changes in salinity of groundwater, and changes in groundwater volume alter the natural ecosystems in the National Park. The myriad of potential impacts from such changes—ranging from massive bird die-offs from avian botulism to increased population of toxic algae growth in the ponds—remains inadequately assessed and lack sufficient scientific study" (Finding no. 339).

The LUC concluded that, by law, it was required to develop and impose conditions that protected national park resources. In its Decision and Order, the LUC imposed 28 conditions on the development. For wastewater treatment, the lot owners are required to hook up to the central wastewater treatment system when it becomes available. Prior to availability, lot owners can use an enhanced septic system that removes 92% of the nitrogen and has added phosphorus removal. Only 45% of the lots (38) can be built upon prior to connection to the central wastewater treatment plant. For stormwater runoff, lot owners have to at least use oil/water separators or filters prior to runoff entering the ground. If a business uses nonpetroleum-based toxic substances, then the catchment basin must be designed to trap and remove them prior to the water entering the ground. The developer has to pay a pro-rated share of water-quality monitoring costs over the next ten years and produce a new Pollution Prevention Plan that is acceptable to the park and other parties.

Impact on Future Development

The LUC made it clear that these conditions would apply to other developers in the area of the park. A second commercial/light industrial development is planned for Conservation land directly south of this petition area and the park has successfully negotiated conditions with this developer. There are also broader implications to this ruling than simple effects on park resources. It appears that this Decision and Order has set an important precedent and that all future development adjacent to Class AA waters, not just in the vicinity of the park, will also likely be required to conform to these conditions.

Lessons Learned

- Comment at every opportunity so there is a record of your concerns.
- Get legal help from the Solicitor's Office early in the process. Legal processes are never simple or easy and are generally complex and extremely time consuming.
- Know what you want from the decision-making body.
- Use experts to analyze scientific documents and for testimony. Where possible, use qualified local experts who are familiar with the resource.
- Make sure your paperwork is in on time.
- Get the decision-makers to the site. Make your park and its resources concrete, not an abstraction.
- Reach out to the local community for public testimony. In the rush to pull evidence, information, and witnesses together, this is perhaps the area where we failed. It likely did not affect the final outcome, but could in future hearings.

Preparing for Conservation—Strategies for the Next Century (Session Summary)

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Although the attendance was small, the scope and potential of this discussion was significant. The session was organized and speakers were introduced by Judy Alderson, national natural landmarks program coordinator and wilderness coordinator for Alaska, National Park Service (NPS), Alaska Support Office. Steve Elkinton, program leader for the National Trails System in the Washington office of NPS, started the presentations by outlining the director's concept of the "Seamless System of Parks, Special Places, and Open Spaces." This concept is still evolving, has been the subject of intense interest by the NPS National Leadership Council, and will be a prime theme of the Joint Venture 2003 Conference (November) in Los Angeles.

Elkinton then went on to describe the National Trails System, created by law in 1968 "to spread the success of the Appalachian Trail across America." Today, it includes eight national scenic trails (NSTs) and 15 national historic trails (NHTs), totaling over 42,000 miles. Of these, NPS has a perpetual administrative responsibility for 17 trails. Successful partnership projects include the 14-state inventory of natural resources along the Appalachian NST, the Mapping Emigrant Trails trail types developed by the Oregon–California Trails Association, innovative use of the Land and Water Conservation Fund to help states protect part of these trails, community involvement along the Potomac Heritage NST, and intercultural links along the Ala Kahakai and Lewis and Clark NHTs. Partner commitment is strong (in FY01, 620,000 volunteer hours and $6.2 million in contributions were donated to support these trails).

Margi Brooks, national program leader for the NPS National Natural Landmarks Program, based in Tucson, Arizona, described the 40-year-old program. It is definitely a working example of the secretary of the interior's "4 Cs," as a voluntary program that encourages local resource conservation. Today, there are 587 National Natural Landmarks, of which 50% are on public lands. Brooks presented examples of how working with landowners had preserved the nationally significant resources within landmarks. Often, designation enables landowners to learn much more about their own property's natural values. One valuable aspect of the program for landowners is technical assistance offered in areas of design, education, and research.

John Sprinkle, National Register historian in the Washington Office, described National Historic Landmarks, which require secretarial action for designation. Today, there are 2,342 historic landmarks, of which about 50% are publicly owned. He also described the National Register of Historic Places, now listing over 76,000 properties at all levels of significance. Most of these nominations come through state historic preservation offices. Save America's Treasures funding is available for nationally significant cultural resources. National Register programs have grown to include travel itineraries and the educational program "Teaching with Historic Places," which are both now found on the worldwide web.

Harry Williamson works for the National Park Service in Sacramento and coordinates the Wild and Scenic Rivers Program for California. He described the program, and the associated compliance, regulations, and section 404 permit reviews. Wild and scenic rivers managed by the NPS are considered units of the National Park System. Many of the wild and scenic rivers are state-managed, requiring close cooperation and coordination with state agencies. Some of the recent river projects are partnership rivers with strong involvement by local communities. Within

NPS there is no hierarchy of responsibility for wild and scenic rivers, although many compliance documents are circulated for review. State management of rivers is often difficult when state economies are struggling. Work with landowners along the river banks is a critical part of the program, and there is a need for expanded communications with these owners to enlist their support for the protection of the river corridors.

Angie Tornes from the NPS office in Milwaukee rounded out the presentations, representing the Rivers, Trails, and Conservation Assistance Program. This technical assistance program operates in all NPS regions with 80 staff, and provides assistance to local communities, state agencies, local nonprofits, and others to develop trails, greenways, river projects, and other conservation-related projects. Projects can range in scope from entire states and watersheds down to urban projects vital to local communities and neighborhoods. The program's key roles are helping groups develop visions and set goals, identifying barriers, educating partners about project benefits, sharing current literature and best practices, and steering groups towards funding sources.

In the closing discussion, five points were raised that may have value for the broader NPS resource management community:

- All of these programs should be better known and used by NPS and its conservation partners. A self-tutorial CD describing the programs and their benefits could be assembled and called "The NPS Family of Services."
- These programs are subtly different, one from the other, based on differences in law and practice. For example, some are more regulatory in nature.
- There is a difference between programs that highlight superlatives (such as national landmarks) and those assisting wherever asked.
- There is plenty of room to encourage supporters and constituents to promote the programs and bring in greater funding.
- When NPS develops new websites, it would be helpful to the public to feature these programs too, state by state, thereby giving information on the full array of NPS services that augment the more well-known park operations.

The Role of the U.S. Geological Survey in Science Delivery to the National Park Service

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The U.S Geological Survey (USGS) was created on March 3, 1879, and signed into law by President Rutherford B. Hayes as a part the appropriations bill for the fiscal year starting on July 1, 1879. The National Park Service (NPS) was created by organic act on August 25, 1916, and signed into law by President Woodrow Wilson. Thus, both agencies are venerable members of the Department of the Interior (DOI) family, with USGS preparing to celebrate its 125th anniversary next March.

These historical facts show that USGS has been around as a sister DOI agency during the entire history of NPS, and we know that the USGS has had an intimate relationship with NPS for much of that time. Many NPS units were added to the National Park System because of the unique and wonderful geology of the area, and NPS has often invited or welcomed USGS geologists to conduct research to help the agency better understand and interpret the physical features of the parks. In addition, numerous parks have stream gauges in place that are maintained by USGS, some of them now approaching almost 100 years of continuous record. Furthermore, topographic maps produced by USGS have long been a staple for both park management as well as park visitors desiring to hike into the backcountry.

All of these facts are true and accurate. However, it is also true that there has long been a certain tension between the two agencies and a certain frustration with USGS on the part of some NPS employees. I believe that three main factors have contributed to this somewhat rocky relationship between the two bureaus.

First, Congress did not expressly give USGS the mission to provide science support to other DOI agencies. Instead, USGS was charged with "classification of the public lands, and examination of the geologic structure, mineral resources, and products of the public domain." When one considers that USGS worked for 37 years under this mission before NPS was even formed, and experienced the subsequent addition of a water quantity determination function (i.e., stream gauging), and a topographic mapping function, both of which responsibilities also ranged well beyond DOI land holdings, one can understand how an agency culture developed within USGS over the years that seemed somewhat indifferent to NPS or other DOI agency needs.

Second, for a variety of reasons, including agency culture, General Accounting Office (GAO) audit rulings, federal procurement laws, and a reluctance on the part of Congress to appropriate administrative funds, a USGS business model developed that had a guiding principle that can be summarized in three simple but significant words, "blind to source," when it came to deciding how much overhead to assess on outside money flowing into the agency. In other words, DOI agencies were charged the same overhead rate as non-DOI agencies. Many NPS managers simply found it too expensive to work with USGS, and resented the fact that the agency would not routinely grant a special, reduced overhead rate to a sister DOI bureau.

Lastly, the USGS generally utilized space rented from the General Services Administration (GSA) to house its employees rather than occupy buildings on DOI-owned lands. This tended to isolate USGS scientists from other DOI employees and make difficult the kind of frequent interactions that land management agencies prefer. Even the USGS headquarters offices were moved out of Main Interior, and later out of Washington, D.C., altogether, to a beautiful wooded campus in Reston, Virginia, more than 23 miles from downtown D.C. This move, as nice as it was for many employees, who could now live close to work and avoid a lengthy commute, further isolated the agency from its sister bureaus and added to the perception of USGS aloofness.

Even given that past, however, several recent events have considerably reshaped the future possibilities. These events have given renewed hope that USGS will now start to play a much greater role in providing science support to her sister DOI agencies, including NPS. We now have every reason to believe that the past will not be a prologue to the future. Let us now review four of these events.

First, on October 1, 1996, Congress merged the former National Biological Service (NBS) into the USGS and created the Biological Resources Division, or BRD. The BRD joined with the Water Resources, Geology, and National Mapping divisions to form a nearly full-service research bureau unmatched anywhere else in the federal sector. Since BRD traces its lineage to several parent DOI bureaus, it has a strong DOI service ethic already entrenched in its subculture. BRD immediately set about trying to inculcate that DOI service ethic into the culture of the larger USGS. Over the past six and a half years we have made slow but steady progress in this.

Second, with the merger of NBS into USGS, the secretary of the interior formally charged the agency with the responsibility to serve the scientific needs of all DOI bureaus. Finally, after 124 years, the USGS now has a clear and unambiguous mission to serve DOI bureaus as well as the public domain in toto.

Third, when the NBS was merged into the USGS, the secretary agreed that the former NBS policy of 0% assessment on DOI funds coming into BRD would remain in force. In other words, USGS now contained a major sector that was no longer "blind to source" when it came to reimbursable income. This set a precedent that would prove to have a major impact on the long-term relationship between USGS and other DOI bureaus, as we will see in event number four.

Fourth, on February 10, 2003, USGS formally adopted a new standard assessment policy for DOI funding. From this time forward, USGS will charge only 15% overhead on any sister DOI agency funding provided to the survey. In other words, the entire survey is no longer "blind to source," and will charge this special, reduced rate to all DOI agencies. The only downside to this new policy is that BRD will no longer charge the special 0% rate, but will be required to use the common business practice rate of 15%. However, since NPS and other DOI bureaus readily pay the same 15% rate to Cooperative Ecosystem Studies Unit (CESU) research partners around the country, this new BRD overhead rate should not be a major problem for those bureaus. Since the rate formerly charged by Water, Geology, and Mapping was considerably higher than 15%, this new rate will save DOI agencies a lot of money each year, thus offsetting part or all of the increased cost of working with BRD. This new policy was approved by the secretary, as well as by both the Office of Management and Budget (OMB) and Congress, before it was adopted by USGS. On the whole, I believe that this new USGS overhead policy will prove to be a good thing for NPS.

Today USGS is more willing and more able to meet NPS science needs than ever before. The entire survey is available to meet NPS needs on a reimbursable basis at an assessment rate equal to what NPS would pay to use a CESU. This allows NPS to carefully consider, with a level playing field, what research tool might best serve its needs in a given instance. Furthermore, BRD still maintains most of the former NPS scientists stationed in the parks or universities where they were when NBS was formed almost 10 years ago. In addition, the many other biologists at our science centers stand ready to help on NPS issues when asked to do so. Scientists in the other USGS disciplines also stand ready to assist NPS when needed, and now at a more competitive rate than ever before. Finally, the FY04 president's budget, now before Congress, has a line item in it for increased USGS funding to support DOI bureaus. This is a modest beginning, at a total of approximately $3 million, but it demonstrates USGS commitment to developing funding sources to use to cost-share with DOI bureaus on science needs in the future.

In summary, I urge NPS to remain aggressive and insistent in encouraging USGS science support for parks. In 1940, most of the small cadre of nine NPS wildlife researchers were transferred to the Biological Survey, the precursor to today's U.S. Fish and Wildlife Service, which was then assigned the responsibility to meet NPS science needs in the wildlife management area. We all know that this plan did not work out very well in the end. I have often wondered whose fault that outcome may have been. In any case, we do not want the past to once again become a prologue to the future. USGS stands ready to do its part, and I encourage NPS to likewise keep the partnership strong. Keep in mind that NPS made a $20 million investment in USGS–BRD that is too valuable to walk away from or to be allowed to drift away. All in all, I believe that this is a very positive time in the history of interactions between USGS and her sister bureaus within DOI, including NPS.

Recreation Management Decisions: What Does Science Have to Offer?

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Introduction: Science and Resource Policy

The appropriate role for scientists and scientific knowledge in natural resource management decisions is hotly debated today (Tauber 1999). Some are calling for more science-based management, with a central and powerful role for scientists (Havens and Aumen 2000; Mann and Plummer 1999; Paul 2000). Scientists are often skeptical or critical of the public's knowledge of resource problems and processes and feel a need to educate and lead in problem resolution (Mackey 1999).

On the other hand, many scholars and managers have voiced concern about turning toward science for answers, arguing that privileging scientists (and/or a scientific process) in policy decisions denies the valid knowledge of other stakeholders or, what is worse, is undemocratic or deceitful (Sclove 1998; Dietz and Stern 1998). Despite their seemingly technical nature, resource problems are "social and political constructs" (Hisschemoeller and Hoppe 1995:43) that invariably involve judgments about what is desirable or appropriate. They involve questions of values, not only in selecting among alternative management regimes but also in the very process of deciding what to study and how to study it. According to Behan (1997:414), "management is as much a political enterprise as it is scientific." In recent years, many analyses have clearly exposed the myriad value judgments that underlie even the most seemingly "objective" scientific enterprises (e.g., Martin and Richards 1995; Tauber 1999; Wynne 1996, 1999).

Given the debates over "science policy" (as it is commonly termed) in natural resources generally, it is no surprise to see the same questions being debated in the context of carrying capacity or other recreation management decisions. It is important that we give careful attention to the question of how science should be used in reaching decisions about whether and how to manage recreation use. Many scholars offer advice about the place of science in resource decision-making. For example, Behan (1997:414) asserts that "science is necessary but not sufficient" for making effective decisions. Adams and Hairston (1996:27) echo this, arguing that "scientific information can be an essential part of the decision process, but alone it is insufficient to deal with complex and dynamic public issues." Unfortunately, many of these articles do little in terms of providing concrete advice about what specifically science is good for. In this paper I describe the characteristics of problems for which I think science is well-suited.

Before discussing the role of science, it may be useful to define what we mean by science. In this paper, I use "science" in its most traditional usage: as an endeavor to discover or articulate knowledge that is based in empiricism (and therefore strives for objectivity), rationality and logic, quantification, reductionism, and specialization (Behan 1997; Ozawa 1996). Whether (or how well) this description fits the reality of scientific enterprise is a matter of debate and disagreement (Tauber 1999), but nevertheless it is a definition with which we are quite familiar and with which most scientists still identify.

What is Science Good For?

Like others, I am convinced that science is critical to making management decisions that have some chance of succeeding in achieving their desired ends. Despite some notable failures, science has a proven track record in generating tangible outcomes and products that are unlikely to have been achieved through any other form of inquiry. In the pages below, I argue that the most appropriate and effective roles for science involve description, prediction, explanation, and assessment. I am certainly not alone in articulating a distinction between description and evaluation and arguing that the former, but not the latter, is the proper domain for science. For example, Freyfogle and Newton (2002:864) argue that the fundamental "aim of science is to describe nature and how it functions, rather than to pass normative judgment upon it."

Description. One important role for science is the discovery of knowledge that generates a new perspective on a phenomenon (Ozawa 1996). Because of their inquisitive nature, analytic skills, and access to technological equipment, scientists can develop understandings of phenomena that occur at spatial and/or temporal scales that exceed human sensory and perceptual abilities. A classic example is the discovery of the ozone hole (Ozawa 1996). In recreation, examples might include identification of noxious weeds carried by recreational visitors into remote wilderness areas or the description of improved human cognitive functioning after exposure to natural environments. In such cases, scientists may discover knowledge during the course of their basic research and not in response to any identified need on the part of managers. Of course, this knowledge may later be brought to bear on specific management issues.

Scientific research is particularly good at describing baseline conditions and the natural variability in phenomena that are of interest to managers and the public (Mackey 1999). Often, recreation decisions involve disagreements about the extent of some phenomenon. If all stakeholders agree about the nature of the data that would answer the question, science can help reach an acceptable resolution. For example, questions often arise about the effect of recreational use on water quality. Managers and scientists generally agree about the types of data that can be used to describe the extent of effects (fecal coliform, streptococci, nutrients), and scientific research is appropriate and often decisive in such cases. (It is important to point out, however, that deciding what levels of impact are acceptable remains a value judgment outside the sole purview of science.) Many mundane, but important, questions conform to this type—managers need information about recreational visitors and their impacts (How many are there? Who are they? What are they interested in? What do they know? Where do they go? What do they do?), which are questions science is well-suited to answer. Understanding baseline conditions through reliable, clearly articulated methods, along with estimates of natural variability, permits science to track changes over time in ways that are more accurate than reliance on human memory or intuition.

Science can describe the strength and nature of relationships among variables, assuming those relationships are amenable to quantification. A good example comes from work on recreational trampling effects on vegetation. Science has shown that the relationship is curvilinear and has identified the morphological and phenological characteristics of species that are susceptible or resistant to degradation. Such insights have been used by managers to justify recommendations about campsite management strategies. In another example, research in environmental psychology has shown that there are strong and consistent relationships between environmental characteristics (such as vegetation, terrain, or the presence of water) and visitors' aesthetic preferences or responses. Such findings have helped recreation managers design recreation sites and predict where visitors are likely to congregate.

Physical phenomena and processes are not the only things science can describe. Science can also be helpful in giving clarity and structure to identified problems and identifying areas of uncertainty and disagreement (Adams and Hairston 1996; Dietz and Stern 1998). Science can identify elements of a problem that has already been defined as problematic by stakeholders. In the example of vegetation impacts, if managers have targeted vegetation loss as an issue in need of attention, science can help identify aspects or dimensions of the problem, such as changes in species composition, alterations in soil chemistry that might perpetuate changes in vegetation, and so on.

Prediction. If we understand how variables interact, then we may gain insight into how systems will respond if variables are manipulated or change. Thus, scientific research can aid in the prediction of future events. Dietz and Stern (1998:441) point out that "good science can suggest what will happen under alternative scenarios." That is, it can define "paths and outcomes" (Adams and Hairston 1996:28). For example, recommendations for the appropriate management of human waste and sanitation on rivers and in wilderness areas have been based on prediction of the outcomes of different management alternatives given understandings about use density. Another case in point relates to predicting how visitors will react under different management regimes. Simulation modeling of recreational use patterns, based on an understanding of the variables that enter into a visitor's decision-making process, permits managers to model aggregate behaviors under different management scenarios. Many scientists feel this is an important role and are more comfortable evaluating the likely outcomes of management alternatives than in proposing or defending the alternatives themselves.

Explanation. One can predict without being able to explain why events occur. Science is, at least potentially, capable of both prediction and explanation. It can be used to design critical tests of competing explanations for observations, as long as parties agree on the criteria to be used, the design of the tests, and the interpretation of data (e.g., Havens and Aumen 2000). For example, in recreation management, there is argument about why visitors in crowded wilderness areas feel satisfied with their experience. Managers know that wilderness visitors seek solitude, and crowded conditions should be antithetical to achieving solitude. One possible explanation holds that people who are sensitive to crowding have been displaced, so that those who remain are simply those who are satisfied. However, an equally plausible explanation argues that people are satisfied because they don't care about crowding. Scientific research is perfectly poised to answer this question through visitor studies. Turning to a biological example, science can describe and predict what types of vegetation are impacted by trampling, but it can go further to explain the mechanisms by which such effects occur.

Causation. Typically, explanations of phenomena involve explicating causal relationships. Often, these are suggested on the basis of correlational designs, and therefore must be accepted with caution. However, if research is conducted through experiments, with controls and randomization, science can make definitive statements about how variation in certain factors leads to changes in other factors. This is an extremely powerful contribution to management. However, it is typically rare that we can create the circumstances necessary to establish causation in recreation research.

Implementation and monitoring. Because of its power to predict and/or explain, one of the most important roles for science pertains to the implementation of decisions (Freyfogle and Newton 2002). Science is appropriate for evaluating the implementation and effectiveness of management actions (Adams and Hairston 1996). If there is agreement about desired end states, science can often determine (or at least determine with more certainty than other ways of knowing) which actions will lead to which end states (Mackey 1999). An increasingly important role for science in resource management relates to monitoring. Science is particularly well suited for this because it generates useful information (i.e., is quickly responsive to managers' concerns); is credible if carried out in systematic, transparent ways; and is efficient, in that it can identify the most cost-effective evaluation techniques. In recreation management, perhaps the most well-known examples are programs designed to monitor the condition of trails and campsites, or the National Park Service's long-term project to monitoring the satisfaction of park visitors across the United States.

What are Scientists Good For?

Apart from bringing scientific knowledge to bear on resource management questions, scientists as trained professionals also bring certain qualities that may facilitate resource management decisions. Scientists are trained to maintain a skeptical, questioning perspective and to employ logical analysis to scrutinize propositions. They can point out the limitations of existing knowledge (Freyfogle and Newton 2002). These are important qualities in policy debates. Humans have a natural proclivity to be uncritical of things with which they agree and to accept arguments from sources to whom they are attracted. To the extent that scientists can overcome such tendencies, they may help in decision-making. Of course, there is no guarantee that that they maintain such perspectives, or that their views will be treated any differently from those of other vested stakeholders (Mattson 1996). Furthermore, this skeptical attitude may be contrary to managers' need to make decisions in the face of limited and uncertain data.

Scientists lend credibility to many proceedings and deliberations (Ozawa 1996). Science is a powerful, authoritative institution in the modern world. Following the accepted strictures of science, especially done while maintaining some independence, lends powerful credibility to an endeavor. Scientists are not always convincing to everyone, but science as an institution does enjoy widespread social support. This authority of course brings responsibility—it is rather easy to fall into using science as a shield, to "create the illusion that science is arbitrating between multiple policy viewpoints," when in fact it is not scientific knowledge, but value commitments, that do the arbitration (Ozawa 1996:224).

When Does Science Offer the Most?

To summarize the above points, science appears to be most useful when (1) problems have limited numbers of dimensions; (2) the questions lend themselves to quantification and reduction; (3) when the value questions have been resolved—either stakeholders have shared values or their values conflict, but at least are certain; (4) when there is adequate time, as science requires time for study; and (5) when the entities under study behave in uniform ways under similar conditions.

A Graphic Model of Problem "Types"

Hisschemoeller and Hoppe (1995) offer a conceptual model to help understand the role of science in decision-making. They identify two axes that shape the nature of the problem and therefore the role of science: (1) consensus on relevant norms and values; and (2) certainty about relevant knowledge (Table 1). Structured problems are those in which all players agree about the desired end state (values) and about the types of knowledge that will help attain that end state (relevant knowledge). Science is of most utility in these structured problems. For instance, stakeholders often agree that restoration of natural vegetation is a desirable end state (values), and it is clear that information on species-specific responses, soil amendments, and similar things is needed to help achieve these ends. Scientific research is the dominant force in guiding such efforts.

Some problems are structured to the extent that stakeholders share views on desirable end states, but not on what types of information are needed to achieve them. Hisschemoeller and Hoppe (1995) describe these as problems that are "moderately structured (ends)." Science is helpful in such prob-

Table 1. Types of resource management problems (based on Hisschemoeller and Hoppe 1995)

		Consensus on relevant norms and values	
		No	Yes
Certainty about relevant knowledge	No	Unstructured (messy, wicked)	Moderately structured (ends)
	Yes	Moderately structured (means)	Structured

lems, but not so much as in fully structured problems, because of disagreement about how to obtain needed knowledge and/or what to obtain. An example may be found in the eradication of noxious weeds from wilderness areas. Many (though not all) share such a goal, but there is disagreement about the proper means to attain it. Another example might pertain to ensuring solitude in wilderness; all agree about need to provide it (the ends), but there is considerable disagreement about what data should be brought to bear to determine whether solitude is being ensured.

Some problems are moderately structured in terms of having agreement about the types of data that are relevant, but disagreement about the desired end states. For example, wilderness managers appear to agree that data on vegetation loss at campsites are needed to manage recreational impacts. But how much vegetation loss is too much? Science can quantify the vegetation loss with relatively little controversy and can help managers understand implications of different value choices. However, science itself does not specify what the threshold level of impact should be. Similarly, many recreation managers believe that they need survey data to describe the characteristics, values, attitudes, and preferences of their visitors. However, there is often disagreement about which visitor segment should be privileged in making decisions, i.e., the relevant values.

Finally, there are unstructured problems (sometimes called "messy" or "wicked" problems), which are characterized by strife over both means and ends. Dietz and Stern (1998) describe such problems as multidimensional (outcomes may have many, unequally distributed effects), uncertain at a meta-level (we are uncertain about our level of uncertainty), fraught with mistrust, and urgent (failure to act has significant consequences). In such conflicts, placing faith in science or scientists will not lead to an accepted resolution. Unfortunately, many important resource management issues, including many in recreation management, fall into this category, and even the descriptive data themselves paint an uncertain picture (Mattson 1996). For example, in wilderness management there is debate over which value (access or preservation) should be privileged and over how we would know when we got there. There is also disagreement about whether wilderness should be managed for wildness or naturalness, and what criteria to use to identify one or the other. Many scholars strongly advocate alternative decision processes for such messy problems.

Conclusions

This review may seem to draw a narrowly circumscribed line around the territory of science. I have contended that science is a powerful tool to describe, predict, and explain, but not to arbitrate values. Thus, I want to conclude by emphasizing that, within the boundaries I have described, science has done a tremendous amount to improve resource management. Science is indeed an essential component to resource and recreation management; it is just not the only one.

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Fun with and Profit from a Non-profit Library Friends Group: Twenty Years of the Library Friends Group at San Francisco Maritime National Historical Park

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What is fun? And what is profit?

I have a couple of definitions that appear to be outside general bureaucratic usage—at least as I experience it.

> *Fun:* What wealthy people do all the time … because wealthy people don't have to do anything that's not fun.

There are wealthy people who have a genuine interest in the subject of my park, and there probably are for your park as well. I feed that interest. I tell them about my hopes and desires for my park, as well as those of others, as well as the official plans for the park. I give them the full menu, it's interesting to them.

But all I do is give information; I do not ask for funding. Why? Because it's fun to hear of hopes and dreams; it's not fun to be asked for money … nor is it fun to ask for money, nor is it acceptable to National Park Service policy.

I have fun with them; I talk ships with them. Or shipyards. Or sail lofts. Or scrimshaw. Whatever their interest is.

I have fun with them; when they invite me to lunch, I go. I take an interest in them as people; I tell them about who I am, beyond my job. I am open to a relationship with them beyond their being simply another visitor, another acquaintance.

Here's another definition:

> *Profit:* Funds that flow to my park or friends group as a result of my having "fun" with wealthy people.

I feed their interest in my park and its development, I give them the full menu and at some point it does strike some of them as fun to fund some element of it. Some 90–95% of philanthropic giving is by individuals rather than foundations. They are worth paying this kind of attention to.

And they *do volunteer* money. Just before writing this, I was talking to a donor about a class in maritime history that our park—and our library friends group—are sponsoring along with two academic institutions; he spontaneously declared that he would fund a scholarship for a youngster.

I like to think of the whole process as fun-raising.

Our library friends group concluded its twentieth year last year with over 200 current paid-up members, and with assets over $350,000, of which over $300,000 were in cash, of which fully $220,000 are in permanent funds, or endowments.

All of the permanent funds have come in the past eight years, and much of the rest as well.

Fun-raising.

The history of this friends group falls neatly into two ten-year periods. In the first ten years, the most important thing they achieved was to lobby successfully for the establishment in the park of a library acquisition fund of $5,000. To this day, regrettably, no other department in the park—which is a museum—has an acquisition fund.

More important, then and now, than what they achieved is what they were: they were and are *friends*—people interested in the challenges and successes of the library … *a morale boost* for a department that often feels that it is at the bottom of the feeding chain in budget and staffing: behind ships, and rightly so; behind health and safety, and rightly so; behind artifacts because they are unique, and rightly so; ineligible for backlog cataloguing funds.

Artifacts, archives, books. Now think with me a moment, parenthetically.

Artifacts are essential; they provide a bone-deep reality that nothing else can. Archives are crucial; use of them advances the body of knowledge, they feed the books.

But let me tell you, it is the printed word—in books, reports, on the screen—it is the printed word and concomitant images, it is the printed word with value added—the values of consolidation, summary, reflection, conclusion....

It is the printed word, which is the ground of our understanding of our park's subjects, the seedbed of the knowledge we are charged to preserve and the education we are charged to impart … the printed word, whose home is the library.

What I am saying is "The library is important."

The library is important.

The library *is* important.

The National Park Service does not understand this, as witness the staffing and funding and policy support it provides to its libraries. The NPS Library Steering Committee is working to repair the damage that NPS has suffered, resulting from its de-emphasis over the decades upon libraries.

But before, during and after whatever success that committee may have, consider this: a library friends group, incorporated as a non-profit, is much more than a friendly morale boost, because a non-profit library friends group is a legal citizen of the world. They can act in the real world, as it were, that is, outside the bureaucracy, and their entire legal purpose is limited to one thing—advancing the library.

It was in the second ten years that our local library friends group took off. The first thing they did was contract for a whaling library that cost 33 times more than anything they had ever bought. They pulled it off too, with loans to pay off the contract within 60 days, then within three years they paid off the loans.

With that success they became a tangible factor in the well-being and the advancement of the library—and the Park Service presented them with a Partnership Leadership Award.

They went on to be instrumental in the acquisition by donation of two additional major private libraries, valued together at an estimated $500,000–750,000.

They published seven monographs on maritime history. They established an endowment which fosters research in maritime history with a $1,000 biennial award. They established an endowment for library acquisitions, an endowment for library collection management, an endowment for maritime education, and a revolving fund for publications. They established on-line sales of books rejected by the library, producing $20,000 in the first year. They established and provide on-going funding for a work–study program; currently there are seven students in the library doing the work of approximately 1.6 full-time employees.

Clearly this library friends group has become a significant factor in the well-being and advancement of the library program at San Francisco Maritime National Historical Park.

But how did this come to pass? Was it all peaches and cream? Were there obstacles? There *were* obstacles *and* dangers. But there were also solutions. To recount only the major items:

> *Item*: Immediately after establishment of the library friends group, my supervisor opposed it on grounds that a museum group already existed. She sent a GAO auditor to grill me. I produced a copy of a memo serving notice to my supervisor of my intention to establish the group. "Well, she had notice," said the auditor, "and took no action." End of threat, for the moment.
>
> *Item*: After about 18 months, my supervisor became more creative. She subverted a board member; he made a motion that since the park was not taking action on a co-operative agreement (which action she in fact was preventing), the library friends should become part of the other, larger group.

The library group was saved by a procedural move. The motion was tabled in favor of the president's inquiry of the superintendent whether he wanted this public–private partnership or not. The superintendent instructed my supervisor to release the co-operative agreement for finalization.

> *Item*: After about 12 years, a president of the library friends, seeking better funding for the library, negotiated with the larger museum non-profit an agreement wherein it would gradually absorb the library friends. I did not endorse this move, but the board voted for it anyway.

The larger group, however, rushed the process, nor did the hoped-for improvement in library funding materialize, so the subsequent library associates president continued to act independently for the library, and fortunately the agreement fell apart.

> *Item*: Serious and possibly litigious problems developed with the library friends' first consultant in administrative support and subsequently with a third-party administration contract. After four years of cautious work by two presidents, the group was able to overcome those difficult situations.

So the library friends group rolled into and through its twentieth year last year. When we realized that we had not celebrated that anniversary, we set down on paper the various aims and desires that had been expressed for the library and the group over the past several years. It was a five-year plan, designed to position the group so it has even better reasons to celebrate its 25th anniversary. We called it the quarter-century plan. The board cogitated it, the executive committee worked it over, and finally the board approved it. Its most startling element is that, all together, it calls for raising $1 million dollars—three times its total current assets—for the permanent funds.

The ground of this chutzpah is found in a quote attributed to the famous German philosopher Goethe:

> Until one is committed, there is hesitancy, always the chance to draw back. Concerning all acts of initiative (and creation), there is one elementary truth—the ignorance of which kills countless ideas and splendid plans—and it is this: that the moment one definitely commits oneself, then Providence moves too. All sorts of things occur to help one that would never otherwise have occurred. A whole stream of events issues from the decision, raising in one's favor all manner of unforeseen incidents and meetings and material assistance, which no man could have dreamed would have come his way. Whatever you can do, or dream you can do, begin it. Boldness has genius, power, and magic in it. Begin it now.

There is not time to even summarize a suggested governance and startup methodology for the projected Friends of the NPS Libraries, but it is based on a model originally written for a Hawaiian group, which is available on-line at www.nps.gov/safr/local/lib/hawaiifriends.html, and I will make one basic, pivotal point regarding the startup methodology.

It is this: the crucial first member of the public to be identified is someone to handle the nuts and bolts, the administrative support—the membership records, the bookkeeping, etc. A retired executive secretary or office manager. It doesn't start with a high-flying executive type; it starts with a *worker* who is willing to make a three-year commitment.

A few years ago I looked for other friends groups of federal libraries.

Across the entire country I found only one other, and it was at the Library of Congress. So I don't expect that you will establish a library friends group for your library, or a friends group for your program area.

What I wanted to do is describe what our library friends group has done for our library, so that you may have some vision of what can be done for your program area by your active participation in conjunction with whatever friends group may address your park, or your region or the National Park Service at large, or merely a category of interest into which your park falls, such as conservation.

If I may paraphrase Goethe, "Do it now! For the fun and profit!"

On Becoming Relevant: Environmental History and National Park Management

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About four years ago, I was driving around Point Reyes National Seashore with Gordon White, the park's new cultural resource manager. We were both relatively new to the seashore, and were fresh with the awe, hope, and optimism common to any new relationship with national parks. We believed we would make a difference. As we toured the park, Gordon related the story of the seashore, renowned for its natural environment, open space, and history of dairy ranching in the shadow of San Francisco. This was no typical park in which the distinction between wild nature and modified nature was starkly clear (in either a physical or intellectual sense). Here, no matter your professional interests, you could not argue for managing the area as if it were pristine nature. Ranching had left an indelible imprint on the Point Reyes landscape since the mid-19th century. It would be difficult for anyone to suggest that if we just pulled back the agricultural curtain we would find primordial nature intact.

To the contrary, the natural world we so enjoyed on that day—the smell of eucalyptus (exotic), the undulating open terrain (grazed lands), and the tranquil pastoral scene (market economy)—was the result of a long relationship between humans and nature on the Point. More importantly, it seemed that park managers were not trying to untangle people from natural systems but to understand how they affected those systems and why. We need to know how we got here, Gordon noted, so we can understand and manage nature that, in a sense, runs through this ranching country, while continuing to protect ranching as a viable way of life.

His observation, I thought, took the classic preservation paradox of national park management to another level, and I told Gordon that this would be a perfect place for an environmental history. He had described almost exactly what environmental history does: it studies the changing relationship between people and the natural world through time. It pays special attention to the intended and unintended consequences of human activities in nature, as well as the ways people have shaped and in turn been shaped by the natural world.

I felt confident in my declaration. I was, after all, an environmental historian and I wanted to see more environmental histories of national parks. But simply pronouncing the virtues of environmental history was not enough, and I found myself unprepared for the enthusiasm and questions that followed. They were the questions that a manager, not an academic, would ask, for they centered on practical (and important) matters, such as:

- How do you use this kind of study?
- What is a good definition of environmental history for national parks?
- How do you do environmental history?
- What kind of topics do you address?
- What would we learn from them?
- How long does it take to do them?
- How much do they cost?
- How are they different than other histories and other reports the Park Service prepares? Not everything is a landscape.
- Last and most importantly: How would we apply this history to management questions about preserving ranch lands and restoring or maintaining biological processes?

Although I now have answers for these questions, I did not at the time. And while I worked to answer them and craft a definition of environmental history for national parks that did not sound bureaucratically bland, the environmental history program took off on its own.

Gordon contacted Richard White, who had been one of my advisors at the University of Washington, and had recently left the history department there for Stanford. Along with historians such as Donald Worster and William Cronon, Richard was considered one of the founders of the field of environmental history and a leading American historian. Gordon invited him to come to the park and discuss the topic of environmental history and the prospects of developing an environmental history program with park staff. Among those at the initial and subsequent meetings were many from natural science backgrounds—biology, botany, range management, marine ecology, and geology.

The main theme of the sessions was that ecologists and historians had common interests and similar historical questions but different approaches to answering those questions. They were good discussions, and park managers were interested in incorporating environmental history into the research and education program associated with its new research station, the Pacific Coast Learning Center. Environmental history, along with other research in the natural sciences, found a place in the learning center's program. As part of his contribution, Richard White started a course at Stanford, an annual seminar on the history of the West and the environment at Point Reyes. The idea was to have students conduct research at the park, using it as their case study and working on topics relevant to park management. In doing so, they would produce an archive of research. Students in the course, now in its third year, have researched and written about a variety of topics, providing a kind of organic research collection that continues to grow and build off of previous years.

So it turns out that this was the beginning of the environmental history program, whether I had intended it or not. I decided at this point to show rather than tell what "applied" environmental history was. I prepared posters and powerpoint presentations for academic and National Park Service conferences. But of greater importance, I was able to develop and quite serendipitously fund three environmental histories and further "show" or "demonstrate" how we can apply this kind of study to management issues within parks. One was a study of San Juan Island National Historical Park, a place where the tension between natural and historic scenes made it a good case study. For funding reasons, the other two projects were environmental history overviews, or prospectuses, that provided well-developed summaries of the relevant themes and topics for Point Reyes and for the fur trade in the Pacific Northwest and its effect on parks there. This summer we'll be starting our fourth, and first fully funded, environmental history, the subject of which will be Tomales Bay at Point Reyes National Seashore. We're carrying out all of these studies, I should add, through the University of Washington, using the Cooperative Ecosystem Studies Unit agreement.

What I'd like to do now is discuss how the program has progressed over the last three years, present what I think is a statement of purpose for environmental history in national parks and talk about how this kind of work is becoming relevant, pointing when appropriate to some of the projects I just mentioned.

First, I don't want to give anyone the impression that environmental history is "new" and has never been done before in national parks. The field traces its roots to the 1930s, its professional debut to the 1970s and the formation of the professional organization, the American Society for Environmental History. Moreover, national parks are natural places for this kind of study, for their creation and management present the important and often problematic relationship Americans have with the natural world. During the last thirty years, national parks have been the subject of some of the best environmental histories for this reason.

Yet environmental history has rarely been applied to questions of park management. Thus, the purpose of the environmental history program is to promote the study of the changing relationship between people and nature through time in national parks. It operates under the notion that nature has a role in the human past, and that nature has a history. It asks some fundamental questions: What were the ecological consequences—both intended and unintended—of human activities? How have people affected and in turn been affected by the natural world? What were the forces and motives for environmental change? Moreover, because this kind of study explores the on-going dialectic between humans and nature and attempts to help us understand, in the words of Cronon, "environmental change in relation to the actions of human beings, blending ... the insights of ecology and economics," the goal of environmental history is to enrich our understanding of past events in a national park, reinterpret the history of that park (by adding complexity), or revise that history altogether.

For many, the story might seem familiar but the focus will be different. The general approach or analytical framework builds off of the questions noted above and is fairly straightforward. What were the forces of change? What attitudes or ideas (culture) influenced people's perception of nature? How did capitalism (market economy) affect their decisions about and relationship with nature? And how can ecology help us understand nature and the changes we have caused? We also might consider material versus cultural notions of nature as part of the analytical approach. It's important to keep in mind that these are at bottom land use histories and therefore rely on a more traditional kind of environmental history approach. But they should remain open to the kind of perspective that comes from more recent approaches such as those that consider the role of gender, race, class, environmental justice, and human health. Finally, the narrative, I believe, is an essential tool in crafting environmental histories of national parks. Understanding human connections to the natural world and their ecological consequences within the framework of a story—with a beginning, middle, and end—is as powerful as it is understated. People respond to this. It doesn't mean the narrative has to be reductive or simplistic, but the gift of historians lies in their ability to provide perspective and context, to show change over time, to tell a story.

What makes environmental history relevant for national parks? Perhaps the most obvious way is that it can provide park managers with a deeper understanding of the ecosystems under their care. I think as a general statement and in my own experience, most ecologists and land managers tend to acknowledge that there are no distinct boundaries between the human and nonhuman, between the natural and unnatural worlds. At the very least, most would agree that it would be profoundly problematic to make such a distinction. For example, as Mark Fiege's work about the history of irrigation in southern Idaho suggests, one cannot imagine nature—the world we have not created—tamed, for it continues to influence the canals and dams that water that desert country in a variety of expected and unexpected ways. In this respect, we should consider that "landscapes are historical creations" influenced by natural and often human activities, and that knowledge of a landscape's history should inform management.

In my discussions with park ecologists, botanists, marine ecologists, and geologists, we've concluded that scientific studies and environmental histories can proceed together profitably because many of our questions are historical; only our approach to answering them differs. Ecologists tend to look at two points in time and assume that what took place between them was the reason for change, but often it's what occurred well before and even after that had a role. And that is a perspective historians can bring. Conducted in tandem with scientific studies, then, environmental history can reveal a broader picture of a landscape's past in both a theoretical as well as a practical context. In this respect, thinking of ecosystems historically and abstractly—as products of their own past as well as products of nature's timeless processes—resource managers will be better prepared to evaluate and respond to unexpected change, such as the 1997 floods in Yosemite Valley, Yosemite National Park. They will also be better prepared to develop long-term strategies for landscape management; for example, the removal of exotic species, the restoration of park ecosystems, or perhaps the finding of ways to reconcile human-modified landscapes with biological processes.

Environmental history is also relevant for parks because it promotes a more interdisciplinary approach to resource stewardship. It helps bring perspective to changes in ecosystems that were the result of "natural" as well as "cultural" actions. It reveals the difficulty in separating the two. As Cronon asserts, environmental history in this regard encourages "resource managers and ecologists to work more closely with historians and other students of human culture" to find more creative approaches to the management of natural resources. Environmental history, I think, then supports a more holistic approach to resource management—one that considers cultural and natural resources as closely related.

Environmental history is relevant for more than illustrating the intimate connections between, rather than the separation of, humanity and nature. It also allows us to reinterpret—or to read nature back into—the history and stories we tell about national parks. What should we interpret to the public? One obvious subject would be the changing ideals Americans have about nature as symbolized by the parks themselves. Perhaps a less-obvious topic would be the history of exotic and native plant species; this would support current management projects such as weed eradication and native plant restoration. But we could also interpret the subject within a larger context to inform the public about the history of weeds in America. As Fiege notes, "[T]he movement of exotics into and across the continent, [was] one of the great ecological shifts ... so crucial to hemispheric and world history." Describing weeds as part of the nation's historic legacy of European colonialism, U.S. manifest destiny, westward expansion, and so on would provide Americans with an opportunity to learn not only about native species found within parks. It would also call attention to issues of biodiversity at a much larger scale, inspiring visitors to see the link between history and ecology and to ponder their own roles in shaping and changing America's ecology. Environmental history can also yield new insights into subjects such as colonial New England, slavery, the Civil War, industrialization, and westward expansion, among others. At Civil War battlefields such as Gettysburg, for example, park interpreters could enhance more conventional histories of the conflict (if they don't already) with discussions about the way military planners viewed the terrain; the role of resources—food, fuel, and the like; the effect of weather, climate, and disease; the use of animals and animal power; and vegetation, especially forests. Already, Gettysburg managers are employing a kind of environmental history to inform a plan for a large-scale restoration of the historic battle "scene" or landscape through, among other things, the removal of forest cover and other vegetation.

The current environmental history projects cannot claim, as yet, such a role in park management, but the potential is there. The environmental history of San Juan Island National Historical Park, a National Historic Landmark, brings an important perspective to a park that commemorates the international boundary dispute between the United States and Great Britain during the mid-19th century. Like other historical parks, there is a tight bond between the park's natural and historic scenes as well as a great deal of tension surrounding what preservation of the natural and historic landscape entails. The study has been well received by park staff for enhancing their understanding of this subject. But what was surprising and rewarding to me was that the research has helped inform discussions surrounding issues raised by prairie restoration and forest thinning projects. Moreover, the study (and the historian working on it) has become part of an interdisciplinary project with the park's vegetation monitoring program. Using the environmental history, we're developing a series of historic maps in GIS to illustrate changes in land cover and use. Finally, research in the park's environmental history has helped inform another interdisciplinary project that is focusing on the cultivation and use of camas by native peoples in this and other Northwest parks.

I selected the fur trade because it was relevant to so many parks in the Pacific Northwest (and even Hawaii), and though obviously a subject for environmental history, the fur trade seemed under-represented from this perspective. It seemed we knew more about the tangible evidence of the fur trade enterprise—forts and other properties—than we did about the environmental effects of the trade. The overview we're writing should also intrigue academic historians because it's a subject ripe for re-interpretation. Through the lens of environmental history, we will perhaps place greater emphasis on the global network of trade and the movement and transformation of animals, fish, timber and other materials harvested and produced in the Northwest as part of this larger market. We could, according to Cronon, "reconstruct the linkages between the commodities of our economy and the resources of our ecosystem." Such an approach could alter how we conceptualize the way fur trade enterprises such as the Hudson's Bay Company managed nature in the Pacific Northwest.

At Point Reyes, an environmental history might expand upon this notion. Ranching has been the primary focus of popular interest and historical inquiry, but the prospectus we're preparing should offer a framework that considers ranching within a larger model of "nature's metropolis." It's a framework that considers Point Reyes within its proximity to the larger urban center of San Francisco. We'll incorporate this overview with the work Stanford students have prepared as a road map for a more focused history of an important body of water in the park, Tomales Bay. This will not only be a history of environmental change, but also a project that will support current scientific investigations of the bay being conducted by the National Park Service as part of its inventory and monitoring program. Having historians and ecologists at work on similar topics, indeed having them in the field together, should generate a greater awareness of the changes to and condition of natural systems.

Environmental history, whether as a special study or as part of a larger research project, can serve as a tool for park management. By placing nature at the center of the story, it can bring a fresh view to traditional interpretations of the past, especially those that focus on the built environments and on the human and administrative histories of parks. It can also yield insights into and the context for the condition of park resources, ecological restoration projects, and inventory and monitoring programs. (Like these programs, it is baseline documentation.) Likewise, it can provide insights for park planning and environmental impact statements. Perhaps its greatest use will be in how the National Park Service interprets environmental change to the public.

Administrative Histories in the National Park Service's Alaska Region

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As some of you may know, much of my work revolves around administrative histories. I read them, write them, edit them, and care deeply about how well they work, and I think that a well-done administrative history can be highly effective as a planning and management tool.

Recognizing that a primary goal of all administrative histories is that they be used as a primary planning and management tool, I feel that the best way to ensure their effectiveness is for administrators or authors of these studies to employ a four-part strategy:

1. Convince park management sufficiently of their worth that they will want such histories to be written;
2. Incorporate the goals and concerns of park staff during the writing process;
3. Make the final product both worthwhile to look at and worthwhile to read; and
4. After its completion, work with existing and new staff to make information available that was discovered during the research process.

I'd like to spend the next few minutes elaborating on each of these four points.

First, it is recognized that an administrative history is just one of many products that cultural resource personnel can use—and fund—with a limited amount of funds. Therefore, it's important to convince both superintendents and resource management personnel of the value of a historical perspective in addressing management problems, especially when examining knotty or critical situations. In Alaska, a Cultural Resources Advisory Committee (CRAC) often votes on whether certain administrative histories will be funded, so it's important to persuade all of the region's CRAC members of the value of an administrative history. It's also important to recognize that, in specific situations, that the best solution to a management problem may be a special, thematic administrative study rather than a general park history. (*Alaska Subsistence: An NPS Management History* and *The Most Striking of Objects: The Totem Poles of Sitka National Historical Park* are examples of special theme studies.)

Second, once the decision has been made to fund an administrative history, it's important to involve park staff in the research and writing as much as possible. For instance, it's important to choose an author who writes clearly and well—not elegantly, but directly and with a minimum of embroidery. In addition, whoever is chosen for the project should be able to visit the park in question with some regularity—enough to get to know a park's staff and its resources. Once the project has begun, it's important for the author to let the park staff know, in advance, when he or she will be visiting. After arriving at the park, it's important for the author to talk to both the superintendent and the various division chiefs about the project, either individually or at a staff meeting. He or she should ask them what specific problems they would like to have addressed in the study, and the author should also ask if there are any specific datasets that should be perused during the research phase. During the writing phase, the author should follow up with park staff from time to time, either in person or by telephone or e-mail. During these follow-up contacts, the author should let staff know what progress has been made, what answers have been found to particularly vexing questions, and if any particularly rewarding materials pertaining to their subject area have been unearthed. Finally, it's important to ask both the superintendent and the various division chiefs to read over the draft chapters; this will both ensure accuracy and increase the degree to which park staff will use the final document.

Third, it's also important to make the final product look good and read well. First, make the length appropriate to the complexity of a park. A colleague of mine once said that an administrative history of Grand Canyon National Park could be written in 100 pages, and I have seen an administrative history of a small, uncomplicated park that was more than 700 pages long. Both lengths, in my opinion, are unacceptable; the history of a small, uncomplicated park should be no more than 150 pages long, while a history of many of the larger parks should be completed in no more than 350 or 400 pages. In the case of the largest and oldest "crown jewel" parks, park management should consider the production of a single-volume general history; once completed, additional histories on specific themes (interpretation, the road system, bear management, etc.) may be considered later.

Be sure to produce enough copies of the final product to allow availability well beyond the immediate distribution process. With staff turnover, there's a constant need for new copies, and given the choice, no one wants to read—or have to produce—a photocopied report. (It's important, by the way, to have a copy of the final report on the world wide web, but this is no substitute for a paper copy; besides, a report's availability on the web is bound to create new demand for a paper copy, not a substitute for it.) If the park being written about has a high degree of public interest, it may be economically advantageous to work out distribution matters with a university press, commercial press, or cooperative association. Using an outside press, however, may delay the receipt of a final product for a year or more, and complicating the situation is that park managers (your primary audience) may demand a different product than representatives of outside presses. In Alaska, where visitation has traditionally been low and where there is little demand for these studies outside of NPS visitor centers, we have had little reliance on outside presses. In the "old" days, prior to the computerization of the printing process, there was a fairly close, mathematical relationship between the number of copies desired and the total printing cost. But since the mid-1990s, the cost of small print runs has cost far more per copy than in the "old" days, while relatively large print runs result in less expensive per-copy print runs than in the "old" days. These changes in the economics of printing have encouraged us in Alaska to increase the number of copies in our typical print run; print runs in the early 1990s typically averaged between 150 and 300 copies, but recent print runs have often topped 1,000 copies.

Given the expense of producing the final document, it matters to all who will receive the document that it look good. Be sure to add an appropriate number of photographs, tables, maps, headers and footers, text boxes, and other elements to make the document appear attactive. Employ a graphics consultant if necessary. Superintendents often like to present these histories to park friends and neighbors, and the small time and expense of producing a visually attractive document is time well spent.

Make sure that the document works well and is accurate. To ensure accuracy, have the author ask several people to review the entire draft. If he or she is unsure about a chapter's completeness, or if a chapter is particularly sensitive or controversial, have the author present the chapter to one or more experts in that field. Here in Alaska, there is a writer–editor employed on the regional staff.

Finally, it cannot be overemphasized that a study such as this demands a good index. Because virtually no one will ever read an administrative history from front to back, a good index is needed in order to ensure that resource managers can quickly look up a specific topic when needed. Adding an index is often the very last item an author wants to do when completing a project, but it is worth its weight in gold. If an author cannot or will not index a document, word-processing programs often have indexing features (which, in my opinion, do not work as well as hand indexing), and professional indexers can also be hired.

Fourth, when the administrative history has been completed, the author (if an National Park Service employee) or the administrator (if the author worked on contract) will need to keep "selling" the administrative history after copies have been distributed. For example, the author may wish to give a talk highlighting the park's history to park staff (perhaps as part of seasonal training), or perhaps to a community gathering in a town neighboring a park. There will often be one or more park staff—perhaps the superintendent, perhaps a resource management specialist—who will show a special interest in the details of a park's history, and it's important to provide a perspective on what was written and to otherwise keep the communication lines open. Depending on who is in charge of distribution, someone may need to accommodate future requests for copies. Finally, it's important for the author to box up the research materials that were used in creating the document. Those materials should then be categorized, and finding aids should be prepared. Once this process has been completed, the materials should be available for future researchers, either at a park office, a regional office, or in the nearest National Archives repository.

Sustainable Design for an Evolving Landscape

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The ability to preserve the Dyea historic townsite in Klondike Gold Rush National Historical Park in some meaningful form requires resource specialists and designers to work together in rather innovative ways. Because of the particular dynamic of the natural processes at this location, there is a need to re-define the traditional National Park Service (NPS) paradigms that generate park facilities. Primarily concerned with varied aspects of recreational tourism, the Park Service's leadership culture has been extremely reluctant to abandon traditional assumptions.[1] Therefore, the methods and techniques used to construct infrastructure need to be based upon the premise that emergence of structure from the landscape is preferred over that of imposition. This means more than a cursory recognition of organic architecture. It is important to begin the design process during the formative period of resource inventory, analysis, and appraisal. A higher level of responsible treatment and use of the landscape can then be attained. The ultimate goal is to demonstrate to the public and to our own professionals that constructed infrastructure can exemplify sustainable design for an *evolving* landscape. The sustainable approach to site planning and design goes beyond combining and comparing site inventories. A sustainable process attempts to determine the *relationships* between site factors and how those factors will adapt to change.[2]

First and foremost, basic preservation and management is predicated upon a decision that was made in the enabling legislation of the park, encouraging the public to enjoy and experience the very resources intended to be protected. Successful implementation of this requires a holistic approach to designed improvements that can assist managers in making difficult decisions about competing and sometimes conflicting resources. This approach to design requires a comprehensive interdisciplinary strategy. Through research and careful planning, ecological preservation and recreational tourism do not have to be mutually exclusive.[3]

Focusing on recreational tourism, NPS neglected to push science to the forefront and make it a non-negotiable element of park management.[4] To alter that thinking, a comprehensive interdisciplinary strategy ideally places a designer of visitor facilities in the landscape at the time of resource assessment to gain an appreciation for the environment in which facility development will eventually occur. The designer can also interact with resource scientists so that they might begin to participate in the development of design criteria. Traditionally, "the principle of beauty of scenery called upon planners to study the landscape by going alone to experience all kinds of weather, at all times of day, and in all seasons."[5] Going one step further, the goal is to develop planning strategies early in the design process that will identify research needs and provide logical methodologies for management decisions. Linda Flint McClelland credits author Frank Waugh with the notion that "the principle of conservation [upholds] the preservation of native flora and fauna as a fundamental but complex requirement, calling for long and serious study." She goes on to note that "[w]here native species were already depleted or lost, Waugh called for their restoration...."[6]

Created infrastructure evolves from many design criteria, but the criteria that respond particularly to the natural and cultural resources of a site or environment give enhanced meaning to form, function, and longevity. Embodied energy that exists in these resources must be viewed for sustainable qualities before any disturbance, alteration, or elimination is contemplated. Once the resources are well understood and can support the criteria that determine design form and function, it is imperative that techniques be used to emphasize their importance throughout the planning, design, and construction of facilities. In the past, concern for the harmonization of construction and nature led park designers to adapt principles of natural landscape design for restoring building sites to a natural condition after construction. In 1930, the recognition of landscape naturalization as an ordinary and advantageous consequence of park development coincided with a policy prohibiting the introduction of exotic plants in national parks.[7]

Today, planning, design, and construction techniques must support cultural and natural resource preservation, including, but not limited to:

- Adequate coordination of planning requirements between the park, relevant stakeholders and all owners of land inholdings to save duplicative processes and unnecessary invasive testing.
- Promotion of research studies by cultural, natural, and interpretive resource staff with a clear intent to provide the compliance clearances necessary for the creation of visitor facilities, but also to contribute findings to the proposed interpretive programs and design development of new facilities. Architect Alvar Aalto conceived of a design process that was more a collaboration of creative individuals than a disparate collection of isolated specialists and disconnected client representatives.[8]
- Preparation of detailed specifications for land surveying to prevent unnecessary resource damage.
- Completion of visitor-use analyses as a key to making sound decisions about the size, location, and function of infrastructural facilities.
- Consideration of sustainable design philosophies to not only minimize impacts on the resources during construction, but also for the post-construction period of maintenance and operations. For example, the naturalistic landscape gardening practices that had evolved in the 1920s called for the planning of groupings of native trees, shrubs, and grasses along roadways, construction sites, and eroded areas, and the removal of vegetation for fire control and beautification. As construction took place in the parks, trees and shrubs were removed from the construction sites of buildings, roads, overlooks, and parking areas and transplanted in temporary nurseries or on the sites of completed construction. By 1930 this process of transplanting and replanting had become known as "landscape naturalization."[9]
- Involvement of resource staff in design submittal reviews and value analyses.
- Construction specifications that thoroughly manage site access, ground disturbance monitoring, vegetative root pruning, temporary erosion controls, equipment and material storage, and appropriate staging activities.
- Construction administration and inspections that provide the potential for an empathic contractor relationship, periodic review of progress by resource staff, and confirmation of interpretive content. Waugh cautioned his readers that "a genuinely naturalistic planting was excessively difficult to achieve" and that training and a close observation of natural conditions were necessary.[10]

The protection of resources in areas designated for intensive public use first begins with recognition, then understanding, and finally empathy. It is commonly understood that pertinent cultural and natural resources must be easily identifiable and separate from undesignated areas or interpretive facilities. No matter how intelligent or familiar a new visitor might be, there is often not a full appreciation or awareness of the differences between significant resource preservation areas, designated interpretive opportunities, and undesignated areas with less or no significant resources. Nor should a new visitor be expected to be aware of these differences. Even when ecological degradation is pointed out to park visitors, the new conditions may be thought of as merely "another change in the scenery."[11] Good design and effective interpretation should attempt to solve this problem. Once a visitor is able to identify the resource(s), it is up to the resource specialists, researchers, and designers to enlighten through effective means of interpretation so that knowledge is shared or enhanced. Ultimately, resource protection is successful if there is a physical, emotional, or psychological experience the visitor gains from the presentation of unbiased interpretive content. Environmental interpretation becomes even more important as natural landscapes and cultural treasures disappear. Today, the public has an expanding role in land management decisions.[12] Have the resources been presented in such a manner that the visitor eventually forms an opinion and/or takes an action? If so, the effort to substantiate sustainable design has been worth it.

So we ask ourselves, how are we to protect resources from human threats (impacts), whether intended as such or not? The answer lies partly in the conscious decision to guide or manage the basic sequential human tendencies of discovery, exploration, domination, alteration, domestication, cultivation, and, in some cases, destruction. The resolve to blend new construction with natural surroundings—to develop the parks without destroying their beauty—formed the basis of landscape architecture's central role in national park development.[13] As a modern designer, one must now confront these tendencies in three ways. *All* threats have the potential for impacts. Design or education can address *most* threats. *Few* threats should require an enforced response.

Ethical design decisions must have a basis in the legislation of the park. When conflicts occur between natural and cultural resource values, choices will be made. Landscape architect John O. Simonds called for a "means of coordination and bringing to concerted focus on our planning problems the experience and accreting knowledge in all areas of inquiry."[14] Even when a "no action" alternative is selected, it requires a conscious decision, and so varying degrees of ethical choices will result. This interdisciplinary approach to visitor facility planning and design may not solve all potential conflicts, but it may help to rationalize the decisions made for the visiting public. As a rule, the focus on decision-making is on those areas of the design problem that are likely to produce the most significant results or the most important consequences for the design as a whole.[15] Therefore, it may be advocated that the ethical reasons for land development decisions are not of critical importance. The ethical relevance lies in the interpretive message that is presented to the visitors so that the conflicting issues and the solutions chosen can be weighed and judged by the public that we are all dedicated to serving.

Endnotes

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Integration of the North American Bird Conservation Initiative (NABCI) into Southeast National Park Service Planning and Operations

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Introduction

Since the creation of the U.S. Geological Survey–Biological Resources Division (USGS–BRD), the National Park Service (NPS) has had limited participation in regional, national, and international bird conservation planning efforts. The NPS personnel responsible for coordinating bird conservation before creation of the USGS-BRD were all essentially removed from this duty when transferred to USGS-BRD, reducing NPS participation in regional, national, and international bird conservation planning. However, individual efforts to promote bird conservation did continue and today, existing bird conservation efforts are largely attributed to individual park units and individuals in park units who have had support of the park superintendent or supervisor. A significant recent NPS contribution to bird conservation has been the development of the Park Flight Program (NPS 2002), a partnership between NPS, the National Park Foundation, the National Fish and Wildlife Foundation, American Airlines, and the U.S. Agency for International Development to facilitate bird conservation between U.S. national parks and Mesoamerican national parks. Park Flight is a great step forward in promotion of bird conservation in NPS.

Another significant NPS bird conservation initiative has been the effort to coordinate and integrate the strategies and goals of the North American Bird Conservation Initiative (NABCI 2000) into the Southeast Region of NPS.

NPS is the fourth-largest landowner in the United States, managing over 380 national park units covering 3.36 million ha of land and water. The 64 units in the Southeast Region of the NPS represent 16% of the total number of park units in the National Park System and cover approximately 5% of its land base. Park Service units in the Southeast Region include national seashores (Canaveral, Cape Hatteras), national parks (Great Smoky Mountains, Everglades), national recreation areas (Big South Fork National River and Recreation Area), national preserves (Big Cypress), national battlefields (Cowpens, Fort Donelson), national monuments (Congaree Swamp, Ocmulgee), and other parks such as the Blue Ridge Parkway, Obed Wild and Scenic River, and Timucuan Ecological and Historic Preserve. The Southeast NPS units provide habitat for over 400 species of migrating, breeding, and wintering birds, as well as for a wide range of federally- and state-listed threatened and endangered species. There is further potential for contributions to bird conservation, through bird or habitat conservation, research, education, or a combination of these. Additionally, the National Park System attracts over 280 million visitors to the parks each year, 120 million of these in the Southeast Region, a region which affords excellent recreational bird watching and opportunities for bird conservation interpretation, outreach, and education programs.

Methods

In 1999, the Southeast Region recognized the importance of coordinating existing bird conservation goals and integrating them into the planning and operation of national park units. To support this, the Southeast Regional Office approved funding for a two-year project to coordinate and implement NABCI strategies. NPS allocated $88,000 over the period to support the project, cost-sharing with the U.S. Fish and Wildlife Service (USFWS) Region 4 (Southeast Region) to hire a bird biologist to conduct the project. Additionally, NPS wrote the interagency agreement that provides for technological assistance when needed. This project is unique in NPS and represents a model for regional bird conservation programs and activities in the agency.

What does "implementation of NABCI strategies" mean in NPS? As envisioned, the coordination and implementation of NABCI strategies in the Southeast Region involves:

- Developing and delivering Avian Conservation Implementation Plans (ACIPs);
- Coordinating with the NPS Inventory and Monitoring Program;
- Developing a web-based project tracking site;
- Establishing bird conservation partnerships;
- Identifying and exploring potential funding opportunities; and
- Providing technical expertise to parks as needed or requested.

Avian Conservation Implementation Plans. The ACIPs will be concise documents that describe the park's avian resources, ongoing bird conservation efforts, and identified bird conservation projects and priorities (if any). They will also describe how the landscape of the park unit fits into greater-landscape bird conservation efforts—regionally, nationally, and, perhaps, internationally. These documents will guide the park for almost any desired bird conservation effort. The preparation of these documents will require site visits to each of the southeastern national park units and information will be gathered following a standard format and in consultation with park staff. The plans will be delivered to the park units based on the NPS Inventory and Monitoring Network (see following section). The general content of each ACIP will include:

- Introduction;
- Background;
- Status of southeastern avian resources;
- Purpose;
- Objectives;
- Park description;
- Coordination with regional conservation initiatives (how and where the park fits into NABCI goals and strategies);
- Integration of NABCI objectives, stepped down from the existing bird conservation plans (Partners in Flight, U.S. Shorebird Conservation Plan, North American Waterfowl Management Plan, North American Waterbird Conservation Plan);
- Implementation; and
- Appendixes.

NPS Inventory and Monitoring Program. In the early 1990s, NPS embarked on a nationwide project to develop and implement an inventory and monitoring program in all parks with significant natural resources. The program was initiated in developmental phases using pilot parks. The program has been expanded to over 250 national park units and organized into networks of parks with similar resources and resource management issues. For instance, because South Florida and the Caribbean have similar natural resources, the national park units in these areas have been selected to comprise the South Florida/Caribbean Inventory and Monitoring Network. A single plan will be developed to identify the basic inventory and monitoring needs of these parks.

The Southeast Region of NPS comprises five inventory and monitoring networks: the Appalachian Highlands, Southeast Coast, South Florida/Caribbean, Cumberland/Piedmont, and Gulf Coast. To develop plans, the networks have established scoping meetings where resources indicators of park or ecosystem health are identified and considered for monitoring purposes. The project coordinator attends each network's scoping meetings to present relevant information on bird and habitat conservation priorities for the park, region, or bird conservation planning area of interest.

Website development. A website will be developed and administered through the USFWS field office in Manteo, North Carolina. The website will describe the project and provide links to:

- Existing bird conservation initiatives and plans;
- NPS home pages (including inventory and

monitoring pages);

- USFWS bird conservation websites;
- ACIPs; and
- Agency contact information.

Access to agency contact information assists with the development and maintenance of partnerships between NPS, other agencies, and bird conservationists. This link will provide a database of nationwide NPS personnel contact information as well as that for key bird conservation specialists, biologists, and bird conservation coordinators. Agency contact information will be provided at five planning levels; NABCI bird conservation regions, Partners in Flight (PIF) physiographic areas, NPS regions, NPS inventory and monitoring networks, and states. Each of these planning levels will have a map, and each map designation will link to a database that provides personnel contact information. For instance, the PIF-level map will show a map of the contiguous United States and Canada, Alaska, and Hawaii, and show all designated PIF physiographic areas. Each physiographic area will have a link to the contact database. For example, if the Southern Blue Ridge physiographic area is selected, the viewer is directed to the database table of associated NPS units in that area, individual unit information (including personnel information), and other primary bird conservation contact information. The website will also have links to potential funding sources, the Park Flight Program, NPS bird checklists, and other relevant bird conservation websites.

Established partnerships. The project coordinator will work with NPS and other bird conservation partners to develop and encourage partnerships that will facilitate cooperative bird conservation efforts and projects. NPS participation in the Appalachian Yellow-bellied Sapsucker Working Group is one example.

Funding opportunities. The project coordinator will work with NPS and bird conservation partners within the existing framework of funding mechanisms to obtain funding for high priority bird conservation projects in the southeastern United States. Funding to conduct research on American oystercatcher (*Haematopus palliatus*) in three national seashores on the Atlantic Coast has been obtained through this coordination.

Technical expertise. The project coordinator will provide technical assistance upon request and help park personnel in making the appropriate contacts with bird conservationists, partners, or other personnel to obtain the technical advice sought.

Results

Avian Conservation Implementation Plans. To date, 36 NPS units in the Southeast Region have been visited. Interviews have been conducted with staff at each of these units and information necessary to develop each ACIP has been obtained.

Three plans have been completed and 33 others are in progress. Draft ACIPs for the parks will be reviewed by park staff and their bird conservation associates to provide for an integrated implementation plan. Final copies of each ACIP will be available on the website and usually on the particular parks internet home page.

NPS Inventory and Monitoring Program. The project coordinator has participated in scoping meetings for the South Florida/Caribbean and Cumberland/Piedmont networks in the NPS Southeast Region. Bird and habitat conservation priorities for the park, region, and inventory and monitoring network landscape were presented to the network teams for consideration in their monitoring plan development. This presentation also provides the opportunity for the network, or parks within the network, to consider and potentially integrate NABCI bird conservation into their plans.

For example, in the NPS Cumberland/Piedmont Inventory and Monitoring Network, three PIF physiographic areas occur: the East Gulf Coastal Plain, the Southern Ridge and Valley, and the Northern Cumberland Plateau. Bird and habitat conservation measures identified in a draft PIF bird conservation plan were presented to the scoping meeting participants, including staff at these parks. A similar presentation was made to the South Florida/Caribbean Inventory and

Monitoring Network meeting participants.

Website development. Development of the website (southeast.fws.gov/birds/nps-birds.htm) was contracted out to a local individual and was launched in mid-July 2002.

Established partnerships. Partnerships were established between:

- NPS, USFWS, USGS–BRD, and North Carolina State University—to conduct research on American oystercatchers at Cape Hatteras, Cape Lookout, and Cumberland Island national seashores;
- NPS, USFWS, U.S. Forest Service, Eastern Band of the Cherokee, and several academic institutions—to conduct surveys for Appalachian yellow-bellied sapsuckers (*Sphyrapicus varius*) in the southern Appalachians;
- NPS and the Atlantic Coast Joint Venture (NPS became an official member);
- Cape Hatteras and Cape Lookout national seashores—as participants in the International Shorebird Survey and website entry into the South Atlantic Migratory Bird Initiative (SAMBI);
- Great Smoky Mountains National Park and USFWS—to manage landscape at "The Purchase" to improve habitat for the golden-winged warbler *(Vermivora chrysoptera);* and
- Canaveral National Seashore and Merritt Island National Wildlife Refuge—to share resources to accomplish management and protection of two federally listed species.

Funding opportunities. USFWS submitted a proposal and received funding for research on the American oystercatcher at Cape Hatteras and Cape Lookout national seashores. A summary of funding opportunities outside the normal annual funding call of NPS has been prepared and will be available on the website. North American Wetlands Conservation Act (NAWCA) grant program information was submitted to the NPS Southeast Region's associate regional director for resource stewardship and science for transmission to park units.

Technical expertise. Technical support and guidance is an on-going activity.

Discussion

The integration and coordination of NABCI goals into the Southeast Region of NPS represents a unique approach to incorporation of bird conservation goals into an agency's planning and operations. Reviewing the situation approximately midway through this project, significant and enthusiastic cooperation has been given by NPS. From the regional directorship down to the park resource manager and volunteer, NPS has welcomed and encouraged this project and is excited to become a more active participant in southeastern bird conservation. Following completion and delivery of the ACIPs to southeastern parks, the next phase will be transferring the conceptual and tactical strategies described in the plans into partnerships, funding opportunities, and projects that will translate into bird and habitat conservation. Once fully embraced and incorporated into agency operations and planning, the ACIPs for parks in the Southeast Region will enable NPS to "deliver the full spectrum of bird conservation through regionally based, biologically driven, landscape-oriented partnerships under the North American Bird Conservation Initiative."

Acknowledgments

Special thanks is given to the Southeast Region of the National Park Service, especially Sheila Colwell and Jerry Belson. In the U.S. Fish and Wildlife Service, thanks to Chuck Hunter and Frank Bowers for promoting this concept of shared bird conservation visions between Department of Interior agencies and seeing that the opportunity became a reality.

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Barriers to Science-based Management: What Are They and What Can We Do About Them? (Session Summary)

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Introduction

The George Wright Society (GWS) was founded in part to promote the application of knowledge to the protection, preservation, and management of parks and reserves. Recognizing that much of the knowledge needed for sound resource stewardship comes from science, the 1998 National Parks Omnibus Management Act (P.L. 105-391) directed the secretary of the interior "to assure that management of units of the National Park System is enhanced by the availability and utilization of the highest quality science and information" (quoted in Harmon 1999). Attendees at the GWS/CR2003 conference expressed interest in a variety of talks and sessions that addressed the role of science in management. In fact, the high level of interest in a workshop focused on barriers to the use of science was unanticipated. Approximately 50 workshop participants crowded into a small room so that many were standing, and those near the doors commented that a number of people were turned away because they could not physically fit into the room. This paper summarizes the workshop presentations and discussions.

Acknowledging that science is a process used to develop knowledge, the workshop was focused on scientifically derived knowledge and systematically collected data. Vita Wright, research application program leader at the Aldo Leopold Wilderness Research Institute, began the workshop with an overview of barriers identified during recent discussions with U.S. Forest Service recreation, fire, and invasive plant resource specialists and local decision-makers with wilderness responsibility. Personal barriers to the access and use of science include time management skills and habits, personal pressures, preferences, and attitudes toward science. Organizational barriers, those beyond the control of individuals, include funding, delegated workloads, training, and agency practices. Finally, barriers that are beyond the control of both the management agency and individuals include the availability and quality of information produced by the research community (Kearns and Wright 2002).

During the introduction, Wright also reviewed the "diffusion of innovation" theory as it applies to research application. Dependent on a "condition of receptivity" to new ideas, this theory describes the stages people go through when adopting innovations. These stages are: awareness, understanding, ownership, and then fitting the innovative idea or technique into an individual's current understanding (Muth and Hendee 1980, as cited in Bunnell 1988). Understanding barriers as perceived by members of the management community can help managers and researchers prioritize technology transfer and research application efforts. This will be most effective when coupled with an understanding of social science theories, especially those addressing how people learn, make decisions, and adopt innovations.

Following the introduction, representatives from the National Park Service (NPS) and Bureau of Land Management (BLM) discussed efforts in which they have been involved that highlight the value of science and/or reduce barriers to using science.

National Park Service

In fall 1999, NPS began implementing the Natural Resource Challenge (NRC). Under a multi-year plan, the Challenge provides new base funding targeted at promoting scientifically sound management of parks, increasing the scientific community's involvement in providing information and in using the parks as laboratories, and facilitating education to engage the public as partners in resource preservation. Don Neubacher, superintendent of Point Reyes National Seashore and co-chair of the NRC council, suggested that a successful science-based management program answers the following questions:

- What are we protecting and preserving?
- What is the condition of our resources?
- How does the condition of our resources change over time?
- What is the condition of resources outside park boundaries?
- What are the implications of these findings for parks and the larger systems in which they reside?
- What actions need to be taken for preserving species?
- How can this information be best communicated to the broader society?

Neubacher described several examples where systematically collected data and an understanding of science have supported management decisions at Point Reyes National Seashore in California. For instance, multi-year data showed a strong correlation between numbers of harbor seal *(Phoca vitulaina)* pups and kayak use. Pup numbers were lower after kayak use increased and higher following kayak use restrictions. This relationship was evident at one of three locations, allowing managers to determine where kayak use had the greatest effect on seal pupping. In a second example, observers documented that fewer snowy plover *(Charadrius alexandrinus)* chicks died the year the park began educating weekend and holiday visitors. While further study was needed to be conclusive, it initially appeared that education efforts reduced disturbance by humans and dogs. Without these types of data, managers would have less information on which to base decisions and no documentation on the effectiveness of these decisions.

Neubacher cited a "lack of long-term credible data" and public opposition to proposed management actions as common barriers to science-based management. He suggested that managers need long-term research on which they can base good decisions. However, this needs to be coupled with extensive public discussion, outreach, and education. Neubacher concluded with two local examples that coupled scientific data collection with raising public consciousness: the Tomales Bay Biodiversity Inventory (TBBI) and the Pacific Coast Learning Center at Point Reyes. Learning centers, which are park-based field stations, are being developed throughout NPS to facilitate both research and education about natural and cultural resources within national parks. The TBBI, supported by private foundation and individual funding, couples a comprehensive marine biodiversity survey with educational opportunities for the public to experience the scientific process first-hand while learning about the stewardship and conservation of marine systems.

Bureau of Land Management

In June 2000, BLM created the National Landscape Conservation System. The NLCS includes national conservation areas, national monuments, wilderness and wilderness study areas, and wild and scenic rivers; these areas were designated to protect important scientific and ecological characteristics. Lee Barkow, director of BLM's National Science and Technology Center (NSTC) and advisor to the agency's Science Coordination Committee, discussed efforts within BLM to improve the use of science in management.

Barkow began with a brief overview of the history and mission of BLM. The fact that BLM has never employed scientists poses significant challenges to creating a link between science and management. Although the agency does not have a science mandate like the Omnibus Management Act, many of the laws it operates under require scientific information (e.g., Federal Land Policy and Management Act, National Environmental Policy Act, Endangered Species Act, Clean Water Act, and Clean Air Act). BLM has recently developed a science strategy, signed in 2000, which addresses the role of science in decision-making, provides a process to identify and prioritize science needs, and addresses the need to communicate those needs to science providers.

BLM has two formal groups that address science issues. The Director's Science Advisory Board, an external committee composed of academic and non-academic members, and the Science Coordination Committee, an internal committee composed of resource specialists representing various administrative levels. These committees provide the strategic and tactical views of science within the agency, respectively. In addition, the NSTC provides free science- and technology-related services to BLM employees. The NSTC provides free library services, synthesizes scientific information, identifies current technologies, and develops partnerships with science providers.

Barkow described several barriers to science-based management in BLM. Science does not have an identity in the budget process; therefore, efforts to improve science depend entirely on broad program support. Additionally, members of the internal Science Coordination Committee address science only as a collateral duty. Barkow noted that science is used by those within the agency who seek it, but its use is not always explicit or well documented. Finally, he cited technology transfer as often being the first target for reduction or elimination during tight budget years. Barkow suggested that science should be a part of the organizational culture, and that it should be valued and desired during the decision-making process. The agency needs full-time staff dedicated to science coordination and to technology transfer. To ensure that sound science is considered in the decision-making process, funding technology transfer should be a priority, and scientific information sources should be readily accessible to managers and resource specialists.

Scientists' Perspectives

Two scientists, Jan van Wagtendonk, U.S. Geological Survey (USGS), and David Parsons, U.S. Forest Service (USFS), provided their perspectives on barriers as well as potential solutions. Van Wagtendonk began by reminding the audience that management is not "science-based," but rather it is "science-informed." Van Wagtendonk and Parsons commented that the scientific community does not offer much support for scientists conducting research application activities. Individual scientists are rewarded more for developing knowledge and distributing it within the scientific arena than for extending the information to land managers. This is particularly true in the Department of the Interior, where experience on research-grade evaluation panels that evaluate the productivity levels of individual scientists shows that USGS offers less credit for research application efforts than does USFS. For research application to be effective, scientists in both agencies must take it upon themselves to extend information about the results and implications of their research. The outcome is that some scientists devote more time to research application, at the expense of developing and publishing new knowledge, than others.

Parsons noted that scientists are also challenged by the legal system (e.g., the 2000 Data Quality Act, P.L. 106-554, Section 515, and subsequent appeals), making literature syntheses and extrapolation of scientific findings to management issues risky. Van Wagtendonk concluded by saying that research application is a two-way street. He emphasized the point that if researchers take the time to summarize results for management audiences, then managers must take responsibility for reading those summaries. There's only so much distilling that a scientist can do without losing the meaning and appropriate application of research. Both scientists acknowledged that it is easier for researchers and managers to develop relationships and communicate about relevant research when the two groups are co-located, as is the case for some previous NPS scientists who now work in park-based USGS field stations.

Workshop Discussion

The spirited discussion that followed the presentations focused largely on the need to extend scientific information, not only to the management community, but also to agency partners and the public. Ironically, a strong advocate of Point Reyes National Seashore complained about restrictions that keep her from traveling where snowy plovers, a species near extinction, nest. Concern was also expressed about the "myth" that managers can "let nature take its course" in parks, while humans continue to develop and pave the landscapes outside parks and protected areas. The sentiment was that if the public better understood the science behind management decisions, they might be more supportive of those decisions.

Discussion also addressed the need to better fund research and research application efforts. Government agencies often are not eligible to compete for external grants. However, government employees interested in research application might investigate sources such as the new educational grants offered by the National Science Foundation. A member of the audience from the Northeast expressed concern that he often sees the same names on proposals submitted for special natural resource project funding under the NPS and USGS Natural Resource Preservation Program (NRPP). Unfortunately, while the NPS's NRC has increased the amount of NRPP funding, many managers and researchers still cannot, or do not, take advantage of it.

In addition to the aforementioned discussions, the audience offered a variety of other ideas to reduce barriers to science-based, or science-informed, management. Whereas Parsons and van Wagtendonk had mentioned the need to improve the reward system for scientists who emphasize research application, others suggested managers could be better rewarded for explicitly including science in management decisions. However, some audience members expressed skepticism that the latter could be effectively accomplished. On a different topic, the discussion ended with the comment that it would be easier for both managers and the public to use science if they had clarification on how specific research results fit within the context of entire ecosystems.

Conclusion

In keeping with the GWS mission and conference objectives, the GWS/CR2003 conference included numerous presentations on the role and contribution of science to natural and cultural resource stewardship. In addition to the workshop described here, there was similar interest in a panel on "Science in the NPS: Where have we been? Where are we going?" With an emphasis on improving the use of science within NPS, that panel focused on cooperative ecosystem studies units, inventory and monitoring networks, and the role of the USGS in NPS science delivery.

Other science emphases at the conference addressed the role of parks as places to develop scientific knowledge, the evaluation of proposals for conducting scientific activities in wilderness, and efforts to integrate scientific knowledge and research with public education. It is my hope that, in addition to providing a forum for sharing information about the contribution of specific research efforts to resource stewardship, future GWS conference committees will continue to pursue—and recognize member interest in—dialogue on how to reduce barriers to science-based management.

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An Investigation of Agency Perceptions of Transboundary Protected Area Cooperation: A Case Study of Wrangell–St. Elias and Kluane Protected Area Complex

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Introduction

The purpose of this research was to explore, understand, and describe the transboundary cooperation between Wrangell–St. Elias National Park and Preserve, Alaska, USA, and Kluane National Park and Reserve, Yukon Territory, Canada, from the perspective of agency managers. The strengths and weaknesses of the existing transboundary management activities were identified and the reasons behind them explored. Based on the research findings, suggestions for the improvement of management practices in this situation are discussed.

Channels of Transboundary Cooperation

Various authors have argued that transboundary cooperation between internationally adjoining protected areas is desirable because the benefits more than compensate for the problems encountered in establishing such collaboration (Sandwith et al. 2001; McNeil 1990). These benefits may include a wide array of outcomes, ranging from safeguarding biodiversity, promoting ecosystem or bioregional management, and controlling species, to reducing political tensions stimulating the regional economy, safeguarding cultural values, and promoting bilateral understanding. However, strong political and managerial commitment is necessary if transboundary protected areas are to accomplish these multiple benefits on a long-term basis (Brunner 1999).

Zbicz (1999) identified six levels of interaction between internationally adjoining protected areas, ranging from *Level 0—No cooperation* to *Level 5—Full cooperation. Full cooperation* requires the full integration of the planning and management of the two protected areas, including joint decision-making, identification of common goals, and the existence of a joint committee for advising on transboundary cooperation.

This study was conducted as a case study (Stake 1995). Data collection methods included interviews, archives, and phone/e-mail contacts, primarily with agency managers. Qualitative data analysis used the NVivo software package. The research findings clearly indicate that the occurring transboundary interaction between Kluane and Wrangell–St. Elias is largely limited to Zbicz's *Level 1—Communication,* and some elements of *Level 2—Consultation.* The protected areas' staff do work together to exchange information, but it is mostly an informal and unstructured relationship. Neither has responsibility to, or for the other, nor are there reporting requirements to either regional or national agency offices. The current relationship is based on mutual respect and understanding, personal good will, a shared boundary and shared interests, and a desire to be of assistance and be a good neighbor. It is also based on a desire to communicate and collaborate, and is truly voluntary. The relationship exists primarily "on the ground," with field-level park employees responsible for maintaining it. Both protected areas may initiate contact, and both occasionally do. Employees communicate at all levels either by telephone, e-mails, or face-to-face interactions. The park superintendents meet once per year and have phone conversations twice a year. Communication between lower-level employees occurs on an "as needed" basis and as frequently as every few months.

The relationship began at the ranger–warden level out of a desire to cooperate. Since the designation over twenty years ago of both areas as a single World Heritage site, the relationship has moved forward to a limited degree. Currently, transboundary cooperation includes both formal and informal elements, both at the upper management level and the field or operational level between rangers and wardens, as well as between scientists.

An annual meeting of the management teams of the two protected areas is held. Although perceived as formal, this meeting barely exceeds information exchange. Moreover, neither protected area retains any minutes of these meetings in their central files, nor distributes them to staff who did not attend the meetings. Similarly, both protected areas possess little information relating to transboundary activities. In general, what scarce relevant information exists is stored in personal notes and files. With most information communicated by word of mouth and most transboundary knowledge limited to the memories of staff members, information flow can be interrupted and the record of activity lost as staff members retire or move.

Every two years there is the Borderlands Conference, a joint meeting between regional natural resource management agencies, including the two protected areas and other agencies from Alaska, Yukon Territory, and British Columbia. The conference focuses on discussing regional natural resource issues and exchanging information, research, and other concerns. Both the Borderlands Conference and the annual management team meetings represent forms of formal communication in that they are prescheduled and announced well in advance of the event.

Cooperation has been strongest at the operational level, driven by a specific need or issue ranging from search and rescue activities to law enforcement. However, staffs from both agencies perceive that interaction at this level has been significantly reduced and replaced by that at the managerial level. There are concerns by operational-level staff related to that shift, but these are somewhat mitigated by the recognition that the change was generated by a general lack of staff time and capacity. It is further recognized that the transboundary relationship is highly dependent on the individuals involved. A strong friendship and fellowship that was developed over the years can be notably weakened with the loss of long-time staff and the arrival of new staff. As a result, a notion exists that to a certain extent a loss of continuity in transboundary cooperation occurs, which according to several staff members should be re-established.

At the agency level there is a 1998 memorandum of understanding (MOU) dealing with "cooperation in management, research, protection, conservation and presentation of National Parks and National Historic Sites" signed between Parks Canada and the U.S. National Park Service (NPS) that allows and facilitate transboundary activities. The agreement does not require cooperation or precisely indicate what, how, and when cooperation should occur. Moreover, Wrangell–St. Elias and Kluane have been identified as and remain a top priority for collaboration between the two agencies. However, it is clear from this research that the scarce transboundary activities between the two protected areas fail to achieve the extent of joint cooperation and objectives that were outlined in the 1998 MOU.

Activities, Programs, Processes, and Behaviors

Managers from both agencies indicated that they recognize opportunities exist to work with their professional counterparts across the border, and that this interaction is both helpful and enriching professionally as well as personally. Interviews indicated that friendships make it easier to work together and to be very direct and frank when dealing with an individual. They perceive the benefits of such interaction to be better understanding of the other's place, culture, people, ways of operating, and approaching problems; encouragement to think "outside the box" by being exposed to different perspective; and exposure to alternative models for managing protected areas. Talking to staff across the boundary and identifying their needs is perceived as valuable and useful for management approaches in both protected areas, as well as for sharing areas of joint concern and being aware of the other side's long-term plans. In case these are similar or the same, there is no "reinventing the wheel" situation, which leads to the reduction of duplicating actions.

Several interviewees also stated that by looking at the other management regime there is an opportunity to discover their own agency's pitfalls and learn from that experience by having new ideas of how to question or change the existing approach to management issues. This process of "pollination" brings ideas and perspectives that differ from the same old patterns. In addition, managers perceive cost efficiencies related to collaborative rescues and training initiatives. Knowing people, building relationships, and understanding the differences make both staffs more confident and comfortable while greatly improving their morale. It is also concluded that while all of these opportunities are extremely beneficial, they are also very hard to quantify.

Currently, regular direct contact exists between the two agencies concerning search and rescue; law enforcement, predominantly aimed at controlling poaching; information exchange; and joint training programs in search and rescue techniques, mountain climbing, and rafting. There is a general belief that it is not the quality but the quantity of cooperation that should be improved. While the official position of both agencies regarding transboundary cooperation is to do so when there is such opportunity, there is a perceived need for improvement in exploring and using potential transboundary cooperation opportunities. For instance, there is no joint control or research program conducted between the two protected areas. Staff exchange does not occur even though there is awareness that it would certainly increase individual skills, improve relationships between the two protected areas, and enhance understanding. There is also a recognized need for additional specialist meetings that currently do not take place (e.g., between wildlife biologists, vegetation specialists, cultural specialists, historians, archeologists).

Respondents also indicated that numerous opportunities could be explored, but in reality none have been seriously considered or pursued. Enhanced tourism and education opportunities are completely neglected. For example, there is no substantial interpretative information available on the World Heritage site designation, nor do visitors to either agency's two visitor centers have an opportunity to hear or learn about the other protected area. The two protected areas have not effectively utilized the World Heritage designation: they are not engaged in any significant formal activity regarding the designation even though managers consider the designation helpful in demonstrating to both governments the international and intergenerational significance of the area.

Facilitators of and Barriers to Transboundary Cooperation

Research shows that the most important facilitator to transboundary cooperation between Kluane and Wrangell–St. Elias is personal interest and commitment to such cooperation. However, having a personal relationship of trust and sharing, as well as a collegial professional relationship, are additional factors that are recognized as enablers to successful cooperation. Modern communication technologies, shared interests that establish connections, the existing pathway to build on, personal initiative, and favorable opinions toward an individual are additional recognized facilitators.

The study identifies factors that most significantly inhibit the current transboundary cooperation, such as lack of staff, time, and, to a lesser degree, money. In addition, the boundary between the two protected areas is fairly inaccessible and located far from the headquarters of either unit, inhibiting the extent and frequency of transboundary cooperation. In both areas management focus is not placed on the border region, but rather on either side, toward Alaska or the Yukon, where the infrastructure and majority of visitors are located. Furthermore, as a part of agency philosophy, staff in Wrangell–St. Elias change every several years, making it difficult to maintain the continuity of the transboundary relationship, whether at a professional or a personal level. Some agency employees indicated that the insufficient transboundary activity was the result of inertia and the fact that transborder collaboration was a low priority both at the protected area and the agency levels. Furthermore, it is perceived that this informal level of cooperation is very comfortable, and therefore preferable to keep, because no reporting is required, nor is there any sense of obligation.

The resistance of local and state politics in Alaska to both the United Nations (U.N.) and international engagement in general (Bleakley 2002) is perceived as an additional burden to both practicing and improving transboundary cooperation. More recently, the aftermath of the attacks of September 11, 2001, has significantly restricted cross-border interactions between the two protected areas. In addition, there are no national policies in either country that foster transboundary relationships between protected areas. Decision-making is entirely left to personnel at the local level and the vision they have—or do not have. In short, there is no administrative obligation. Moreover, it is widely accepted by both agencies' managers that Canadians appear more comfortable with international relationships than many Americans. Few, for example, object to either the national government or the U.N. in Canada, while there is significant animosity to both in the U.S. generally, and among Alaskans in particular.

Suggestions for Improving Transboundary Cooperation

Based on the research findings and the reviewed literature, the following suggestions are proposed:

- *Establish a formal transboundary protected area agreement and joint transborder committee.* Working within the framework outlined in the agreement, the committee should develop short- and long-term strategic plans, coordinate the development and implementation of cooperative work programs, undertake a regular review of progress, and report annually to agency heads.
- *Develop joint management plans.* Such plans would help to further safeguard biodiversity conservation as well as other resource stewardship goals. The sheer vastness of the protected areas already facilitates the protection of migratory species, but additional joint monitoring, scientific research, and collaboration might increase the long-term health and maintenance of the regional ecosystem.
- *Develop an annual work plan.* An annual plan should be implemented with clear stipulation of goals, activities, programs, and expectations.
- *Report and evaluate the protected areas' transboundary activities and accomplishments at regional/national agency offices.* Annual reports should be prepared and serve as a basis for performance evaluations.
- *Develop collaborative professional development of staff members through staff exchange.* The need for seminars, training programs, meetings, and exchanging information more often at all levels is recognized, and therefore should be implemented.
- *Keep documentation on the transboundary activities and make it available to the protected areas' staff.* For example, a park botanist who is not invited to attend a meeting between the two protected areas should be informed of the possibilities or achievements of the transboundary cooperation.
- *Explore the potential for developing shared tourism information, interpretation, cultural and education activities, programs, and materials.* There is a need for communicating continuous messages across the boundary through development and production of jointly designed maps, brochures, videos, or display materials. Given the similarities in visitor profiles and markets, there are further benefits to be gained by integrating thematic messages, visitor programs, and marketing approaches, as well as designing a common logo. In particular, much more could and should be done to raise the profile of the World Heritage designation. Attractiveness to visitors could be enhanced by a joint effort to publicize and

increase awareness of the significance of this World Heritage site.

- *Identify and implement opportunities for supporting and strengthening socioeconomic development of local communities and indigenous people.* Such opportunities could be explored through tourism, local cultural heritage, and appropriate infrastructure.

Conclusion

While transboundary communication between Wrangell–St. Elias and Kluane does presently occur, more contact and cooperation could substantially increase benefits to the two areas, visitors, and local communities. Ultimately, enhanced cooperation will require a formal agreement that would enable agency managers to move upward from the current communication level to full cooperation. Such an agreement should include specifics, imperatives, goals, timelines, and measures of success. As a result, an agreement would reduce the present dependence of transboundary interaction on individual initiative through implementation of regular monitoring of progress and reporting to regional and national agency heads.

Indeed, without integrated management mechanisms and agreements, cross-border ecosystem integrity cannot be guaranteed (Fay 1992). Unfortunately, neither park- nor national-level staff believe that this is likely to happen in the near future. NPS is hesitant to establish formal procedures, and prefers to remain non-directive-oriented and vest authority in superintendents to either engage in transboundary activities, or not, at their discretion.

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Carrying Capacity and Visitor Management: Facts, Values, and the Role of Science

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For close to a century, concerns have been voiced about both the biophysical and experiential impacts of recreational use on parks and protected areas. In response, managers have grappled with the task of deciding where and how to manage visitor use and scientists have sought to help them. This effort has often been referred to as defining and managing "recreational carrying capacity." The carrying capacity literature is voluminous. However, there are widely divergent opinions on the value of this research and on the utility of the carrying capacity concept (Cole 2001). Some champion its use as an organizing concept (e.g., Manning 1999), while others argue that the concept is misleading and counterproductive (McCool and Lime 2001). This paper attempts to assess progress in grappling with the carrying capacity issue, barriers to and opportunities for further progress, the distinction between facts and values, and the role of science.

Wagar (1964) developed the first formal exploration of the recreational carrying capacity concept. Among the important ideas he presented were the following: (1) in contrast to earlier characterizations of carrying capacity as an inherent property of a place that can be determined, carrying capacity is not an absolute value; (2) carrying capacity depends on the needs and values of people and can only be defined in relation to some management objective; and (3) the need to limit use can be reduced through other management actions such as zoning, engineering, persuasion, and the management of biotic communities. This latter point led to a substantial expansion of the meaning of carrying capacity—from a focus on numbers of visitors to the entire topic of "how to plan and manage a particular recreation resource" (Lime 1976). In this paper, I equate carrying capacity with the prescriptive aspects of visitor management generally. Defining carrying capacity means making prescriptive decisions about what ought to be done in our parks and protected areas—what recreational opportunities should be provided, what conditions should be maintained, and how recreation use should be managed.

Description and Evaluation, Facts and Values

Wagar's first two conclusions point out the centrality of human values within the carrying capacity concept. Shelby and Heberlein (1986) subsequently elaborated on the importance of human values, suggesting that there are both descriptive and evaluative components to the establishment of carrying capacity. The descriptive component is concerned with how the recreational system operates (with what is), while the evaluative component is concerned with how the system should operate (with what ought to be). It is in this latter component that human values operate. Shelby and Heberlein (1986) go on to propose "a scientific process" (p. 17) for arriving at decisions about evaluative standards (statements of what ought to be). With evaluative standards in place, and descriptive information on relationships between use, management, and impacts, it is a relatively simple matter to prescribe a visitor management program (i.e., establish a recreational carrying capacity).

Shelby and Heberlein's division of the carrying capacity process into descriptive and evaluative components has been highly influential and has never been challenged, although Manning (2001) has recently referred to the evaluative component as the "prescriptive component." The research process they propose (usually referred to as the "normative approach") has been the dominant paradigm for empirically deriving evaluative standards (e.g., Vaske et al. 1993; Manning et al. 1999). Within the past decade, however, critiques of this approach have emerged. Some are of a technical nature. For example, empirical studies have shown that within-subject and within-population variability in norms (evaluative standards) can exceed between-area variability (Williams et al. 1992; Cole and Stewart 2002). Others question whether normative research actually gets at people's values (Roggenbuck et al. 1991). Questions have been raised about the population that is sampled, usually current on-site visitors. When subpopulations are mixed, management may inappropriately be directed at the needs and desires of an average visitor who does not exist (McCool and Cole 2001). Equity issues are raised when studies only give voice to certain populations (Stewart and Cole, in press).

More fundamental are concerns about the scientific objectivity of normative research and its claim to provide a scientific basis for the evaluative decisions inherent to defining carrying capacity. Several decades ago, Burch (1981, 1984) and Becker et al. (1984) judged many carrying capacity studies to be irresponsible and dishonest, having "more to do with coinciding lines of ideology held by the manager and the researcher than by the empirical data" (Burch 1981:227). More recently, Tom More (2002) reminded us that, since the 18th century when David Hume drew the distinction between facts and values, it has been a general established point of logic that "you cannot derive 'ought' statements (values) from 'is' statements (facts)" (p. 115). Perhaps divergent opinions about both the value and the ethics of carrying capacity research come from divergent beliefs about the relationship between science, facts, and values.

The Role of Science

Clearly, science has been tremendously helpful to park management, both in developing decision-making frameworks (e.g., Limits of Acceptable Change and Visitor Experience and Resource Protection) and in building a factual basis for visitor management. We know a lot about the relationships between use characteristics and both ecological and experiential conditions and about the efficacy of diverse management techniques. This is Shelby and Heberlein's descriptive component—factual information about how the recreation system works. Science is well suited to developing descriptive information and facts.

This descriptive information can only be developed into management prescriptions (carrying capacity) in the context of a series of value-laden decisions. Explicit decisions need to be made about park purposes, clienteles to be served, and experiences and conditions to be provided. These decisions about values constitute Shelby and Heberlein's evaluative component and this is the step that seems to give managers the most trouble. The controversy that has developed around the normative approach is largely a debate about the ability of that research approach to provide a scientific basis for decisions about park purposes, clienteles to be served, and experiences and conditions to be provided, decisions that are ultimately codified in specific evaluative standards of acceptable decisions. Moreover, this debate can be expanded to an assessment of the role of science generally in making value-laden decisions.

The limitations of a science-based approach to making evaluative decisions are more obvious when considering carrying capacity as it relates to limits on the ecological impacts of recreation use. There have been no significant attempts to generate evaluative standards regarding ecological impacts based on the normative approach and surveys of current visitors. It is clear in this case that (1) current visitors are only one of many relevant stakeholders; and (2) they seldom have the knowledge and perspective to make wise decisions about how much ecological impact is too much.

Conclusions

Protected area managers have been grappling with the issue of carrying capacity (how to manage visitor use) for decades. Science has been tremendously helpful to management, both in developing decision-making frameworks and in building a factual basis for management. We know a lot about the relationships between use characteristics and both ecological and experiential conditions and about the efficacy of diverse management techniques. However, at the core of the carrying capacity issue are value-based decisions about what ought to be, and managers still struggle with these decisions. The ability to make these decisions appears to be the limiting factor in progress related to carrying capacity.

Science is less equipped to contribute to decisions about values. The scientific method can be employed to describe the values of individuals or social groups. However, science is about describing what "is" and, as Hume noted, it is impossible to derive "ought" statements from "is" statements. Describing values and making decisions about values are not equivalent. Shelby and Heberlein's (1986:17) statement that the normative approach provides "a scientific process for carrying capacity" is misleading at best. Value-laden decisions can be informed by science, but science cannot make those decisions, nor can science make those decisions easier. Moreover, unless the values implicit in most normative research are made explicit, science may not even make those decisions better. Descriptions of values will vary greatly depending on which population is sampled, how results are displayed in means and distributions, the context of specific questions, and the amount and type of information given to respondents.

Park managers will continue to grapple with issues of carrying capacity, prescribing management actions intended to meet management objectives. Science will continue to inform those decisions. Further insight into relationships between visitors, management, park conditions, and experiences will add to the descriptive foundation for management. Normative research will continue to build the knowledge base regarding park visitors, an understanding that is valuable when making prescriptive decisions. Hopefully, new types of research into societal needs and values will also inform value decisions. In my opinion, however, the rate of future progress on the carrying capacity issue will be determined more by the willingness of managers to make value judgments than by the ability of science to build an empirical foundation for those decisions.

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The Place, Cost, and Value of Vision in Preservation: The *Ranger* Steam Engine

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In 1876, a three-masted, square-rigged sloop-of-war named *Ranger,* with an auxiliary steam engine, was launched for the Navy in Wilmington, Delaware. The story of the preservation of her engine has interesting twists, and understanding the costs and values involved may suggest something regarding the place of—and a caveat associated with—vision in preservation.

But first, the background. A substantial part of her Navy time was spent sailing in survey duty off the west coasts of Central and North America. Most of the U.S. charts of the west coasts of Mexico and Central America even today bear the legend, "Based on surveys of the U.S.S. *Ranger.*"

By 1905, she had crossed the equator more times than any other ship afloat, because of her numerous magnetic equator surveys. The navigator on her last Navy assignment—a voyage in 1908 from China to Boston—was Chester A. Nimitz, which means something to someone who every day drives the Nimitz Freeway.

From 1909 to 1946, the *Ranger* served under four different names as a training ship for maritime academies. Her greatest fame came in service to the Massachusetts Nautical School as the *Nantucket,* in honor of the island where in 1816 the first nautical school in the country was established. Her four-month summer cruises covered as much as 10,000 miles, visiting ports from South America to the Mediterranean, mostly under sail.

In 1942, the ship was transferred to the United States Merchant Marine Academy at Kings Point, New York, and renamed *Emery Rice* in honor of an 1897 graduate who sailed out of San Francisco for fifteen years, and who scored the first American hit on an enemy submarine.

This background demonstrates the myriad of connections of this ship—and this engine—to signal events and illustrious individuals in our national (particularly West Coast) maritime history.

In 1958, the *Emery Rice* was sold to a scrapyard for $13,000, yet her engine alone to date has commanded fundraising and donations in-kind which are conservatively estimated at well over $1 million.

Scrapping of the ship in 1958 is where Karl Kortum, director of the San Francisco Maritime Museum, enters the picture. To prepare for a caveat at the conclusion regarding the place of vision in preservation, I must tell you something about Kortum.

Before 1958, Kortum had sailed as able-bodied seaman in the last American square-rigger to round Cape Horn with lumber to South Africa, and then around the Cape of Good Hope to Australia, by which time he had been promoted to first mate, and America had declared war on Japan. In Australia, he assembled crews for the Army's small ships division, which supplied the war effort in the far Pacific. And of course, before 1958, he had also established the San Francisco Maritime Museum, and saved the square-rigger, the *Balclutha*.

After 1958, Kortum was instrumental in the rescue of a dozen historic ships around the world, including the seven in San Francisco. He conceived and developed the Hyde Street Pier and the Victorian Park in San Francisco. He helped found the World Ship Trust and the National Maritime Historical Society. He was praised by a spread of notables, of whom I quote only one, Walter Cronkite, who said, "By sheer determination, backed by ... intellectual brilliance, he has made the case for historic ships clear to us, and he has made it stick."

Kortum also publicly called his National Park Service (NPS) superiors "stumblebums and vulgarians," and he was suspended for a week without pay for "insubordination and bad behavior" when he decried as "extra-terrestrials" a group of museum consultants whom NPS had gathered to advise the San Francisco museum.

What Kortum did first in 1958 was fail. He sought to persuade Kings Point, as well as other East Coast maritime museums, to preserve the engine, and failed. Or perhaps, in retrospect, it was those institutions that failed.

In any case, if Kortum wanted to see the engine preserved, he would have to do it himself. So he began on the twin grounds that the ship was a familiar presence on the West Coast, and that the museum collected important marine steam engines. The back-acting horizontal steam engine of the U.S. sloop-of-war *Ranger* would be in good company, making the museum's fine collection even better, even arguably the finest collection of marine steam engines in the world.

Why exactly is the *Ranger* engine important? This engine represents the halfway mark from earliest paddle engines to sophisticated steam turbines. There are no comparable marine engineering landmarks preserved from this era. This engine is in original condition, virtually complete, and now 130 years old. Made to lie low in the ship to avoid hazards from shot in warfare, this engine is totally unlike anything seen today. It can arouse wonder, impart basic information, and stimulate appreciation of marine engineering art.

The secretary of the Stationary Engine Society reported:

> I have reflected several times on my own reaction, upon seeing (the *Ranger* engine) for the first time. I had seen a sketch of it, but somehow wasn't fully prepared for this huge, rectangular block of metal which looks nothing at all like our usual conception of an engine.... [T]here (was no) crankshaft, connecting rods, crossheads, or even cylinders; none of the most basic elements one looks for in viewing a steam engine! It wasn't until I had walked slowly around the engine ... identifying each component, that I appreciated what a marvelously ingenious design it is, and what a wonderful engine to be preserved!

Using admittedly subjective quantifiers, at the inception of the project, I rate its value to maritime history as "a whole lot," based on this engine's connection to events and individuals in maritime history, and its place in the development of marine engineering. And because the engine complemented the museum's existing collection of steam engines, I rate its value to the museum as a whole lot. Its value to Kings Point now is zero.

So how did Kortum rescue this engine? He had no funds to transport or store the engine, no staff to preserve it, no place to store or display it. What he did have was vision. He also understood the importance of the engine. He had courage, determination, will. He was persuasive. As Cronkite said, "He made the case clear, and he made it stick."

He persuaded the scrapyard to donate the engine. A museum trustee arranged for a steamship company to carry it *gratis* from the East Coast to San Francisco. Another trustee persuaded Senator William Knowland to influence the 12th Naval Division to off-load the sixty-ton engine and store it at the Naval Supply Center in Oakland.

At this point, not because of dollars spent, but because of time and energy spent—and goodwill called in—I rate the cost to museum as "quite a bit." And because the engine is now headed, not for scrapping, but for display, I rate the value to public as "some."

The Naval Supply Center in Oakland celebrated in their newspaper: "Museum-bound Historic *Ranger* Engine Due Here." They agreed to store it for "four or five months." It sat there for nearly 25 years. Here are some snapshots from those years.

April 1964, from Assistant Director David Nelson to Kortum: "July 1 will be critical.... [T]he Oakland Naval Supply Depot will become a joint operation under a single commander ... not a sympathetic Navy man, but one General Conroy of the US Army. (It is) prime operating space. (The Navy is) afraid the engine will cause a tidal wave when the General tosses it into the Bay. Whada we do now, Coach?"

Coach did nothing, Navy did nothing, Army did nothing. A year later, from the Navy:

"Contacts with David Nelson on various occasions during 1961, 1963, and 1964 indicated the difficulty you were experiencing in negotiating ... the conversion of the Haslett Warehouse to house the USS *Ranger* engine...."

In response, Kortum activated an advisory committee member, Bob Blake, who was also a museum supervisor. Blake threatened to call San Francisco newspapers and say, "The Navy refuses to store a valuable Navy artifact." If I know Kortum, that threat was not entirely Blake's idea.

Result, from Navy files: "Admiral Metzger concurred in our storing for a *reasonable* time."

In mid-1967, the museum curator, Harlan Soeten, in a memo to Kortum:

> I stopped in to look at the engine which I had not seen for about a year. The covering tarpaulin has been blown off and the engine is completely exposed to the elements. A lot of rusting has taken place—nothing serious to date, but it will get progressively worse. Additionally, the Army is still making inquiries as to when they can use this dock-side area. They did not react kindly to my suggestion that we arrange to have the engine sprayed with preservative oil and then recovered with a new tarp.

Harlan closed the memo, saying: "Do *not* get Blake or higher-ups involved. Please."

Cost to the museum is going up as Kortum's own staff gets resistant. And the engine's value to maritime history is deteriorating as the artifact is deteriorating.

In February 1970, the newspaper came out with a story on the dumplike conditions of storage of rusty artifacts at the San Francisco Maritime Museum. The reporter obviously knew nothing of the *Ranger* engine. But should its condition become a scandal in the newspapers, its cost to the museum could hit bell-ringer. About six months later, therefore, the Navy received letters from two congressmen, Phillip Burton and William Mailliard, thanking the Navy for their community service in storing the engine. Scrawled on the letters were the questions: "What's this about? What's the purpose of these letters?"

What the letters were about was Kortum—fighting off the scrapyard again, building support in high places, hanging onto that engine with whatever it took.

The record ends there, but the oral tradition is that every four years a new commandant arrived and threatened to call the scrapyard. Kortum called Phil Burton, Burton called the commandant, and another four years rolled by, then the cycle repeated.

On the day after Christmas of 1977, Kortum had a conversation with Chester Locklin, a marine consultant from Florida, who had been "shipmates with the *Ranger* engine (in the training barkentine *Nantucket*), 1926, '27, '28," as Kortum titled his account. Kortum had him identify the various elements of this strange engine. Locklin noted, "Suicide Alley was that tunnel through the condenser.... You had to inch your way through.... The crossheads (are) in action on either side of you and not much clearance. A dangerous operation."

Kortum took every opportunity to capture the words of the grassroots folk in the maritime history he always sought to advance. For Kortum's ability to capture the human side of the engine's story, I raise the value to maritime history to a whole lot—plus.

This era of the preservation ended in 1983 when Kings Point awoke and realized that the *Ranger*'s marine steam engine was an authentic part of its heritage. Thereupon began the second era in the preservation of this engine, which is another story.

The Museum Association, with other San Francisco sectors, sent $63,000 to Kings Point to get the project underway. Cost to the museum now: a whole lot—plus.

Regardless of the engine's exalted place in the museum's collection of steam engines, Kortum ultimately recognized that Kings Point had a higher claim because the engine was a direct connection to their history. But the engine was gone. Value to museum now down to zero.

Kings Point, to their great credit, raised

$345,000 and built a glass structure to display the engine 24 hours a day. Value to public now rates as a bell-ringer. And value to Kings Point, because of positive media coverage, including in *The New York Times*, is perhaps also a bell-ringer.

At this point in the project, there are high values to maritime history, the public, and Kings Point—a laudable result as service to the world at large. But with regard to the museum itself, it was a poor result; the cost was high and the value to museum was zero.

There are two notes to bear in mind. One: This case study is not necessarily typical of preservation projects begun with vision alone. In his preservation of the *Balclutha*, Kortum also began with nothing more than vision; its concluding cost to the museum was low and its values to the public and to maritime history, as well as to the museum, were high.

Two: This case is not finished. Kortum acquired the pledge of Kings Point to assist in acquisition of a replacement engine, but there is none available, so the Kings Point pledge remains unfulfilled.

There is, however, an exploration underway with Kings Point that would return to San Francisco a significant part of our heritage—a direct connection to *our* history—just as the *Ranger* engine was to theirs. It is the masterpiece of San Francisco's premier maritime painter, which hangs in the superintendent's building at Kings Point. The *Blue Light Burning* shows a ship battered by storm, about to sink, but with hope still alive in the signaling blue light burning. This painting, curiously, is a good symbol of the situation in 1958—the *Ranger* engine about to be scrapped, but hope alive in the person of Karl Kortum—the blue light burning. If that masterpiece ultimately returns to San Francisco, the pledge would be fulfilled, and the value to museum raised to bell-ringer.

In summary, what about the place of vision in preservation? Certainly with the *Ranger* steam engine, vision was crucial; without Kortum's vision, that engine today would be part of your toaster. But in general, *what about* assuming a large preservation task of an important artifact with only vision—no staff, no funds, no place to store or display?

There are two ways to look at it. One is the caveat: unless you are an unusual individual, uncommonly confident, courageous, and determined; willing to make use of the media and politicians; willing to commit your institution to unknown costs; willing to absorb blows to your reputation; willing to proceed with no facility, no staff, no funds; willing to act "outside the box"; willing to risk probable failure—unless you are all these things, then perhaps it would be prudent to think twice about any visions you may have.

The other way is best summarized by a quotation attributed to the great German philosopher Goethe:

> Concerning all acts of initiative (and creation), there is one elementary truth: that the moment one definitely commits oneself, then Providence moves too.... A whole stream of events issues from the decision, raising in one's favor all manner of unforeseen incidents and meetings and material assistance, which no man could have dreamed would have come his way. Whatever you can do, or dream you can do, begin it. Boldness has genius, power, and magic in it. Begin it now.

So, which of the two ways: prudence or boldness? Each of us, on a case-by-case basis, chooses.

Carrying Capacity as "Informed Judgment": The Values of Science and the Science of Values

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Carrying Capacity of Parks and Wilderness

In its most generic form, carrying capacity refers to the amount and type of visitor use that can be accommodated within a park or wilderness without unacceptable resource and social impacts. Recent experience with carrying capacity suggests that it can be applied most effectively through formulation of indicators and standards of quality for biophysical conditions (resource carrying capacity) and for the visitor experience (social carrying capacity) (Stankey et al. 1985; Stankey and Manning 1986; Graefe et al. 1990; National Park Service 1997; Manning 1999; Manning 2001). Indicators of quality are measurable, manageable variables that define the quality of park and wilderness resources and the visitor experience. Standards of quality define the minimum acceptable condition of indicator variables.

By formulating indicators and standards of quality, parks and wilderness can be managed within a defined carrying capacity. Indicator variables are monitored over time, and if standards of quality are violated (or are in danger of being violated), management action is required. This approach to carrying capacity is central to contemporary park and wilderness management frameworks, including Limits of Acceptable Change (Stankey et al. 1985), and Visitor Experience and Resource Protection (National Park Service 1997; Manning 2001).

"Informed Judgment"

Some studies have suggested distinguishing descriptive from evaluative and/or prescriptive components of carrying capacity (Shelby and Heberlein 1984, 1986). The descriptive component of carrying capacity focuses on factual, objective data. For example, what is the relationship between the amount of visitor use and perceived crowding? The evaluative/prescriptive components of carrying capacity determination concern the seemingly more subjective issues of how changes in the recreation environment are judged and, ultimately, how much impact or change in the recreation environment is acceptable. For example, the evaluative component of carrying capacity might address the question of how visitors judge increasing levels of use, while the prescriptive component of carrying capacity might address the question of what level of perceived crowding should be allowed.

From this discussion, it is apparent that carrying capacity analysis and management require a strong element of "informed judgment." Park and wilderness managers must ultimately render judgments about acceptable levels of biophysical and social impacts, and associated use levels, but such judgments should be as "informed" as possible. Findings from scientific studies represent an important approach to informing such judgments.

The Values of Science

Science can inform management judgments about carrying capacity in at least two ways. First, research findings should serve as the basis of the descriptive component of carrying capacity. A substantial body of scientific literature has been developed on both the resource and social components of carrying capacity, and recent meta-analyses have begun to integrate and synthesize this growing body of knowledge (e.g., Hammitt and Cole 1998; Manning 1999).

Second, research findings can also help inform the evaluative/prescriptive components of carrying capacity. Again, a substantial body of scientific literature has been developed on the degree to which park and wilderness visitors are perceptive of recreation-related impacts and their subjective evaluations of these impacts. This research explores the park and wilderness-related values of visitors, and can be used with other types of information to help inform management judgments about standards of quality and, ultimately, carrying capacity.

The Science of Values

Within the context of carrying capacity, scientific approaches to park and wilderness-related values have been applied primarily to formulation of standards of quality. Standards of quality ultimately reflect the values that visitors place on parks and wilderness. Research on visitor-based standards of quality has conventionally focused on normative theory and techniques. For example, what is the maximum acceptable number of groups that visitors feel can be encountered per day along a wilderness trail? More recent research has begun to extend the normative approach by emphasizing the potential consequences or trade-offs that may be inherent in normative research. For example, park and wilderness visitors may value both solitude and access, but these values may ultimately conflict. How do concerns about maintaining reasonable public access to wilderness areas affect normative judgments about the maximum acceptable number of groups that can be encountered per day along wilderness trails? The following subsections briefly describe and illustrate this evolving research on alternative park and wilderness values and their relationship to formulating standards of quality.

The normative approach. Developed in the discipline of sociology, the concept of norms has attracted considerable attention as a theoretical and empirical framework in park and wilderness research and management (Jackson 1965; Shelby and Heberlein 1986; Vaske et al. 1986; Shelby and Vaske 1991; Donnelly et al. 1992; Shelby et al. 1996; Manning 1999). If visitors have normative standards concerning relevant aspects of recreation experiences, then such norms can be measured and used as a basis for formulating standards of quality. Using normative theory and methods, the personal norms of individuals can be aggregated to test for the existence of social norms or the degree to which norms are shared across groups. Normative research in outdoor recreation has focused largely on the issue of crowding (e.g., Shelby 1981; Heberlein et al. 1986; Whittaker and Shelby 1988; Patterson and Hammitt 1990; Williams et al. 1991; Manning et al. 1996a, 1996b; Vaske et al. 1996; Manning et al. 1999d; Manning et al. 2000; Manning et al. 2002a, 2002b), but also has been expanded to include other potential indicators of quality. Research findings from published studies of recreation-related norms have recently been compiled in Manning (1999).

A hypothetical social norm curve is shown in Figure 1 to illustrate normative theory and methods. The norm curve traces the average acceptability ratings of a sample of recreationists for encountering a range of groups of other visitors per day along a trail.

Extending the normative approach. As research on normative standards has proceeded, several approaches to measuring norms have evolved. Traditionally, outdoor recreation-related norms have been measured using a “numerical” or “narrative” approach. For example, respondents might be asked to evaluate a range of encounters (0, 5, 10, 15, etc.) with other groups per day along trails. The personal normative data derived are aggregated and graphed (as illustrated in Figure 1) to construct a “norm curve” from which social norms might be identified.

More recently, visual approaches to measuring crowding and other outdoor recreation-related norms have been developed. Computer software has been used to edit and produce photographs depicting a range of use levels and environmental impacts (Hof et al. 1994; Manning et al. 1995; Manning et al. 1996a, 1996b).

An issue implicit in all of these measurement approaches concerns the evaluative dimension used in these questions. When respondents have been asked to evaluate a range of use levels and related impacts, the response scale has included terminology specifying a variety of evaluative dimensions, including “acceptability,” “preference,” “pleasantness,” “desirability,” “satisfaction,”

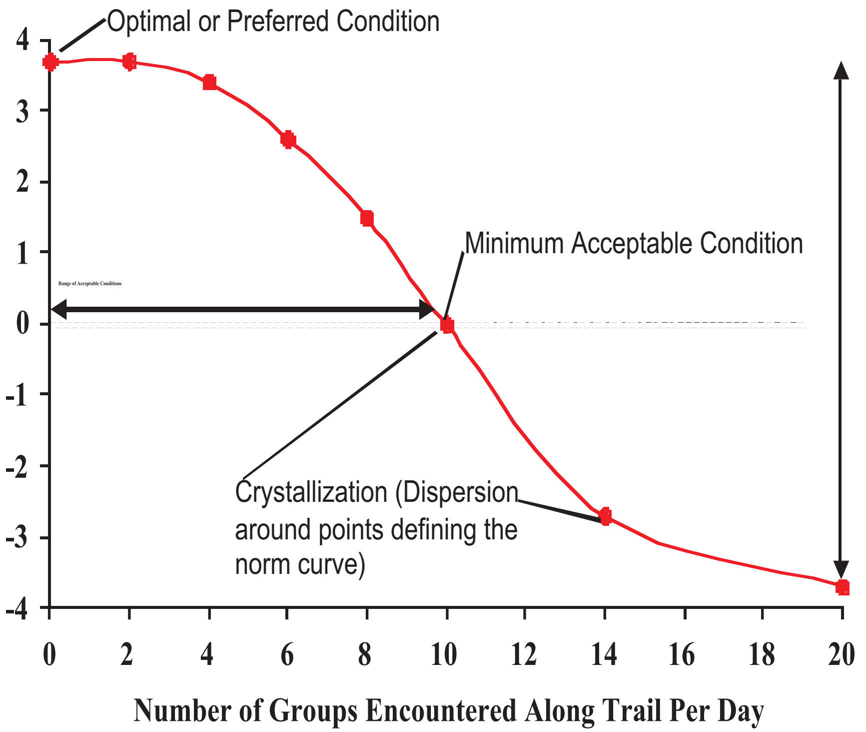

Figure 1. Hypothetical social norm curve.

and "tolerance." These alternative evaluative dimensions may have substantially different meanings to respondents, and may result in significantly different personal and social norms.

A related issue concerns the normative nature of evaluative dimensions. Application of normative theory and techniques to outdoor recreation has noted several important elements of norms as they traditionally are defined (Roggenbuck et al. 1991; Shelby and Vaske 1991; Williams et al. 1991; Noe 1992; Heywood 1993a, 1993b, 1996a, 1996b; McDonald 1996; Shelby et al. 1996). One of these elements suggests that norms have a strong obligatory nature; that is, norms define what "should" be. This suggests that norms might be measured by asking respondents about what recreation conditions or level of impacts they feel managers "should" maintain.

Recent studies of crowding-related norms for several national parks have allowed comparisons of findings among the norm measurement approaches described above (Manning et al. 1997a, 1997b; Manning et al. 1998; Manning et al. 1999b, 1999c; Manning et al. 2000). These comparisons suggest that alternative measurement approaches can affect resulting norms in a statistically significant and substantive way (Manning et al. 1999a). The most powerful effects concern the evaluative dimension used and more explicit introduction of the normative notion of the recreation conditions that managers *should* maintain.

These findings suggest three important points. First, a range of personal and social norms can be estimated using a spectrum of evaluative dimensions that range from "preference" to "displacement" or "absolute tolerance." Second, the "management action" evaluative dimension may be of special interest to park and wilderness managers because it more explicitly addresses trade-offs inherent in crowding-related issues (i.e., a desire to avoid crowding while also maintaining reasonable public access), and therefore may more closely approximate the traditional prescriptive nature of norms. It is important to note that "management action"-related norms are consistently and often substantially higher than "preference"- and "acceptability"-based norms. Finally, the range of crowding-related norms developed in the literature based on alternative evaluative dimensions may be useful to researchers and managers, as it facilitates a more comprehensive understanding of the evaluative and prescriptive components of carrying capacity.

Beyond the normative approach. Data derived from the normative approach can be useful in helping researchers and managers quantify the values of park and wilderness visitors and formulate crowding-related and other standards of quality. However, such studies have also illustrated the complex nature of this research, as well as the strengths and weaknesses of normative theory and empirical techniques. In particular, conventional studies designed to estimate crowding-related and other norms may substantially underestimate such norms because these studies fail to explicitly (or even implicitly) introduce trade-offs between the desire to avoid crowding and other impacts of recreation and the desire to maintain reasonable public access to parks and wilderness.

Indifference curve analysis. Research on park- and wilderness-related values might be strengthened through adaptation of alternative theoretical and empirical approaches, especially those that more explicitly address inherent trade-offs in park and wilderness management. For example, indifference curve analysis, developed in the discipline of economics, provides a model representing the tradeoff decisions an individual makes in allocating a fixed level of income between two consumer goods (Nicholson 1995). This approach has recently been adapted to examine the trade-offs that visitors would prefer to make between solitude and access to Delicate Arch, a popular visitor attraction in Arches National Park (Lawson and Manning 2000; Lawson and Manning 2001b; Lawson and Manning 2002a). A representative sample of visitors was asked a series of questions regarding alternative combinations of solitude (number of people at Delicate Arch) and access (percentage chance of receiving a permit to hike to the arch). Study findings provide potentially important insights into the appropriate balance between these two desirable attributes of the park experience, and can help inform management judgments about the carrying capacity of this site.

Stated choice analysis. Stated choice analysis represents another research approach to quantifying carrying capacity-related values and trade-offs inherent in park and wilderness management. Stated choice analysis models have been developed in the fields of psychometrics, econometrics, and consumer marketing to evaluate public preferences and related attitudes (Green and Srinivasan 1978). In stated choice analysis, respondents are asked to make choices among alternative configurations of a multi-attribute good (Louviere and Timmermans 1990).

Recently, stated choice modeling has been adapted to carrying capacity analysis and applied at Denali National Park and Preserve (Lawson and Manning 2001a; Lawson and Manning 2002b) and Yosemite National Park (Newman et al. 2001; Newman et al. 2002). For example, wilderness visitors to Yosemite were asked their preferences between alternative wilderness scenarios that were described by a range of six attributes: campsite impacts, signs of stock use, trail encounters, campsite encounters, likelihood of receiving a wilderness permit, and regulation of campsite choice. Study findings suggest that campsite impacts are the most important attribute (or indicator of quality), and that most visitors would prefer to accept more management regulation to assure a minimum standard of quality for campsite conditions. Data also suggest that campsite condition three (on the park's five-level "condition class" campsite monitoring system) may be an appropriate standard of quality.

Stated choice analysis provides a potential improvement over conventional normative research approaches to park and wilderness carrying capacity because resulting data are derived from a more holistic or contextual perspective. That is, visitors' normative judgments and the resulting multivariate statistical analysis explicitly consider the inherent tradeoffs among the conditions of social, resource, and managerial attributes. Further, this expanded approach to normative research yields information to help formulate standards of quality for multiple and related park and wilderness attributes simultaneously.

Conclusions

Carrying capacity is an important issue in park and wilderness management, and is likely to increase in importance as the popularity of parks and wilderness continues to grow. It is clear from the literature that management of carrying capacity involves matters of both science and values, and that both of these elements must be integrated into "informed judgments" on the part of park and wilderness managers. That is, managers must ultimately make value-based judgments about the maximum acceptable levels of visitor-caused impacts to the resource base and the quality of the visitor experience. However, such judgments should be informed to the extent possible by scientific data on the relationships between visitor use and resulting impacts, and the degree to which park and wilderness visitors and other interest groups judge such impacts to be acceptable. Such information represents the "values of science" to managing carrying capacity in parks and wilderness.

A growing body of literature has begun to address the corresponding "science of values," and how this type of information might be integrated into park and wilderness management. Visitor-based research has employed normative theory and techniques to explore the acceptability of a range of biophysical and social impacts related to visitor use, and findings from these studies are being integrated into a body of knowledge and applied in management decision-making. Conceptual and methodological extensions of the normative approach are currently being explored in a variety of park and wilderness contexts, and new theoretical and empirical approaches, including indifference curve and stated choice analysis, are being adapted to address tradeoffs inherent in carrying capacity management. In these ways, the science of values is progressing to meet the opportunities and challenges of the values of science to park and wilderness management.

While progress has been made in developing a more conceptually and empirically informed approach to the carrying capacity of parks and wilderness, this research should be interpreted and applied carefully, and more research is clearly warranted. For example, normative theory and techniques borrowed from the discipline of sociology have proven useful in carrying capacity analysis, but such data derived in the context of park and wilderness management may lack the full prescriptive power of norms as they have traditionally been defined. Moreover, the normative data described in this paper are often analyzed and presented using measures of central tendency, such as means and medians. Researchers and managers should be careful not to mask important variation that might exist among different types of park and wilderness visitors.

A related issue concerns the inherent complexity and diversity of carrying capacity and its application to parks and wilderness. Current visitors have been the subject of most carrying capacity research, but other interest groups may be considered legitimate stakeholders as well, including local residents, displaced visitors, and the general public. Research should be expanded to include a wider spectrum of interest groups. Carrying capacity research has also traditionally been conducted on a site-by-site basis. However, viewing individual parks and wilderness areas as parts of larger, regional or even national systems of outdoor recreation areas—and conducting research and management accordingly—may result in a more diverse system of park and wilderness opportunities that more fully serves the spectrum of public preferences. Such a "systems approach" may also help relieve some of the tension and confrontation often associated with the application of carrying capacity, as the preferences of multiple groups might be incorporated into larger-scale research and management. It should also be noted that the types of data described in this paper are only one source of information on public values that might be incorporated into analyzing and applying carrying capacity to parks and wilderness areas. Other sources of information include legal and administrative mandates, agency policy, historic precedent, interest group politics, personnel and financial resources and—inescapably—management judgment, but judgment that is scientifically "informed" to the extent possible.

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Russian Zapovedniks (Strict Nature Preserves) and Importing Ecotourism: Destruction of an Ideal or Learning from the U.S. National Park System?

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Introduction

In 1991 the Soviet Union's experiment in a planned economy and centralized political system collapsed. Boris Yeltsin declared the official beginning of the Russian liberal project in October 1991 when he said, "We must ... provide economic freedom, lift all barriers to the freedom of enterprises and of entrepreneurship and give people the opportunity to work and to receive as much as they can earn...."(quoted in White 2000:123). This paper addresses how the emerging political and economic realities are influencing policy and practice on one category of Russian protected natural area—zapovedniks (strict nature preserves).

The Soviet Union contained one of the most extensive protected natural area systems in the world (Grigoriew and Lopoukhine 1993). Millions of hectares were protected under a network of strict nature preserves, national parks, and wildlife refuges. But the emerging sociopolitical conditions have had profound effects on the management strategies. While embracing the Western model of ecotourism, perhaps the system may be able to learn from the U.S. National Park System. This analysis focuses on the Altai region in Siberia. I demonstrate that the Western liberal model of ecotourism is being adopted and that the protected natural areas have strategies to mitigate potential negative effects. However, in the entrepreneurial rush to capture Western tourist dollars, more cautious strategies to preserve ecosystems and cultures may be lost by the wayside. This case study (Yin 2003) includes data from 1994, 1995, 1999, and, most recently, a 26-day ecoscientific tour with 12 students in 2002. The field work was built around three questions: (1) What is ecologically unique to the region? (2) Does the Altai have the social and political infrastructure to support ecotourism? (3) What can Altai's protected area managers learn from the National Park Service?

Ecotourism and Change in Russia

As defined by Honey (1999:25), "Ecotourism is travel to fragile, pristine and usually protected areas that strives to be low impact and (usually) small scale. It helps educate the traveler; provides funds for conservation; directly benefits the economic development and political empowerment of local communities; and fosters respect for different cultures and for human rights." The World Tourism Organization reports that annually, ecotourism is capturing a larger and larger market share. Ecotourism is "tourism with a normative element" (Ceballos-Lascurain 1996:20). Although all reported ecotourism may not fit this definition, it serves as a benchmark for assessment.

Tourism in the Soviet era was a state-run operation (Hall 1991). The constraints on travel, limited options, and general xenophobia directed international visitors to the main cities, or, in the case of scientific exchanges, restricted experiences to field research. As people adjust to a new economic paradigm, the international tourism industry is an attractive potential source of income. Despite bureaucratic and institutional lethargy and a lack of any history of community-level planning (Hall 2000), both national parks and zapovedniks have emerged as tourist destinations (Burns 1998).

The risks of ecotourism include decline of habitat, overdevelopment of border towns, underdevelopment leading to illegal activity, and redirection of park resources to accommodate visitors (Vaske et al. 2000; Dearden

2000). Management guidelines have emerged to mitigate the negative effects of tourism and ecotourism (e.g., Butler and Boyd 2000; Eagles et al. 2002), but as cash-strapped protected areas struggle to pay salaries and purchase necessities, ecotourism is becoming an attractive alternative (Ostergren 1998). Nonetheless, ecotourism is not a long-term solution if there is a substantial departure from traditional practices, if the industry merely turns a profit for politicians and bureaucrats, if the experience only works as a "feel-good" green cover for self-centered tourists, or if the visitors degrade the resource they purportedly wish to protect.

The Altai Region and Zapovedniks

Located in south-central Siberia, the Altai Mountains contain dry steppe, mountain meadows, alpine, taiga, and desert biomes. Representative of the central Eurasian continent, the area contains Mount Belukha, the highest peak in Russia (4,506 m), and the headwaters of the Ob and the Irtysh rivers (Badenkov 2002). The area is identified by the World Wide Fund for Nature (WWF) as one of the most endangered ecoregions on the Eurasian continent. In part, the Altai is a perfect candidate for ecotourism because large swaths remain in relatively good condition with a wide range of protected areas. Nonetheless, the ecoregion is far from being "protected" in a practical sense.

The region includes a backbone of nine zapovedniks, or strict nature preserves. Initiated in the late 1800s in the steppes of Ukraine, zapovedniks were intended as inviolable regions of nature. These areas have traditionally been dedicated to scientific research on natural ecosystems (Weiner 1999). Two national parks in the area protect nature and offer opportunities for outdoor recreation. The Russian national park system was established in 1983 and now includes 35 parks protecting more than 6 million ha. Park boundaries in European Russia often include agricultural enterprises or villages, but in Siberia, the focus is on natural phenomena (Chebakova 1997; Ostergren 2001). Overlaying the entire region is the 1.6-million-ha "Golden Mountains of the Altai" World Heritage Site.

In 1995, the Federal Law on Specially Protected Natural Areas delineated the rights and responsibilities of protected areas (Ostergren 2001). The express inclusion of environmental education (and, by extension, ecotourism) for zapovedniks is highly controversial. Traditional researchers are concerned about anthropogenic disturbance to flora and fauna (Volkov and de Korte 1994; Rhodes 1998). At the turn of the 20th century, planners could hardly imagine the demand for, and role of, environmental education in society. Nonetheless, some preserves (< 1% of the total territory) have always had museums for public education, and several preserves have long allowed limited access for recreation or education. However, the 1990s witnessed a dramatic increase in ecotourism and environmental education. If (the theory goes) more people know about their mission, then protected areas gain political saliency and budgetary support.

The nongovernmental organization (NGO) community has also supported and promoted ecotourism. In several WWF planning documents, tourism and ecotourism play an important role in sustainable, nonconsumptive development. In December 1999, the World Conservation Union (IUCN), World Commission on Protected Areas (WPCA), and EcoCenter Zapovedniks (a Moscow-based NGO) convened a meeting to create strategies for actions, including the use of ecotourism, to protect nature. Local NGOs in the Altai region, such as KATUN, also support ecotourism (Shishin 1999). There is a strong belief that if the local economy can realize the benefits of "intact nature," more exploitive and resource-intense activities may be averted.

Katunski Zapovednik was established in 1991, and rather then attempt to hire enough border guards to keep people out, they adopted a strategy of environmental education for school children to create a generation of caretakers. This preserve had regular experience with adventure tourists. The Katun River offers challenging kayaking and rafting (Class

4–5) and requires that people camp for three nights on zapovednik territory. Mount Belukha has hosted backpackers and mountaineers for decades. In 1991, Katunski initiated a two-tiered fee system that differentiates between foreigners and Russians. For groups such as ours, the preserve charges an extra fee and the two biologists accompanying us significantly supplemented their annual salary ($50 per month is an average salary).

The director of Katunski, Aleksandr V. Zateev, estimates that about 100 ecotourists (including foreigners, Russian high-school-age groups, and rafters) visited the zapovednik each year during 2001 and 2002. Tourists will never number more than 500 per year and be limited to a few trails with constant supervision by biologists. For our group, an additional precaution was that we never entered the zapovednik proper: we walked (with horse-pack support) for two and one-half days one-way, and were still just in the buffer zone (an area subject to all sorts of activity, including grazing).

In 1995, the local town, Ust–Koksa, was in the throes of economic depression. Gasoline was scarce, public transportation had come to a standstill, and even diesel fuel for farm machinery was at a premium. Inflation was high, the cattle industry subsidies had evaporated, the potato crop was failing, and locals were stockpiling pumpkins for the winter. In stark contrast, by 2002 the village center was boasting a dozen new shops, a restaurant served tourists, and a couple of guest houses had started up. Although statistics are nonexistent, the tourism contribution to the economy appeared to be significant. With meals, four inspectors (i.e., horse wranglers), a donation, four nights under a roof, seven nights in the wilderness, trail food, bus rental, two biologists, and a flurry of souvenir buying, the 14 people in our group spent about US$3,000 locally. If the zapovednik continues to carefully manage ecotourism (i.e., fewer than 500 visitors per year), there are implications for the surrounding wildlands. A U.S. group leader on another trek observed that the real worry for natural conditions was not U.S. tourists, but the Russian traditions of cookfires, canned goods, and burning refuse. The allure of pristine conditions in Katunski Zapovednik may prompt foreigners to seek it out, and the increased revenue may prove too tempting to maintain a limit of 500 travelers per year.

Established in 1932, Altaiski Zapovednik protects over 880,000 ha of taiga, subalpine, and alpine ecosystems and the spectacular 78-km-long Lake Teletskoye. The eastern shore serves as a portal into the northern half of the preserve, while more remote, alpine regions lie to the south. In 1994–95, logging was the principal activity for the small community of 3,000–4,000 inhabitants. Lake traffic included fishing boats, with a few tourists visiting Korbu Waterfall. A half-dozen guard stations dot the shore and several remote guard stations are located on the periphery of the preserve. In 1995, the opportunity for ecotourism was immediately apparent, but as Altaiski Zapovednik Director Sergei Erofeev stated, "If we let the tourists on the zapovednik they would carry it off in the tread of their boots."

In contrast, our study group arrived in Altaiski in 2002, and in 2001 fifteen eco-science tourists visited from Germany. Both times a full-time research scientist was assigned to teach and monitor the group. We paid a daily entrance fee ($3.00 per person per day), a stipend for the biologist, a boat fee ($300), and made a contribution to the preserve ($300). The most remarkable contrast from 1994–95 was that zapovednik managers met me at the front office (with a bill) and sent us into the preserve with an agenda.

Clear precautions included that "none of our activities could produce a long-term impact on the ecosystem." The contrast to a western wilderness area is profound because our travel was often on vague or nonexistent tracks, and even close to the lake, bear and wildlife sign was common. In 2002, 160 Russian schoolboys camped on the shores of Teletskoye to learn about ecosystem processes (in 2001, 180 had). Combined with the few travelers per year (50–80 researchers) traveling through the 880,000-ha preserve, our general impact may be considered insignificant.

The more substantial impact is outside of the preserve in (1) an unofficial mass camp-ground (100–200 campers per night) on the shoreline; and (2) at the three vacation lodges on the non-zapovednik shores. Between 15,000 and 18,000 visitors per year now travel by boat from Arti–Bash to Korbu Waterfall, where a small tourist industry has sprung up. Three small kiosks sell trinkets, souvenirs, snacks, and vodka. In 2002, each visitor paid $0.63 to the zapovednik to stop at the falls. The kiosks do not pay a concessionaire fee, nor do the dozens of tourist boats (ranging from 15-ft speed boats to 90-ft passenger tugs) pay a docking fee. The good news is that there are outhouses and an educational display. The bad news is that the sacred nature of the spot has been compromised and the sheer volume of visitors will eventually takes its toll. There is a limit to water quality even in the huge Lake Teletskoye, but staff note that there is little they can do to limit use. The bigger concern is poaching by indigenous Altains who suffer from a high unemployment rate (approximately 60%). Unfortunately for many Altains, there is no "trickle-down effect" from tourism, and they only know that they are excluded from the larder.

Concluding Remarks

To paraphrase Honey (1999), the debate is: "Who does own paradise?" That is, how can a region benefit economically from a natural resource? Throughout the entire Altai Republic, campgrounds, restaurants, health spas, souvenir stands, and adventure services are capitalizing on the steady flow of tourists. Ecotourists are a part of the tourism stream and are only ecotourists for that small period of time they are in a small guest house or on the trail, river, or mountain top.

Criticisms include the following: (1) *any* recreational activity will lead to ecosystem degradation; (2) if zapovedniks become a wilderness refuge for wealthy foreigners, local resentment may prompt an increase in poaching; and (3) resources once dedicated to research or protection are now redirected to hosting visitors. In fact, inspectors are being drawn into private tourist organizations because the pay is twice to three times as great. Nonetheless, at the current scale the impact of ecotourism on the preserves remains slight. Zapovedniks are realizing the financial benefits of ecotourism and the added notoriety among Russian students will sow the seeds of good will. Existence value among Russians seems high, and working on large intact ecosystems is an incredible opportunity for international researchers.

In essence, zapovedniks are "corners of freedom" (Weiner 1999)—free to be wild. They are prepared to handle ecotourism by restricting small numbers of visitors to "sacrifice zones." But these islands of nature are icons, and wild, beautiful nature is the draw to the Altai. There is pressure from the regional government to expand business despite potential problems. It is no stretch of the imagination to picture a time when the surrounding economic activity impedes biodiversity goals. Altaiski Zapovednik is approximately the same size as Yellowstone National Park—a park that by some estimates should be twice as large to adequately preserve the ecosystem. Major obstacles to expanding Yellowstone include logging, mining, grazing, and tourism—all products of a market economy and individual entrepreneurship.

What is the future role of zapovedniks in regional development? Perhaps guiding management strategies *outside* of the preserve may be the salvation. The long-term goal could be to influence agencies to make certain communities realize benefits. Simultaneously, the area needs to maintain high-quality outdoor experiences so that the zapovedniks do not become the last refuge of wild nature, the last place left to both protect biodiversity and try to offer recreational opportunities in a wild Siberian landscape—a balancing act all too familiar in the liberal West.

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Parks as Battlegrounds: Managing Conflicting Values

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Management decisions in protected areas are often choices among very different, and often conflicting, values. The role of the protected area manager is to advocate the full range of values for which the area was established and to make the critical decisions in favor of those values.

Discussion of impairment and intangible values has been central to management decisions such as protecting air quality in Shenandoah National Park, preserving dark night skies in Arches National Park, and closing one-third of Denali National Park and Preserve to all snowmobile use. Preservation of opportunities for solitude, natural soundscapes, and the dark night sky are now common discussions in general management planning for U.S. national parks (Manning, Valliere, and Minteer 1996; Power 1998; Sovick 2001). Values such as solitude, natural quiet, challenge, a sense of freedom, opportunities for introspection and self-discovery, restoration, and personal growth are now critical components in the decision-making process. In waiving entrance fees for Veteran's Day 2001, Secretary of the Interior Gale Norton highlighted the value of parks and public lands in the U.S. as places that "are an inspiration to the freedoms all Americans cherish" and stated that families have visited natural and historic areas "to gain hope and strength" (*Salt Lake Tribune* 2001).

Conflicts Over the Values of Parks and Protected Areas

In the U.S. National Park System, the importance of protecting a wide range of values has emerged during the past century of park management and is supported by judicial decisions, legislation, and public opinion. However, this does not reduce the potential for conflict over different values, and in fact may result in more intense and more polarized debates. The potential for conflict has also increased along with the growing numbers and types of uses of protected areas.

Understanding why values-based conflicts occur is essential to making decisions about which values take precedence (Manning 1999). According to Lewis (1993), "Conflict erupts mainly when people with competing interests and different values interact."

Management decisions in protected areas become controversial because people care a great deal about different values of protected places. In particular, intangible values of an area trigger an emotional response to management decisions. People care about tangible values like wildlife and scenery, but also about knowing a place is protected for future visits, their children, or simply because it seems like the right thing to do (Manning, Valliere, and Minteer 1996).

Connection to place is an essential part of an emotional response to management decisions and motivates individuals to get involved in planning and management issues affecting parks and protected areas. Connection to place often involves intangible values and can evolve through experiences during a visit to the place or even from just knowing about it, believing it is special, and feeling it is important to have it protected. Connection to place can often result in a much stronger response from individuals than can be accomplished through scientific information or legal or political arguments (Bushell 2001).

Environmental ethicists find aesthetic, artistic, educational, recreational, humanitarian, intellectual, mystical, scientific, and spiritual value in wilderness (Rolston 1988; Minteer and Manning 1999; Fausold and Lilieholm 1996; Morton 1999; Parker and Avant 2000). These intangible values defy measurement but are equally, and in some cases, more important than tangible values. But because they are difficult to define and quantify, there has been a tendency toward ignoring them or weighting them less than values that are more easily quantified. In recognizing this reality, protected area managers should not underestimate the importance of intangible values surrounding how connections to place develop, such as how it feels to be there, spiritual significance, and symbolism.

While intangible values are seldom in conflict with one another (Rolston 1988), they often compete with economic and "use" values in park management. Conflicts are quick to arise when uses in a park or protected area are not compatible with the purposes for which the area was established.

Making Decisions Among Competing Values

In resolving conflicts among competing values, it is the land manager's responsibility to prioritize values and decide which values take precedence in which areas. These decisions are often made within a highly charged political arena and under close public scrutiny. The following examples illustrate how some recent conflicts among competing values in very different national park units have been resolved.

Snowmobile use in Denali National Park and Preserve. Mount McKinley National Park was the first national park unit established (1917) after passage of the National Park Service Act in 1916. It was intended as a "game refuge" and included North America's highest peak. The Alaska National Interest Lands Conservation Act of 1980 expanded it from approximately two million to over six million acres and renamed it Denali National Park and Preserve. This raised some ambiguity over whether motorized use, permitted under certain conditions by the new law, would be allowed in the former Mount McKinley portion of the park, most of which was now designated wilderness.

Because of rapidly increasing snowmobile use in the park additions and the growing number of incursions into the designated wilderness or "old park" area, the Park Service permanently closed this part of the park to all snowmobile use effective in 2000. This action was very controversial, especially within Alaska, since it called for removing a current use and restricting it in the future, at least to the 1980 park additions. Prevailing against potential litigation and legislation to reverse the closure, the Park Service successfully argued that managing the "old park" area for non-motorized recreation was critical to protecting resource and other values such as opportunities for solitude, natural sounds, and the integrity of the winter landscape (NPS 1999a). Public opinion strongly supported this position, with about 96% of over 6,000 comments in favor of the closure.

In this example, the values of access to public lands versus protection of natural sounds and opportunities for solitude were in direct conflict. Snowmobile users questioned the value of setting aside a large protected area if access was to be very difficult. Supporters of the closure argued that snowmobile use was still allowed in the park additions and on adjacent lands, and that the former Mount McKinley National Park had been managed for non-motorized recreation since 1917.

Protecting the historic scene of Civil War battlefields in the United States. Controversy over competing values has been recently resolved in two historical parks in the eastern United States, Gettysburg National Military Park and Manassas National Battlefield Park. By contrast with Denali National Park, these areas were established primarily to protect cultural resources, and specifically to commemorate battles fought during the American Civil War, 1861–1865. During the early 1970s, a 300-foot-tall observation tower was constructed on a site just outside the Gettysburg park boundary, despite substantial opposition. The tower became a popular destination for visitors to Gettysburg, and since it was outside the park boundary, the Park Service could not take any action. A 1982 general management plan for the park did not address the issue. However, a new boundary study in 1988 and a land protection plan in 1993 addressed the potential for land acquisition, including the tower site. Once the Park Service had successfully acquired the site, the tower was slated for demolition, which was carried out with considerable ceremony and public support on 3 July 2000 (Latschar 2001). The Park Service had succeeded in protecting the historic scene as a value above the economic interest in the tower as a tourist attraction.

Protecting the historic scene at Manassas National Battlefield Park in Virginia has been equally challenging because of expanding urban growth in northern Virginia. In the late 1980s, there were 542 acres of historic land adjacent to the battlefield subject to immediate development. The developer had local political support, while advocates of battlefield preservation had generated public support on a national level. The U.S. Congress eventually authorized federal condemnation of the land with compensation to the landowners, adding the acreage to the national battlefield. While the national public support for protecting the site was a pleasant surprise to preservationists, an ultimate concern is that future reactive federal efforts to protect land are much too costly to be viable in the future (Gossett 1998).

Air tours in Grand Canyon National Park. Air tours over Grand Canyon National Park have expanded significantly over the past two decades. Beginning in 1988, the Park Service began to work actively work to reduce the frequency of flights over the canyon. A protracted conflict culminated in a U.S. Court of Appeals (District of Columbia Circuit) decision in 1998, determining that aesthetic resources such as natural quiet are an essential part of overall resource values (Grand Canyon Air Tour Coalition v. FAA 1998). Air tours are now restricted to above the canyon rim, protecting natural sounds in the inner canyon.

These above examples illustrate how cultural practices and values can directly conflict with established purposes of protected areas. A common factor in each case was widespread public support for the Park Service position, based on the fundamental purposes of the respective protected area. While learning some hard lessons at times about how to avoid past mistakes, the agency has successfully recognized the importance of working with a citizenry that demands involvement at a more sophisticated level than ever before. The lessons learned lead to some common principles for making legally and publicly supportable decisions in parks and protected areas where very different values are in competition.

Principles for Supportable Decisions Involving Competing Values

Based on our review of the literature and analysis of cases such as those presented hereabove, we have identified seven principles that should help in making decisions about which values should take precedence when conflicts arise.

Managers must acquire accurate and thorough resource information, but must also recognize the limits of scientific information.

There are recurring reminders in the literature about the importance of accurate and current scientific information to decision—making in protected areas. However, management goals are ultimately based on societal values, and managers cannot avoid making choices between competing values. Rolston (1988) statesd that "[e]nvironmental decisions are not a data-driven process; rather, the data are caged by a value-driven theory. The data seldom change anyone's mind, but they are gathered and selected to justify positions already held...."

Application of scientific knowledge to management decisions becomes even more complex when intangible values are involved since such values often defy measurement. For example, existence value is hard to measure or evaluate, as is a protected area's intrinsic worth. With respect to wilderness areas in particular, Kaye (2000) concludesd:, "[W]e have a few objective criteria, and no standard metric with which to quantify or evaluate actions that enhance or detract from the character of our nation's natural sacred places. This is the unique challenge of wilderness management, preserving what is unseen and unmeasurable."

It is critical that park and protected area managers involve the public at all levels of planning and decision-making.

In reviewing why conflicts arise in parks and protected areas, Lewis (1993) concludes that in many cases conflicts relate to (1) people in nearby communities having substantive needs that have come into direct opposition to the needs of the park, and (2) not enough attention being paid to the process of involving local people in decision-making and park management. However, managers must recognize the full constituency for a protected area. This includes not only local residents who are directly affected, but also those who may be distant but still have an affinity for the place. A common factor in all cases is connection to the place, which can happen on many different levels.

Intangible values such as natural sounds, opportunities for solitude, and even existence value are more appreciated and better understood than ever before. Advocates of these values and of others that directly conflict, such as motorized access and motorized recreation, are becoming more organized and involved in park planning and management decision-making. These interest groups and the public will expect this trend to continue.

Clarify the purposes of the park or protected area to the public and manage to provide for and protect these purposes.

Managing according to the fundamental purposes for which a protected area was established may be self-explanatory, but there is a continuing need to find new ways to communicate with the public about these purposes. In the Denali example above, snowmobile use expanded in area and numbers until there was an expectation, at least on the part of this user group, to continue the activity. Preventing this issue from becoming a management problem in the 1990s would have required immediate action after passage of the Alaska National Interest Lands Conservation Act in 1980 to clarify the conditions under which snowmobile use was allowed. Because the Park Service did not have either the legal or political ability to take such action at the time, the expectation for continuing motorized access, one type of value, developed in conflict with other values such as natural sounds and opportunities for solitude.

While conflicts develop when people with competing interests and different values interact (Lewis 1993), these competing interests are often rooted in very different understandings of the purposes of the park or protected area. Managers can do a great deal to shape these expectations through information about the site. These educational efforts may take several years to accomplish, but are no less critical than the management action itself.

Plan proactively and consider how decisions today will affect the area well into the future.

Proactive planning can prevent greater problems in the future, and taking a long-term view of protected areas is critical. Proactive management actions by the Park Service not only appear to have been the best actions among the options available; they have also been upheld in court. Based on U.S. Circuit Court decisions, the Park Service, in meeting its responsibilities under its organic act, need not wait for actual damage to occur before taking protective action to prevent degradation to wildlife and other natural resources (*Wilkins v. Department of the Interior*, 995 F.2d 850, 853 [(8th Cir. 1993)]; *New Mexico State Game Commission v. Udall*, 410 F.2d 1197 [(10th Cir. 1969]).

Recognize that all parks cannot provide for all opportunities; look at park planning and management in a regional context.

Often, managers make decisions that are good for the local area for which they are responsible but may be poor decisions for protected areas on a larger scale. Failure to plan and make decisions looking at protected areas in a regional context creates problems in adjacent areas, leads to a homogenization of experiences, and decreases recreation values (McCool and Cole 2001).

Management planning often presents a good opportunity to clarify how a park or protected area fits into its regional context. A question that should be addressed is whether the area will be managed similarly to surrounding lands or adjacent sites, or whether it provides unique opportunities. The answer should relate directly to the fundamental purposes of the site; this is an appropriate context for articulating why the place has protected status, what its most important values are, and why it is different from other places.

Effective use of standardized decision-making processes can lead to a more defensible decision.

Much has been written on tools for decision—making (e.g., Bader 1990). In looking specifically at conflict among values, carrying capacity or visitor capacity analysis can be an effective methodology for articulating which values are to be protected in which areas.

Management zoning that is generally done as part of capacity analyses is essentially decision-making about which values to provide for in which places or in what context. For example, some places may be managed to allow for convenient motorized access, while others are managed to maximize opportunities for solitude. This allocation concept makes it possible to include a variety of uses and manage an area for groups with different values while preventing conflict, which will become increasingly important in parks and protected areas (Rothman 2001).

Allocation among conflicting uses has been effectively used by land management agencies for many years, and the Park Service has been upheld in court in this type of decision-making, such as in *Bicycle Trails Council of Marin v. Babbitt,* 82 F.3d 1445 at 1452 (9th Cir. 1996; Bader 1999). Management zoning or allocation of uses makes it possible to accommodate a range of values in a protected area—but not all in the same place at the same time.

Sometimes decisions can be delayed in the interest of conservation. One could simply state that the best course of management action is to always make the right decision. Outside of this ideal world, managers are presented with any number of options, and only in hindsight can be certain of which course of action is best. There are times when deferring a decision may be the best decision, especially in cases where additional impacts to resources and other values of the protected area are unlikely. If there are no immediate threats, deferring a decision may result in increased values being placed on a protected area, especially if those values are uncommon elsewhere.

Rolston (1988) recommends against making "decisions by default. Sometimes doing nothing is the cheapest thing to do and also protects values already in place." Some basic rules that apply are that it is far more costly to undo development than to do it right the first timee, and that when we have deferred decisions in the past, we have almost always been grateful to have the opportunity to take another look at the values of a protected area in a new context.

Conclusion

Decision-making in parks and protected areas is becoming increasingly more complex and politicized. The role of park planners and managers as "arbiters of value" is to make sure all values are included in the discussion, defining park values broadly to reach more than one interest group. All protected areas, regardless of size and fundamental purposes, tend to have intangible values, the protection of which is essential to the long-term viability of the area.

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Conserving Our Collective Heritage—The Paradox of Integrated, Yet Distinctly Different Management of Cultural and Natural Resources

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Introduction

Most parks are a mixture of natural and cultural resources. Envision the historic site that requires the adjacent farmland or forest and cliffs to maintain the historic landscape setting. Or the large natural area laced with historic patrol cabins, concession lodging, fire lookouts, or archeological ruins. The mixture creates a greater whole than either one alone. Together they forge the connection between people and places. Together they reflect how the land and its people and culture are intertwined in an intimate union. Our goals for both are the same: the conservation of our collective heritage. Because our goals are the same for cultural and natural resources, the mantra of recent years has been integrated or holistic management, but is this even possible? How do we most effectively plan, interpret, and manage mixed cultural and natural resources?

Integrated Planning and Interpretation for Mixed Natural and Cultural Heritage Resources

First, let's examine planning. Good planning requires that we bring diverse interests and disciplines together to solve problems and set agreed-upon goals. This is imperative with mixed cultural and natural heritage resources. Each has different needs that must be considered in planning. Where do we manicure the formal grounds of the cultural landscape and where do we allow natural ecological processes to unfold? Where do we control the rain and runoff to prevent damage to ruins or historic buildings, and where do we stand back to allow the rain and runoff to flow naturally? Where are "wild" animals problems to be controlled so they don't damage the cultural landscape or historic structures, and where are they cherished elements of natural diversity? Good planning has to answer these questions.

Good interpretation requires that we examine and explain complex subjects to diverse audiences so they understand relationships and meanings of mixed heritage resources. Understanding the interconnectedness and depth of a subject requires that it be interpreted from various perspectives. Natural resources may be interpreted alone and the cultural story may be interpreted alone, but the richest story is the interplay of people and places. Why was this fort or lighthouse built at this location? What was used to heat this home? What did the Indians eat here and from what did they make their lodges? Did it matter what time of year the pioneers crossed this trail? Does this architecture use the local climate to help heat and cool the building? Are human activities affecting visibility, acid precipitation, water quality, and wildlife migrations? How global is air pollution and is global warming real? Are the glaciers retreating naturally or faster due to human activities? What can we do to help preserve our park and planet? As John Muir said, "When we try to pick out anything by itself, we find it hitched to everything else in the Universe." Accordingly, the most intriguing stories of our collective heritage require our full attention to both cultural and natural history, and their interplay.

Mixed Heritage Resources in the Light of Ecological Succession

If we must plan and interpret the resources of our collective heritage together, can we manage their day-to-day operations together? Before directly answering this question there are three concepts that need to be examined.

The first concept is ecological succes-

sion. Prior to human civilization, the natural world was a mosaic of plant and animal communities in various stages of ecological succession. Some regions with few disturbing forces had areas that stayed near their mature, latter stage of ecological succession. These areas would have been at climax, a fairly stable state that persists as long as the climate remains consistent. But most regions were a mosaic of natural communities in various stages of ecological succession resulting from fires, floods, storms/hurricanes, avalanches, changes in predator–prey or herbivore–vegetation relationships; or changes in diseases, parasites, or insects that affected other plants or animals. In essence, the natural forces that dramatically changed an ecological community would send it back to an earlier stage of succession with less diversity and less stability. Powerful forces drive natural communities and keep ecological succession moving toward greater diversity and stability, toward climax.

The second concept is the human influence on ecological succession. Stone Age humans burned large areas to improve hunting success and forage, and to clear travel routes. Then humans with agricultural and engineering skills totally altered the natural ecological patterns. As humans mold the environment to suit their needs, they usually move ecological communities to early stages of succession and/or retain them there. Clearing a forest to make a meadow for cows moves the ecological community from a state of complexity and diversity to a much simpler and less diverse ecological community in an earlier stage of succession with higher productivity. Converting that meadow to a wheat field or a village makes it even less complex and moves it to an even earlier stage of succession. Mined lands and densely developed cities are in the earliest stages of ecological succession, with natural communities that are very low in diversity and stability. Generally, human-altered landscapes are in early stages of ecological succession, and it takes a great deal of energy and work to keep those landscapes there.

There are exceptions to this generalization, such as a botanical garden in a city, or a naturally occurring un-diverse community, such as some deserts, where humans make it more diverse by bringing in water. But here again, it takes a great deal of human energy and work to keep that landscape in a different level of succession than would occur without human intervention.

The third concept is the interplay of these first two concepts where cultural and natural resources are mixed or adjacent to each other. Where our goal is the preservation of natural systems, we must strive to allow ecological processes to work unimpaired. Where our goal is the preservation of cultural resources, we must strive to maintain that landscape by fighting or modifying natural processes.

In other words, to preserve natural landscapes we strive to allow natural processes and ecological succession to proceed unimpaired. The natural communities will be diverse and relatively stable, trending toward the mature or climax stages of ecological succession. Natural resource management is often focused on combating the impacts from human activities that destabilize the natural community, reduce its diversity, and send it back to earlier stages of ecological succession. By contrast, to preserve cultural landscapes we are fighting ecological succession to keep the area in an early stage of succession. We are fighting the forces of nature that would otherwise reclaim that cultural landscape and move that area along on its path of ecological succession.

It is for this reason that we often manufacture the distinction between "natural" and "cultural" resources, despite the fact that our collective natural and cultural heritage are parts of a greater whole. Additionally, the distinction occurs because the effects of human-altered landscapes on ecological succession are so visually dramatic and require so much effort to maintain in their early stage of succession. Most "cultural" and "natural" landscapes stand in such clear contrast to one another that anyone can distinguish them apart. Accordingly, we humans have categorized cultural landscapes as something different from nature, even though they are clearly integral with nature. Although the distinction is contrived and the goal of preserving our collective heritage resources unimpaired is the same for both, it is relevant and useful terminology because the distinctions and needs between natural and cultural resources are so dramatic when considered in the light of ecological succession.

When we refer to a cultural landscape that we intend to preserve, we inherently understand that we will have to put energy and resources into maintaining it unimpaired as a farm, house, formal garden, field, road, or whatever it is. To most of us this is just preserving our cultural heritage. When we refer to a natural landscape that we intend to preserve, we inherently understand that we will have to put energy and resources into ensuring that its natural processes proceed unimpaired. To most of us this is just preserving our natural heritage. What is so dramatically different in park management is *how* we actually go about preserving those two types of resources.

Managing Our Collective Heritage Resources

We have found powerful meaning and great value in natural areas. To preserve our natural heritage we have trained employees to protect the natural processes by minimizing or eliminating the influences of human activities that impair them. This active management is an intervention into natural processes. Our natural resource staff must be diligent in understanding the obvious and subtle influences that human activities have. Acid rain and other airborne pollutants can devastate an ecosystem. Human introduced or exotic species can dramatically alter natural systems. Blister rust fungus introduced from Europe has decimated the white pines or five-needled pines throughout North America, notably in Mount Rainier, Glacier, and Yellowstone national parks. The balsam woolly adelgid from Europe destroys true fir forests in North America, for example at Great Smoky Mountains National Park. Eurasian knapweeds in many of our western national parks and Asian kudzu in many of our southeastern national parks invade and dominate landscapes. Introduced wild pigs destroy vast acreage with their rooting at Great Smoky Mountains, Cumberland Island National Seashore, and in our Hawaiian parks. Threatened and endangered species often require management actions or human intervention to preserve them from extinction. Runoff from mining spoils, sedimentation from logging, or polluted runoff from development can alter or destroy aquatic ecosystems. These disturbances from human activities are destabilizing the ecological communities and setting them back to earlier stages of ecological succession. So, we have professional staff ready to do their duty, ready to preserve or intervene in natural processes, often by combating the impacts from human activities.

At the same time we have found powerful meaning and great value in many human activities, including historic structures, landscapes, and events. To preserve our cultural heritage we have trained employees to protect those cultural resources from the natural processes that would otherwise destroy them or alter their historic context. Our cultural resource and maintenance staffs must be diligent in combating the persistent natural processes that inherently produce change or destruction of cultural resources. Roofs must be maintained to keep rain out of buildings, and runoff must be kept away from building foundations. Buildings must be maintained and actions taken to keep rats, mice, woodpeckers, skunks, squirrels, snakes, and other animals out of buildings. Historic grounds and landscapes must be maintained or they are taken over by "wild" shrubs and forest. A number of historic structures at Cumberland Island, including the Plum Orchard Carriage House and Dungeness Recreation Building/Bachelors Quarters, are rotting away in ruins covered by vegetation and inhabited by wildlife because their exterior envelopes were not maintained. White Grass Ranch at Grand Teton National Park has been saved from the brink of destruction by clearing the site and stabilizing the structures. Pueblo Indian ruins throughout the Southwest have to be stabilized to keep them from being lost to the forces of nature. There are professional staffers ready to do their duty, ready to preserve cultural resources by combating the destructive effects of natural processes.

When there are cultural and natural resources mixed together, as collective heritage resources, the overarching objective is to steward them all in perpetuity. Both cultural and natural heritage resources merit preservation and require equal consideration. One does not top the other. Yet when it comes to *how* their preservation is accomplished, diametrically opposed management objectives and activities exist side by side, diametrically opposed management strategies and tactics are advanced side by side. This paradox can lead to great stress for those who have to manage the resources.

The fundamental and essential ingredients for successful management of mixed resources are effective staff communications, and integrated planning that produces distinct management objectives for cultural and natural resources and clearly defined boundaries to distinguish where those objectives should be applied. An integrated planning process must involve all of the interested and affected public, government representatives, organizations, and especially park staff. Effective communications in conjunction with integrated planning involving all affected parties are needed to build a common understanding of the opposing interests, goals, and needed management between the adjacent natural and cultural heritage resources. Clearly defined management objectives or desired future conditions for given areas will benefit both the cultural and natural heritage resources. Those will be quite different for cultural and natural resources, which beg for clear geographic delineation. Clearly defined zones or areas distinguishing the cultural and natural resources will dramatically improve the management of the resources.

With that boundary on a map it becomes relatively easy for the maintenance employee to know where to mow the lawn, tend the ornamental shrubs, and cut down unwanted tree seedlings that grew from seed blown in from the adjacent natural area. All these maintenance activities keep the landscape in an early stage of ecological succession. Likewise, the maintenance worker knows where to stop his or her maintenance activities and let those naturally generating tree seedlings grow unfettered. This allows the process of ecological succession to proceed naturally. However, the boundary is an imperfect device. For example, when wild animals from the natural area degrade the cultural landscape; the cultural, natural, and maintenance staffs must rely upon their effective communications to solve the problems. All need to work together effectively. But generally, distinct management zones with clearly defined boundaries solve many problems about which management strategies and tactics should be applied where.

Conclusion

All of our park resources inherited and stewarded in perpetuity are heritage resources. Where there are intermixed cultural and natural heritage resources, they need to be planned in full cooperation of all parties, and interpreted in an intimate, integrated fashion. However, they must be managed with distinctly different strategies and tactics. Natural resources will generally be managed to allow their natural processes to function as unimpaired from human impacts as possible. Their stage of ecological succession will ebb and flow over time as the forces of nature alter an area, but the plant and animal communities will be trending toward diversity, complexity, and stability of the middle to latter stages of succession. And cultural resources will be managed to preserve them from the forces of nature that would otherwise destroy them or alter their historic context. The cultural landscape's stage of ecological succession must be maintained to preserve it, and it will usually be in the early stages of succession. For mixed natural and cultural resources, integrated planning and interpretation are essential, but their divergent preservation needs will require distinctly different management approaches and activities. The conservation of our collective heritage resources demands this complex and paradoxical management.

The Challenge of Managing and Interpreting Avifauna on Cultural Sites within the Timucuan Preserve

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Introduction

Many National Park Service (NPS) units face the challenge of balancing the management of natural and cultural resources. The present paper explores the challenges faced when managing birds on significant cultural sites within the Timucuan Preserve, located on the northeastern coast of Florida near Jacksonville. Resource education is a key aspect of preserve management and protection. Effective management of resources must include the diverse expectations and values of the visiting public.

Timucuan Preserve was authorized as an NPS unit in 1988. Other land owners include state and city parks, as well as over 300 private land and home owners. The multi-ownership nature of the preserve requires a management approach that relies greatly on outreach and partnerships.

The preserve contains diverse biological systems consisting primarily of estuarine ecosystems, including salt marshes, coastal dunes, and upland hardwood hammocks, as well as salt, fresh, and brackish waters that provide habitat to a variety of life, including resident and migratory birds. Within the boundaries are over 200 recorded archeological sites providing evidence of over 6,000 years of human habitation. There are numerous historic structures and sites, including those at Kingsley Plantation and Fort Caroline National Memorial. These are important cultural sites that focus on issues such as slavery, indigenous culture, land use, early American history, and cultural conflict. The prehistoric and historic events and associated issues are intimately linked with the natural environment. There are many natural resource management challenges within this context, but this paper will specifically focus on the management of birds and their habitats.

It is readily apparent that birds comprise a major segment of the vertebrate fauna of the 46,000-acre preserve, and as such, the birds likely interact at many levels with the estuarine ecosystem and the on-going management activities within the preserve. The preserve is within the lower breeding limit of many northern bird species and offers habitats for wintering and migrating birds. The preserve provides refuge for many birds that are increasingly threatened by land development and recreation along coastal areas. It is a challenge to communicate this and other important natural resource issues to visitors at the Kingsley Plantation and Fort Caroline, two important cultural sites with the preserve.

The Role of Education

The resource education division of the preserve provides opportunities for visitors to form their own intellectual and emotional connections with the cultural and natural resources that include birds and their habitat. Visitors to Kingsley Plantation and Fort Caroline come with diverse expectations. Often, expectations are immediately modified by the cultural landscape or by the striking natural beauty before there is any contact with any literature, waysides, rangers, or any other interpretive media. This creates both challenges and opportunities for integrating many interpretive stories, including historical elements and natural history. One important goal of interpretation is resource protection. The apparent conflict between the cultural and natural resource meanings becomes an opportunity to provide relevance and multiple perspectives on important resource issues and protection.

A goal of interpretation is to provide opportunities for visitors to form their own connections with meanings inherent in the resources of a site. It is hoped that if visitors make connections, they will be more likely to find value and develop a caring attitude about the resources, resulting in active participation in resource protection. It follows that integrated and meaningful interpretation serves the visitor and the resource.

During their contacts with the public, rangers are able to share information and interpretation about bird resources and answer questions from visitors concerning the preserve's large bird population. Resource education staff obtain information from preliminary inventory and monitoring projects being conducted in the preserve (Eakes 1996; Tardona et. al. 1997; Tardona et. al. 1999). In addition to the benefit gained from the data gathered during the surveys, involvement of people from the local community strengthens and expands support for park goals. A preserve bird list (presently over 325 species) is provided to visitors along with other bird information guides. Information about birds is integrated into formal public programs. The preserve has been participating in a research project that has not only provided data about an important bird species, but also is providing opportunities to facilitate connections between the natural environment and cultural resources.

The Painted Bunting Project

Monitoring of bird species has implications not only for the preserve, but also broadly aids in data collection on migratory species for other agencies and bird observatories. Involving visitors through resource education efforts provides enjoyment, understanding, and appreciation of bird natural history. As a result, however, visitors assist park management in communicating both natural and cultural resource protection needs. An important bird species that is being monitored in the preserve is the painted bunting. The preserve contains habitats for breeding and migratory painted buntings.

This bird is a species at special risk in the southeastern United States and has been declining at approximately 4% annually since 1966 based upon Breeding Bird Survey data (Hunter, Pashley et. al. 1993; Sauer et al. 1997). The cause or causes of this decline are not known but may be associated with fragmentation of eastern forest habitat into isolated patches (Robbins et. al. 1989), loss or significant alteration of optimum breeding habitat (Askins et. al. 1990; Askins 1993), or brood parasitism by the brown-headed cowbird *(Molothurus ater)* (Brittingham and Temple 1983; Trail and Baptista 1993). Other possibilities include increased predation by domestic cats, problems on wintering grounds (related to the cage bird trade in Cuba and possibly in southern Florida), or other undetermined causes. Survival rate of the southeastern coastal population of the painted bunting is unknown.

A six-year study of annual survival of the southeastern population of the painted bunting is currently in its fourth year, covering an area from near Wilmington, North Carolina, and extending along the immediate coast to the St. Johns River in northern Florida. The object of this study is to determine annual survival by age and sex using trapping/retrapping and sightings of banded painted buntings throughout the Atlantic Coast breeding range. Study sites are located along the coast from North Carolina to Florida. Timucuan Preserve participates by providing four study sites with two temporary baiting stations at each site (a total of eight baiting stations). Two baiting stations are located south of the St. Johns River at Fort Caroline National Memorial (one near the Fort Caroline fort exhibit and the other approximately 0.6 miles away at the Ribault

Monument). Six other baiting stations are located north of the St. Johns (two at Cedar Point, two on Fort George Island near the grounds of the Kingsley Plantation, and two on the grounds of Little Talbot Island, part of the Little Talbot Islands State Parks). This study is providing information for resource managers and is an essential vehicle for interpreting many critical cultural and natural resource management issues in the preserve.

Resource Integration in Management and Interpretation

Among the many factors to be considered in decisions regarding natural and cultural resources are interpretive opportunities. If interpretation is viewed as a valuable tool of resource management, then interpretive opportunities created or lost by management decisions must be considered. For example, one challenge the preserve faces is at Kingsley Plantation. During the plantation period, much of the island was cleared for the planting of cash crops such as Sea Island cotton, sugar cane, and indigo. One of the significant cultural resources at the site are the Kingsley family structures, tabby slave cabins, and the historic landscape. Much of the Kingsley family structures have been modified since the Kingsley era and the landscape has changed dramatically. One unresolved management question has been to what degree and at what time period should the landscape be "recreated." Much of the landscape has been reclaimed by nature since the Kingsley era. Clearing of the landscape to a closer approximation of that era's landscape will require sacrificing some important natural habitat of the painted bunting and other bird species. Considering the declining population of buntings and the still unclear reasons for their decline, how much of an impact would the landscape restoration have upon bunting habitat and overall population?

One possible scenario that may have interpretive value, but would compromise some of the "historic scene," is clearing a small piece of land between the slave cabins and the main house. One alternative for discussion is the interpretive value of clearing and maintaining only one-half of the site to its "historic" landscape condition, while leaving the other half to demonstrate the reclaimed area by nature and thereby minimizing potential habitat loss for painted buntings. Perhaps such a decision would offer greater opportunities for interpreting the challenges of managing natural and cultural resources. It would clearly demonstrate that history, including landscapes, is not static, and thereby would present multiple perspectives about the resources of the site. At the same time, opportunities may arise for interpreting natural resource conditions. Deciding how best to manage this area is not easy, and many other factors will need to be considered.

While the painted bunting study is being carried out, a temporary demonstration bait station has been set up on the grounds of the Kingsley Plantation, next to the interpretive garden. During the times when data are being collected at the research bait stations, visitors have the opportunity to observe the collection process at many of these stations. During data collection, mist nets are erected in succession surrounding the bait stations and monitored at each site in the early morning hours for half a day at each station. The study areas are systematically sampled to try to prevent any effect of time of year. Buntings captured in the mist nets are quickly leg-banded with uniquely colored bands. Birds are released at the net sites after data on banding, age, and sex are recorded. (For more details on project methodology see Sykes, Kendall, and Meyers 2002). Annual survival rates are calculated based on recaptures the following year and on re-sightings. Visitors are afforded the opportunity to observe from a distance and are provided with a short interpretive program at the site. Preliminary results of this study show a decreasing trend in captures of buntings in the preserve for the past four years.

Data collected from the research project, though preliminary, are easily and clearly communicated where and when appropriate to visitors to Kingsley Plantation and Fort Caroline. This information is integrated into resource education programs. For example, birds were important for the native people occupying the region before European contact. Birds were a resource for food and materials such as feathers, and perhaps even assisted native people in fishing, hunting, and other activities as they observed their natural behavior. Birds have served in native spiritual and social endeavors. The bait station located near the Fort Caroline fort exhibit is interpreted to interested visitors by a roving ranger. The resource education staff is considering an unobtrusive temporary interpretive sign at the location. Birds are integrated into historical resource education programs. For example, one of the items presented to the French explorers at first contact with the Timucua (the native people who occupied the area at the time of European contact) were bird feathers. A brief discussion about birds and Timucua life is introduced and contrasted as part of a clash of cultures. This provides opportunities for interpretation of birds in the preserve today, including the painted bunting project. In addition, birds have been effective as a vehicle for interpreting many critical resource issues during orientation and informational programs.

At Kingsley Plantation on Fort George Island, birds are integrated into interpretive programs, as several species are readily apparent and sometimes “distracting” from the cultural theme of a program (e.g., the call of a pileated woodpecker or wood stork sailing overhead). These “distractions” are not ignored, but incorporated into the particular program theme. For example, birds and their habitat are employed as a tool in creating an image of everyday life of both owner and enslaved people during the plantation era. Ideas about birds and the slaves are presented as speculation and not as historical fact (there are few, if any, written records from the slaves themselves who lived at the Kingsley Plantation). For example, rhetorical questions are posed to visitors such as “Might the birds observed by slaves remind them of their homeland in Africa?” “Might the painted bunting have reminded them of a similar bird in parts of Africa and the folklore associated with it?” In many plantation sites, zooarcheological remains include birds and yield information about the daily life of enslaved people and how they may have interacted with birds.

Interpretive themes include concepts of freedom reflected in some of the folktales created by enslaved African people. Interpretive programs explore how enslaved people combined memories and tales of their homeland in Africa with their experiences in the environment of their new world, including those associated with birds. Discussions revolve around not only plantation life, but if, or how, birds were viewed by planter and slaves. Some visitors even speculate whether the owners or slaves ever maintained any kind of bird feeder to attract birds (there is no historical record of this). The research project becomes a topic of discussion, as it relates to the natural resource elements of the historic site. In discussions about land use on the island, birds are interwoven into the stories about how the landscape changed from the native Timucua through the plantation era, when much of the island was cleared for planting crops. These examples provide opportunities to integrate meanings inherent in specific cultural and natural resources at the site. For example, during the country club era on the island, a 1930s brochure for the Fort George Club advertised “a bowling green, putting green, canoeing ... and walks through the bird sanctuary, where over eighty species have been seen, some of them rare.” During the 1940s, students and faculty from Rollins College used 150 acres on the south end of the island for scientific studies (*Florida Times-Union* 1950). Today, that same area is still known as the Rollins Bird and Plant Sanctuary. These are just a few examples of how an important natural resource can be integrated into the cultural themes within the preserve.

Conclusion

When two resources come into direct conflict, it is often difficult to make resource management and interpretive decisions about which takes priority. There are many examples beyond the scope of this paper that could be cited. Despite many guidelines, such as a park’s enabling legislation, the National Environmental Policy Act, the National

Historic Preservation Act, the Endangered Species Act, and others, there still exists no definitive equation to help resource managers decide what or what part of a specific resource takes priority. Many factors have to be weighed, including cumulative effects on a resource, impact of adjacent land management, local and national significance, sociopolitical factors, public sentiment, and interpretive value. This paper has been an attempt to present important resource management and interpretive issues facing an NPS site when a manager needs to balance cultural and natural resource values.

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It's All in the Family: Recommendations for Cultural and Natural Resources Reconciliation

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Introduction

While diverse values attract passionate support, their combination in one park represents a considerable management challenge. Finding a balance among so many vital but tenuous links to cultural and natural history is complicated and often contentious. This paper will discuss methods for reconciling these interests and going forward with the critical work of preservation for all the cultural, social, and/or natural values associated with national park resources. The paper uses experiences from the Presidio of San Francisco and Golden Gate National Recreation Area to frame its recommendations.

The Presidio of San Francisco is a 1,490-acre unit within a national park located at San Francisco's Golden Gate. The area boasts a unique mix of cultural, natural, and recreational resources. First inhabited by the Ohlone, the Presidio was a seasonal village site until the Spanish came and claimed it for Spain in 1776. From this point until 1994, the Presidio was an important bellwether for the West's military history. First established to protect the San Francisco Bay under the Spanish Army, the Presidio was transferred to Mexico after it won its independence from Spain in 1822. In 1846, the Presidio was turned over to the United States Army, which developed and managed it as a military base until it was decommissioned in 1994 and incorporated into Golden Gate National Recreation Area. Due to its colorful and lengthy military history—it was the longest constantly running military base in the nation when it closed in 1994—and its remaining structural and landscaped resources, the Presidio is one of the United States's National Historic Landmark Districts.

Today, five federally listed plant species exist within Presidio boundaries, making their home among rare dune, serpentine, and wetland habitats that are quickly disappearing from coastal areas and are entirely gone from San Francisco. The park boasts historically significant forest stands, the last free-flowing creek in San Francisco, and a majestic sand-and-bluff shoreline overlooking the Pacific Ocean. The Presidio is also home to Mountain Lake, one of two remaining natural lakes in San Francisco. Wildlife in the Presidio is plentiful and various, although becoming more rare due to loss of precious habitat.

Recommendations

These seven recommendations are meant to initiate natural and cultural resources reconciliation by promoting frank discussion and encouraging understanding and compromise between the disciplines.

1. Acknowledge the fundamental differences—and common ground —between natural and cultural resources. The fundamental difference between natural and cultural resource values is fairly straightforward: cultural resource values generally refer to the human influences that have changed natural systems, while natural resource values instead privilege the pre-European environment. Although pre-European ecology can sometimes satisfy both camps, the period of significance at the Presidio is the post-European contact period, which often conflicts with natural resource values.

Between the natural and cultural disciplines, subtle differences in understanding can have a tremendous impact on the planning process. The most prevalent cause for misunderstanding is a difference in language. For example, historic resource treatment standards have distinct definitions for rehabilitation, restoration, and preservation, while natural resources policies define these terms with much more flexibility. For example, when natural resources professionals entertain the idea of "restoring" an area, the cultural professionals assume that this goal is strictly defined, when in fact it is quite elastic. Cultural and natural resource professionals must realize that these terms are not clearly shared across discipline lines, and openly clarify their terms before entering discussion. The first step in addressing a project conflict is to ask that the language be defined and interpreted.

While the differences are important to acknowledge, equally meaningful are the similarities that bind the two camps. The most obvious similarity is both natural and cultural resource professionals' common goal to preserve the national heritage for future generations. The goal of any resource manager is to ensure that people can experience their country's history and ecology for centuries to come.

2. Begin all projects with a mutual understanding of the basic cultural and natural resources laws and policies. Any resource management discussion should begin with an open recognition of the laws and guidelines that apply to the project. Laws and policies provide the backbone for resource work and the framework for associated decision-making. The effort taken to review and respect the other discipline's guiding policies will greatly benefit joint projects. While it may be difficult to learn all the appropriate legislative acts and policy documents, requesting that a professional counterpart explain the basic elements of the law can help both groups understand the other's knowledge, and respect their basis for negotiations. Examples of essential cultural resource laws and guidelines include the National Historic Preservation Act, Archeology Resources Protection Act, and the Historic Sites, Buildings, and Antiquities Act, as well as federal standards on cultural landscape treatment and the State Historic Preservation Office review process. Guiding documents for natural resources professionals include the Endangered Species Act, the Wilderness Act, the Migratory Bird Treaty Act, the Clean Water Act, and the Clean Air Act.

3. Acknowledge that there is a history to natural history, and a natural history to history. Finding where resources overlap can be helpful for identifying common ground. One example of this beneficial overlap is what natural resource professionals call "type localities." In natural history, a type locality refers to the very first place a species of plant or animal was discovered and described. Since the first ships into the San Francisco Bay stopped and collected plants, the Presidio holds many sites of type localities for plants and animals. Even California's state flower, the California poppy, has its type locality at the Presidio. The cultural resource term "prototype" corresponds with the natural resource "type locality." On the Presidio, an example of a prototype is an Endicott-era concrete battery, which served as the model for such batteries constructed throughout the country.

As type localities represent the "history of natural history," the Presidio's riparian oak woodland illustrates the "natural history of history." This natural habitat was esteemed a contributing factor to the National Historic Landmark District designation, a symbol of great cultural import. The majority of the Presidio's historic forest was planted by the Army, but natural forests existing at that time were retained by the Army and thus included in the historic designation. Using transferable examples such as type localities and the historic oak woodland may help bridge the gap of understanding between the disciplines.

4. Allow the resource experts to work through the balancing without mediation. It is beneficial for cultural and natural resource specialists to get together early in the planning process before lines are drawn in the sand. Holding an initial collaborative meeting among resource staff allows these professionals to focus on cross-resource education and value identification, without becoming adversarial. The goal at this stage is for each resource professional to balance advocacy with inquiry.

Early discussion among the resource staff can build common ground for future coordination, but inviting non-resource staff to this initial collaboration can curtail necessary open debate. Decision-makers and planning staff have the important role of balancing not only resource needs, but also issues such as park neighbors, operational needs, and additional values such as recreation. These additional considerations tend to make resource professionals territorial. Further, planners can misinterpret the intensity of resource negotiations and start holding separate discussions with each camp, believing that this is the best way to mediate. In fact, it is crucial that both cultural and natural resource staff remain engaged in each step of the planning process in order to ensure the preservation of the resource.

5. Use a scientific approach to decision-making. Discussion of any individual natural and cultural resource overlap issue must occur in a framework of professional integrity built on a foundation of science, research, and policy. Passion about the involved values can be tempered with a more technical and integrated eye for park values. A design for guiding the process of integration could include conducting survey and identification work, consulting appropriate literature prior to planning, and exploring scientific validation.

In general, resource professionals should come to planning meetings prepared to quote the source or experience from which the professional opinion was drawn. This will strengthen the credibility of the information, and is especially helpful when new players are at the table. Ideally, the researchers themselves would be available to describe their findings. Independent researchers especially can help alleviate doubt regarding data interpretation. Resource management agencies should always document the researchers and the science that has helped inform the decision-making process.

The post-mortem review of the Presidio Crissy Field project revealed a lack of hard science underlying early decision-making. The Crissy Field project included restoring a tidal marsh, sand dunes, and a historic airfield. Both archeological and hydrological information were eventually found to be inadequate. Having learned from this experience, detailed research, including aquifer studies, comprehensive archeological testing, and historic property identification is being planned for two adjacent resource projects.

6. Adopt an unwritten understanding to help each other. Whenever possible, resource staff should express the good-faith understanding that both cultural and natural resource values are important to preserve and protect. During the Crissy marsh restoration, a Native American midden was found in the area where the marsh was planned. Recognizing the discovery's blow to the natural resource objective, the cultural resource staff contributed additional space for the marsh to mitigate the loss. Similarly, when a new type of plant community (dune swale) was proposed in the Crissy dunes, the natural resource staff worked to finalize a cultural plant palette that would please the Native American community and satisfy a tribal agreement that basket materials would be planted for their collection and use.

7. Realize that a solution may not be available at that moment in time. The issues are often complicated and may need to be worked out over time. Projects that include cultural and natural resources tend to take a while to mature, and often undergo adaptive management during the planning, implementation, and monitoring phases. Often, a values trade-off may not be ideal for either resource, but may still be the best accommodation at the time. All projects are processes; they include successes and failures as well as outcomes requiring continuing study. The success of the existing vegetation and habitat value at the Crissy marsh may guide future decisions about expansion, and the success of the Crissy airfield restoration may depend on future decisions about possible "air museums." Creating a vision for resource preservation and keeping that vision in mind throughout the project process is the key to a successful resource project. By continually articulating a vision, it will be translated into action, even if it becomes modified in the translation.

Conclusion

Through years of experience, the authors have gone from dueling across conference room tables to understanding how to work comfortably together. The hope is that these recommendations will help new professionals in resources management get to common ground even faster.

Zzyzx Mineral Springs—Cultural Treasure and Endangered Species Aquarium

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A Brief History of Zzyzx

Human use has been documented at Soda Dry Lake back to the early predecessors of the Mohave and Chemehuevi native peoples, who occupied the land when the Spanish explorers first explored the area early in the 19th century. Soda Springs lies in the traditional range of the Chemehuevi, who likely used and modified the area in pursuit of their hunter–gatherer economy. Trade routes existed between the coast and inland to the Colorado River and beyond for almost as long as humans have occupied this continent. These routes depended on reliable springs, spaced no more than a few days' walk apart, and Soda Springs has long been a reliable oasis in a dehydrated expanse.

The first written record of Soda Springs comes from the journals of Jedediah Strong Smith, written in 1827 when he crossed Soda Lake on his way to Mission San Gabriel. Smith was the first American citizen to enter California by land. He crisscrossed the western half of the North American continent by foot and pack animal from 1822 until he was killed by Comanches in 1831. In his journal, Smith wrote of his Soda Lake sojourn: "I came to border of a salt plain and at this place found some holes of brackish water. The water was in holes dug about two feet deep and quite brackish. Making some new holes I found the water some better."

The U.S. Army followed on Jedediah Smith's heels. Various government and, in particular, Army surveys were conducted in the 1850s. Lieutenant Robert S. Williamson provided one of the earliest written descriptions of Soda Lake in 1853. Lieutenant Amiel Weeks Whipple gave Soda Lake its name in 1854, and in 1857 Edward F. Beale laid out a wagon route through the Mojave Desert for emigrants bound for southern California. This route would eventually become known as the Mojave Road. Numerous massacres of these emigrant parties by the Mohaves led the Army to establish a permanent post in 1859 at Fort Mohave near present-day Needles. Shortly thereafter, they established a camp at Soda Springs, dubbed "Hancock's Redoubt" for Winfield Scott Hancock, the Army Quartermaster in Los Angeles at the time. The Army's presence provided a buffer between the emigrants from the East and dispossessed natives. California miners also traveled the Mojave Road on their way to the Colorado River in 1861. During 1867 and 1868, the army established "Soda Station," or "Fort Soda," an army outpost at Soda Springs subordinate to Camp Cady. From Soda Station, the army provided escorts to the stages and U.S. mail carriers along the Mojave Road (Casebier 1999). After the army withdrew in 1871, Soda Station and other similar posts were sporadically manned by civilian station keepers.

The early 20th century brought mining, railroads, and religious colonization to Soda Springs. The Pacific Salt and Soda Company ran a sporadic mining operation there between 1907 and 1911. Evidence of the Pacific Salt and Soda evaporation ponds is still apparent. In 1906, Francis Marion "Borax" Smith had built the Tonopah and Tidewater Railroad through Soda "Dry" Lake to serve his borax mines near Death Valley. From 1907 to 1940 the T&T averaged one train per day between Ludlow, California, and Goldfield, Nevada. The rails were for removed for raw material during World War II and the graded bed now marks the boundary of Mojave National Preserve south to Crucero on the Union Pacific line.

Pastor Charles T. Russell founded the Watchtower Bible and Tract Society at Soda Springs in 1914. Only two written records of this religious colony, the "Russellite" sect of Jehovah's Witnesses, exist. Russell died October 30, 1916, and David G. Thompson, a geologist working for the U.S. Geological Survey, reported the site abandoned in 1917. Curtis Howe Springer and his wife moved onto the site in 1944, filing mining claims with the Bureau of Land Management and San Bernardino County for over 12,000 acres around Soda Springs. Springer built and operated the Zzyzx Mineral Springs and Health Resort at Soda Springs for 30 years until the Bureau of Land Management evicted him in 1974. His daily radio broadcast touted the miraculous healing powers of Jesus, mineral baths, and elixirs such as Hollywood Pep Tonic and Antediluvian Desert Herb Tea. Although the charges against him—invalid mining claims, tax evasion, and exaggerated advertising—are certainly true, his main activities may have been providing sermons and health food to lost souls and unintentionally supporting the Mohave tui chub. Springer claimed to have coined "Zzyzx" in order to have the last word in the English language.

Springer excavated an artificial pond in about 1955 and called it "Lake Tuendae." He stocked it with a minnow-sized fish that lived in a small limnocrene spring nearby, now called MC (for Mojave Chub) Spring. This spring is natural, but needs occasional clearing of cattails *(Typha domengensis)* and sedges *(Scirpus olneyi)* to maintain open water. Springer also enlarged a water-filled mine shaft near Lake Tuendae that became known as "Three Bats Pond" and, later, "West Pond." One version of the story is that Springer enlarged West Pond with dynamite to mine gold. Another version holds that he was constructing a swimming pool. Given that Springer needed to pretend to be mining in order to hold onto his claims, and that the gold he was mining actually came from the purses of his "guests," the truth is probably somewhere in the middle. The fish population in West Pond was killed in 1984 when water conditions became too bad, even for the incredibly tough Mohave tui chub. Hypoxia associated with algae blooms was blamed; this may have been triggered or exacerbated by sewage.

The present-day Desert Studies Center, operated by a consortium of California state universities, was conceived by Dalton Harrington at California State University–San Bernardino when it became apparent that the Bureau of Land Management was finally going to evict Springer. The Desert Studies Center hosts classes, field trips, and conferences in Springer's buildings, restored by the consortium.

A Brief History of the Mohave Tui Chub

The Mohave tui chub *(Gila bicolor mohavensis)* is the only fish native to the Mojave River basin in California. It preferred quiet pools in the intermittently flowing Mojave River and tended to be swept downstream during floods. Sport fishermen introduced the arroyo chub *(Gila orcutti)* in the 1930s as live bait, and it interbred with the Mohave tui chub. A isolated relic population of genetically pure Mohave tui chub survived in MC Spring. How the fish got into MC Spring remains a mystery. The Soda Lake playa is a closed basin at the end of the Mojave River watershed and, during wet seasons, becomes a real lake with water. The fish could have been washed into the ephemeral lake during floods, with a few becoming trapped in MC Spring as the waters receded. An alternative explanation is that the fish somehow move underground through fractures in the limestone. The Bureau of Land Management excavated a pit adjacent to MC Spring to test this latter hypothesis. The pit filled with water but fish never appeared.

The Mojave River originates on the northerly slopes of the San Bernardino Mountains and flows northeasterly into the closed basin of Soda Lake about 100 miles away. Twenty-thousand-year-old fossilized fish remains in Lake Manix recall a time when

Mohave tui chub lived in its favored habitat (USFWS 1984). Lake Manix is now a flat stretch of desert along Interstate Highway15 north of Barstow. The Soda Springs area lies on the western shore of Soda Dry Lake at an elevation of 930 feet. Most of the buildings of the proposed Zzyzx/Soda Springs historic district lie on a shoreline outcropping of Permian metamorphic limestone. The Soda Mountains are Mesozoic granitic and metavolcanic rocks flanked by short, low-angle, alluvial fans and debris flows characteristic of extreme aridity. Mean annual precipitation at Soda Lake since 1980 is 3.5 inches, occurring mostly from July through September during the summer thunderstorm season (Mojave National Preserve 2002).

There are two distinct aquifer systems influencing Soda Springs. Groundwater below Soda Lake is part of the Mojave River Sink and is recharged from percolation through Afton Canyon and Kelso Wash. Another aquifer appears to be related to carbonate rocks in the Soda Mountains. Thompson, the U.S. Geological Survey geologist who surveyed the region in 1917 and 1919, observed two or more springs flowing from the east side of the limestone formation. He wrote of these as "appearing to seep directly from the rock about five feet above the surface of the playa. The largest spring flows into a concrete reservoir about 15 to 30 feet in area and 5 feet deep. A small ram pumped water from this reservoir to a domestic use tank in 1917 but, by 1919 had been removed" (quoted in Duffield-Stoll 1994). Water chemistry suggests that a fracture system through limestone provides a conduit for water flow to MC Spring. The spring tends to have a pH of around 8.5, as compared with 9.5–10 in Lake Tuendae, and low dissolved oxygen. The fact that cattails and sedges in MC Spring must be cut back about every 18 months or so suggests that the existence of this open pool of water, with a surface area of 250 square feet and a volume of 1,000 cubic feet, is anthropogenic.

Springer or his associates most likely introduced the tui chub into Lake Tuendae and West Pond. The oblong impoundment of Lake Tuendae is about 125 feet wide by 500 feet long in an east–west direction. Water is supplied to the lake from a well through a fountain in the lake center. Lake Tuendae is connected to the Soda Lake aquifer by seepage, which has probably prevented a long-term buildup of salinity. Lake Tuendae gradually fills in with sediments and cattails and must be dredged about every 10 years.

The tui chub was listed as endangered by U.S. Fish and Wildlife Service (USFWS) in 1970 and by the state of California in 1971. In addition to the original population in MC Spring and the population introduced into Lake Tuendae, populations of Mohave tui chub have been established in artificial impoundments at China Lake Naval Air Weapons Station and Camp Cady. Attempts to establish other populations at San Felipe Creek (San Diego, California), Rio Santo Tomas (Baja California, Mexico), Paradise Spa (Las Vegas, Nevada), Piute Creek (San Bernardino, California), South Coast Botanical Garden (Palos Verde, California), Two Hole Spring (San Bernardino, California), Dos Palmas Spring (Riverside, California), Lion Country Safari (Laguna Hills, California), Eaton Canyon Nature Center (Altadena, California), Busch Gardens (Van Nuys, California), and Lake Norconian (Norco, California) have all failed.

Where Do We Go from Here?

In the fall of 2001, the National Park Service dredged Lake Tuendae, which was becoming filled with silt and cattails. Some fish were killed when an inflatable dam, which was holding water in one half of the lake while the other half was being dredged, slipped. Ten dead fish were sent to the University of San Diego for necropsy and all were found to be infected with the Asian tapeworm. The Asian tapeworm is a parasite believed to have entered the U.S. in shipments of grass carp and spread to California by live baitfish. It is known to have deleterious effects on fish of the Cyprinid, or minnow, family of which the tui chub is a member. The Mohave tui chub shares Lake Tuendae with the Saratoga Springs pupfish *(Cyprinodon nevadensis nevadensis)* and the exotic mosquito fish

(Gambusia affinis), native to southeastern U.S. *Gambusia* has traditionally been introduced to control mosquitoes but also may consume eggs and larvae of endemic fish. Spring 2003 saw an anomalous plankton bloom in Lake Tuendae, perhaps related to the dredging. Predation on zooplankton by Gambusia also could allow ecological release of phytoplankton in the lake and exacerbate an ecological imbalance. Tests of the water showed alkaline pH (9.5), total dissolved solids of 2130 mg/L, and salinity of 2.2%, still within the range tolerated by the chub.

Small, isolated populations are susceptible to extinction, commonly resulting from multiple stressors. Isolation, small population size (estimated at about 5,000 in Lake Tuendae and 500 in MC Spring), poor water quality, maintenance requirements reflecting an aquarium-like environment, and invasion of exotic species all stack the odds against the Mohave tui chub. Objectives in the recovery plan for delisting the species depend greatly on hope. The plan, which was approved on September 12, 1984, calls for establishing populations in Afton Canyon and Mohave Narrows where perennial ponds persist. Exotic species found in these habitats include black bullhead *(Ictaluras melas),* green sunfish *(Lepomis cyanellus),* fathead minnows *(Pimephales promeloas),* and the Mohave tui chub's old fecund nemesis, the arroyo chub. These species would have to be eradicated before Mohave tui chub could be reintroduced and expected to survive. Actions intended to destroy exotic species could spill over and impact other species such as the protected western pond turtle *(Clemmys marmorata)* in Afton Canyon. Assuming complications could be overcome, the reintroduced chub would still need to contend with floods. The recovery plan recognizes this and makes delisting contingent on the re-established populations surviving at least one flood.

In reality, Mohave tui chub populations will likely be maintained in aquarium-like environments for the foreseeable future, complicated, yet enhanced, by their presence within the fabric of the historic footprint. Efforts to sustain and potentially recover the chub must consider the rich and varied history of human occupation that substantiates the National Register nomination and the calculated visitor attraction of Lake Tuendae. Here can be found a collection of structures comprising Zzyzx Mineral Springs and Health Resort, a beleaguered population of fish in Lake Tuendae, and the sole remaining source population of Mohave tui chub in the wild at MC Spring.

The National Park Service faces multiple challenges as steward of the endangered Mohave tui chub living on historic lands. There are presently no plans to reintroduce the chub into the Mojave River drainage or to increase artificial habitat at Zzyzx or elsewhere. The preserve is seeking funds for assessment of the Asian tapeworm impact and is working towards revisiting the recovery plan with USFWS and the California Department of Fish and Game. In the meantime, a die-off in any one of the existing impoundments would severely reduce both the remnant population and its potential for recovery.

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Creating a Sustainable Invasives Program in the East: Controlling Invasive Vegetation at Eight National Parks in Virginia, 2000–2002

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The National Park Service's (NPS's) Virginia invasive vegetation management team (the Virginia cooperative) was created in 2000 using grant funding to protect natural and cultural resources at eight parks threatened by invasive exotic plants. Participating parks are noted in Figure 1.

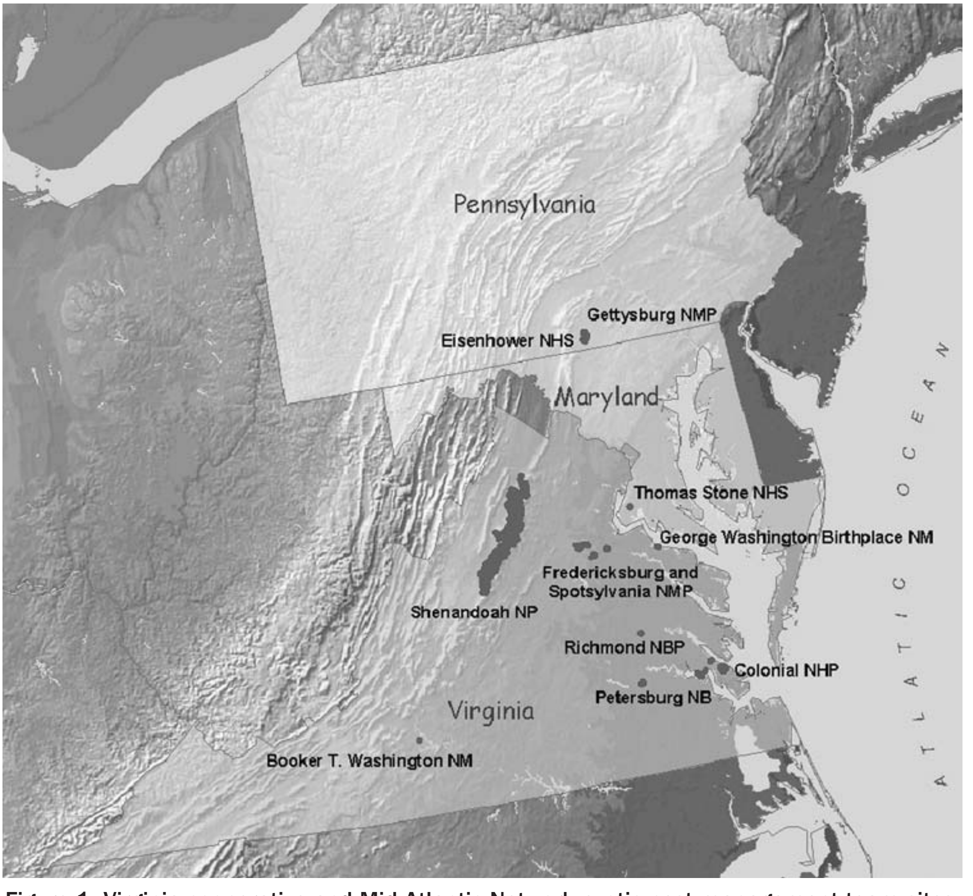

Figure 1. Virginia cooperative and Mid-Atlantic Network exotic pest management team sites. Note: Appomattox Court House National Historical Park, though not shown on the map, is part of the Virginia cooperative.

The Virginia cooperative assessed the extent of invasive vegetation at all eight parks, created management plans, fulfilled environmental compliance requirements, conducted invasive plant treatments, and accomplished follow-up monitoring of treatment effectiveness. It augmented park capacities to manage exotics by training local staffs and purchasing equipment and supplies for implementing independent and cooperative invasive plant management.

Finally, the Virginia cooperative developed a public outreach program of media articles, posters, brochures and attendance at professional meetings. With the establishment of NPS base funding in 2003, the effort has broadened in scope to the Mid-Atlantic Network exotic pest management team that now includes two additional parks in Pennsylvania and one in Maryland (see Figure 1). Programmatic and on-the-ground cooperation has created increased effectiveness and an atmosphere for success.

Accomplishments

- Field reconnaissance and initial assessments were completed at all eight parks.
- The Virginia cooperative treated 1,047 acres over three years, exclusive of park efforts; individual parks treated an additional 1,516 acres (Figures 2 and 3).
- Site restoration was initiated at three parks, totaling 12.1 acres. This included planting native grasses and shrubs and follow-up effectiveness monitoring.
- Management plans were completed for seven of the eight parks. The plans set a management framework, identified current and potential high-priority invasive plants, and prescribed control methods and long-term monitoring techniques. Environmental clearance was completed for all eight parks to begin active management.
- The Virginia cooperative worked with the National Capital exotic plant management team to increase the overall effectiveness of both teams. Larger projects were tackled at three parks in each region.
- Training was provided to team and park staff in species identification, integrated pest management, control techniques, safety issues, and monitoring techniques.
- Monitoring plots were established at seven parks to aid evaluation of treatment effectiveness.
- Public awareness of the threat of invasive exotic vegetation was increased through a series of newspaper and magazine articles, posters, speeches, and handout materials.
- Organizational capacity was expanded with the purchase of tools, supplies, and material for the Virginia cooperative and individual parks.
- The organization is well prepared to assist parks in Pennsylvania and Maryland, expanding its role to cover the NPS Mid-Atlantic Network for the NPS Natural Resources Challenge.

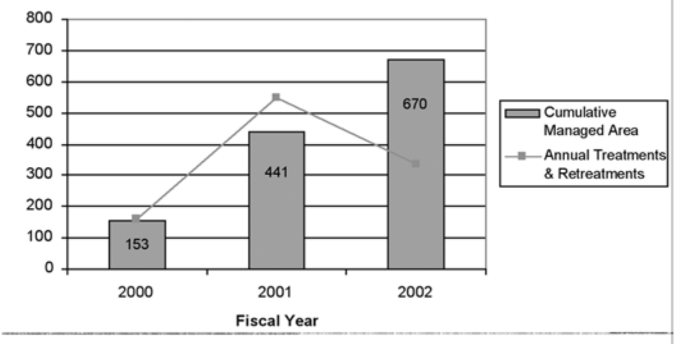

Figure 2. Cumulative management area and annual treatments accomplished by the Virginia invasive vegetation management team, FY2000–2002 (by fiscal year).

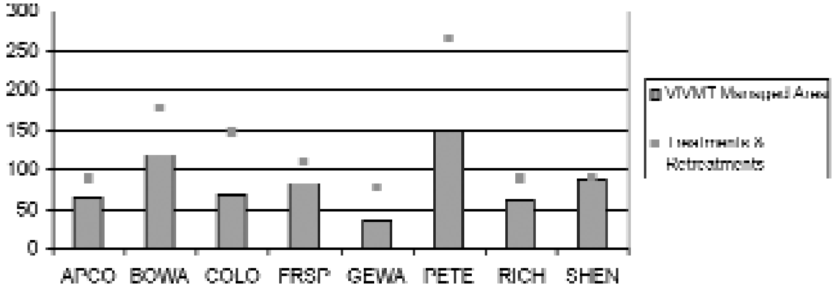

Figure 3. Managed area and treatments in the Virginia cooperative, FY2000–2002 (by park). APCO = Appomattox Court House National Historical Park; BOWA = Booker T. Washington National Monument; COLO = Colonial National Historical Park; FRSP = Fredericksburg and Spotsylvania County Battlefields Memorial National Military Park; GEWA = George Washington Birthplace National Monument; PETE = Petersburg National Battlefield; RICH = Richmond National Battlefield Park; SHEN = Shenandoah National Park.

Preventing Zebra Mussel Infestation of Lake Powell

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Zebra mussels *(Dreissena polymorpha)* and quagga mussels *(D. bugensis)* constitute one of the greatest threats to water resources in the western United States. These small invasive mussels with varying stripes have already spread throughout much of the eastern United States. The genus *Dreissena* is unique among freshwater mussels in that they can attach to surfaces using byssal threads. The use of byssal threads allows zebra mussels to build up mats that can reach over 30 cm thick. Zebra mussel mats can form within pipes, reducing or clogging their flow. These mussels will encrust docks, launch ramps, rocks, and any hard surfaces in the water. Industries in infested areas spend billions of dollars every year to remove zebra mussels from raw water-related structures (O'Neill 1996).

Zebra mussels have a great impact on recreation. Boats left in infested waters will develop a layer of zebra mussels on their hulls and engines. Microscopic life stages can enter, attach, and clog the cooling systems of engines. Beaches can become covered with piles of shells washed up by wave action. The shells have sharp edges that can cut bare feet. The shells also carry bits of zebra mussel flesh that fill the air with a stench as they decompose.

In addition to the costs to industry and recreation, zebra mussels cause ecological damage. Any strategy to kill zebra mussels in the environment will also destroy other forms of aquatic life. Zebra mussels will encrust crayfish, turtles, and native clams. They show a preference for attaching to other mussel shells, inhibiting their shells from opening or closing, and thus killing them. Zebra mussels filter an enormous amount of water, removing large quantities of algae, thus disrupting the food chain. Undigested food is packed into a ball of mucous and ejected as a pseudo-fecal pellet. These pellets can form thick layers beneath infestations, creating a large oxygen demand that can cause fish kills. There are no predators of consequence in the United States. Within their home range, zebra mussel populations are probably kept in check by parasites, such as trematodes. The parasites in the native range of zebra mussels do not promise much utility for control in the United States because they are rather non-specific. It has been suggested that since zebra mussels are so prolific, humans could use them as a food source, but zebra mussels are very efficient at accumulating toxins because of the large amount of water that they filter. Even other animals that eat zebra mussels can be unfit for human consumption due to the biomagnification of the toxins in zebra mussels.

The zebra mussel life cycle progresses from a tiny egg stage to a veliger and post-veliger stage, which are all planktonic. After the post-veliger stage, they enter a settling stage when the production of a shell makes them too dense to float. The forming mussels begin to sink and seek a substrate upon which to attach. The passage from the egg to settling stage requires two to three weeks. After settling, zebra mussels can detach, move around, and reattach as they grow up to 3 cm long and live four or five years. Some zebra mussels have been reported to live up to nine years in Europe (Marsden 1992). They become sexually mature after the first year and each female can reportedly produce up to a million eggs annually.

Native to the Caspian and Black seas of Eastern Europe, zebra mussels had spread throughout Europe by 1920 with the creation of canals and increased capacity of humans to spread the mussel. It was recognized at that point that their havoc could be spread to the United States in the ballast water of commercial ships. They were first discovered in America in 1988, amongst the Great Lakes in Lake Saint Clair. Since then, they have spread throughout the Great Lakes and into eight major river systems.

Zebra mussels are of great concern to resource managers at Glen Canyon National Recreation Area. Lake Powell is considered the most likely point of introduction of zebra mussels to the Colorado River system. Nearly three million people visit Lake Powell each year. People spread zebra mussels attached to the surfaces of boats, and in their microscopic forms even a drop of water may transport them in the bilge, engine, live well, or trailer of a boat. The conditions in Lake Powell are good for zebra mussel colonization. Table 1 presents the life requirements of zebra mussels and the how those parameters compare with ranges found in Lake Powell.

Glen Canyon Zebra Mussel Prevention Program

To stop the spread of zebra mussels to Lake Powell and the Colorado River system, the national recreation area operates a Zebra Mussel Infestation Prevention Program (ZMIPP). ZMIPP works in cooperation with the Utah aquatic nuisance species action team and the 100th Meridian Initiative. The Utah Division of Wildlife Resources started the Utah aquatic nuisance species action team. It has produced pamphlets and signs to aid in the education of boaters and promoted the inspection of boats at 23 Utah state parks. The National Invasive Species Act of 1996 founded the 100th Meridian Initiative, which is a forum for multi-agency cooperation with the goal of stopping the spread of invasive aquatic nuisance species across the 100th meridian from east to west. This goal is achieved by promoting information and education, voluntary boat inspections and boater surveys, monitoring, rapid response, and identification and risk assessment of pathways (Mangin 2001).

ZMIPP consists of monitoring Lake Powell for infestation, screening visitors to identify boats that may carry zebra mussels, and providing for potentially infested boats to

Table 1. Zebra mussel colonization potential based on limnological parameters (O'Neill 1996). Typical values for Lake Powell are in bold.

Variable	Colonization Potential			
	High	Moderate	Low	Very Low
Salinity (ppt)	**0–1**	1–4	4–10	10–35
Calcium (mg/l)	**25–>125**	20–25	9–20	<9
Hardness(mg CaCO3/l)	90–**>125**	45–90	25–46	<26
PH	**7.5–8.7**	7.2–7.5 8.7–9.0	6.5–7.2 9	<6.5 >9
Water Temperature (C)	**18–25**	**16–18** **25–28**	**9–15** **28–30**	<8 >30
Turbidity (cm Secchi)	**40–200**	**20–40**	**10–20** **200–250**	**<10** **>250**
Dissolved Oxygen (ppm)	**8–10**	**6–8**	4–6	<4
Water Velocity (m/sec)	**0.1–1.0**	**0.09–0.1** 1.0–1.25	**0.075–0.09** 1.25–1.5	**<0.075** >1.5
Conductivity (uS)	83–**>109**	37–81	22–35	<21

be washed. The monitoring portion of ZMIPP uses artificial substrate samplers to detect the settling-stage zebra mussels. Buoys and docks are also informally checked for the presence of adult zebra mussels. No zebra mussels have been found in Lake Powell.

Visitor screening is conducted at entrance stations. Lake Powell has relatively few access points. Many of the access points have staffed entrance stations where visitors are contacted directly. At each of these entrance stations, including Wahweap, Antelope Point, Bullfrog, and Hall's Crossing, visitors entering the national recreation area with boats are asked questions that assess the risk their boats pose to Lake Powell. The questions are kept to a minimum to avoid lines. Each visitor with a boat is asked, "Has your vessel been used east of the Rocky Mountains in the past 30 days?" If the visitor answers "No," the questioning is over. If the visitor answers "Yes," they are asked, "In which states or provinces east of the Rocky Mountains was your vessel used?" If the answer includes states or Canadian provinces where zebra mussels are known to have infested, the visitor is given a "prevention packet."

The prevention packet includes a pamphlet, a coupon for a free boat washing, and a map with directions to the washing facilities. The pamphlet, produced by the Utah aquatic nuisance species action team, gives information on zebra mussels and other aquatic nuisance species. The maps give some information specific to Lake Powell and directions from the entrance station that the visitors have entered to the washing facilities. The concessionaire conducts boat washings at no cost to the National Park Service (NPS) or the visitors.

Resource management staff at Glen Canyon National Recreation Area work with the concessionaire to ensure that washings are conducted in a manner to minimize the potential of zebra mussels being spread to Lake Powell. Boat washers must assume that the boat is infested. Infestations can be hard to detect, and boats sent for washing have been identified as a high risk. Because the microscopic veligers can exist in very small amounts of water, all standing water must be drained from areas such as the bilge, live wells, bait buckets, and engine cooling systems. The drained areas are then flushed with water at over 60°C to kill zebra mussels. Any organic matter visible on the boat or trailer must be removed, and the entire boat is washed with a high-pressure, hot-water spray. Special attention must be paid to all areas that will contact the water, including the hull, lines, fenders, motor, trim tabs, anchor, trailer, and especially any confined or tight spaces that can create moist microhabitats. Adult zebra mussel survival when exposed to air is limited by desiccation. Care should be taken not to spread zebra mussels with removed organic matter, water drained from the boat, and any rinse water not hot enough to kill the mussels.

The threat to western states from zebra mussel infestation is very real. Agricultural check stations in California, Oregon, and Washington inspect boats for zebra mussels; at least four boats have been found carrying zebra mussels. In the spring of 2002, the national recreation area's aquatic ecologist was at the Bullfrog Marina on Lake Powell to educate concessionaire employees about zebra mussels and the proper procedures to follow when washing boats. The concessionaire employees stated that a boat from Wisconsin had been launched several weeks earlier. Upon inspection, zebra mussels were found on the trim tabs. It took several tense hours to contact the owner of the boat for permission to pull the boat out of the lake.

The owner said that the boat had been out of the water for nine months prior to being launched and had experienced freezing temperatures during that time; the zebra mussels were assuredly dead. The owner had moved from Wisconsin to Grand Junction, Colorado. He wanted to moor his boat on Lake Powell. He knew that his boat had become infested with zebra mussels. Specifically to remove the zebra mussels, he had the boat sandblasted and painted before bringing it to Lake Powell. Despite the owner's warning about zebra mussels, the trim tabs were not cleaned. The most frightening part of the story is that this visitor had tried to do everything right, but still Lake

Powell was not safe. The only reason the boat had been out of the water for so long is because weather conditions had not been good for painting.

During the 2001 season, 13 potentially infested vessels entered the national recreation area. Nine of the 13 went to the concessionaire for the free washing. In 2002, 31 boats were identified as "high risk" and 22 were washed. Washings in 2001 and 2002 were entirely voluntary. The dramatic increase in the number of boats identified as a risk probably does not indicate a rise in risk level, but instead, better participation from the fee collectors. During 2001, fee collectors were not consistently asking the questions described earlier. By 2002, many of them had been better educated and understood the risk involved. Consensus-building among park staff and concessionaires is a very important step in preventing zebra mussels and other aquatic nuisance species. Another benefit of a greater consensus in the park is that for the 2003 season, regulations have been put in place that make washings mandatory for any boat identified as a risk by the program.

Zebra mussel infestation is one of the most significant and potentially devastating threats to western water resources. ZMIPP is a proactive and unique effort to stop zebra mussels from infesting Lake Powell and the Colorado River System. Zebra mussel awareness in western states is slowly increasing. Other NPS units that are taking action to prevent zebra mussels, primarily through education efforts, include Lake Mead National Recreation Area and Curecanti National Recreation Area. In the spirit of the NPS mission, Glen Canyon National Recreation Area is protecting resources and providing for recreation by taking action to stop the spread of zebra mussels and promoting education that could save all waters of the West.

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Reintroduction of Bonneville Cutthroat Trout in Great Basin National Park

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Background

Bonneville cutthroat trout (*Oncorhyncus clarki utah*; BCT) are the only trout native to the east-central Great Basin and to Great Basin National Park. These trout lived in the extensive Lake Bonneville during the Pleistocene, but as water levels dropped, they moved into mountain streams to survive. During European settlement, intensive stocking of non-native salmonids, coupled with habitat degradation due to livestock overgrazing and water diversions, created harsh conditions for the native trout. Approximately 94% of the western populations were extirpated.

In 1999, a Bonneville Cutthroat Trout Reintroduction Management Plan was written to restore this native fish back into 18 of the 25 miles of historic habitat in Great Basin National Park streams, leaving the other miles as non-native recreational fishing areas.

Reintroduction Steps

1. Survey streams. Each potential stream is surveyed for macroinvertebrates, mollusks, amphibians, fish, physical habitat, and water quality to determine if any sensitive species or habitats are present that might need special attention.

2. Treatment. If the stream is deemed to be good habitat for BCT, the non-native fish are removed either using electrofishing or a piscicide (antimycin or rotenone).

3. Monitor. The effects of the treatment are monitored, in particular the recovery of macroinvertebrates.

4. Reintroduce BCT. Once macroinvertebrate populations have recovered to 75% of pre-treatment numbers and diversity, BCT are reintroduced.

5. Monitor. The new BCT populations are monitored to determine if subsequent reintroductions are needed and when the populations are sustainable.

Survey Streams

Before treatments could be completed, stream surveys were essential to document what species were present. Of particular interest was the Great Basin springsnail; the park had entered into a memorandum of understanding with several agencies to prevent Endangered Species Act listing of this species. Also, the presence of amphibians would necessitate careful scheduling of treatment to minimize any disturbance.

Highlights of the surveys include:

- A high diversity of macroinvertebrates from stream to stream and seasonally within streams.
- No amphibians found in the park.
- No sensitive mollusk species in the streams, including Great Basin springsnails. To date, four populations of Great Basin springsnails have been found in springs near the park boundary.
- Spawning period of BCT documented for the first time in the South Snake Range in 2002, with spawning occurring about 26 June–3 July when the average daily stream temperature reached nearly 12°C, with maximums near 14°C and minimums near 8°C. Spawning information was used in an attempt to boost BCT populations using streamside incubators. However, due to low streamflow, high sedimentation, and fungus growth, the streamside incubators were unsuccessful in 2002.

Treatment

Staff treated Strawberry Creek in 2002 with rotenone and Snake Creek in 2002 with antimycin. The park plans to treat the South Fork of Baker Creek in 2002–2004 by electrofishing.

Reintroduction

BCT have now been reintroduced into two streams: in 2000, the South Fork of Big Wash (three miles of habitat), and in 2002, Strawberry Creek (five miles of habitat in park, plus two miles outside park). BCT are expected to be reintroduced into four miles of Snake Creek in 2003. Anglers may fish for BCT, but are strongly encouraged to use catch-and-release techniques until the BCT populations become sustainable.

Monitoring

BCT monitoring first started in 2002 on the South Fork of Big Wash, where 56 BCT had been reintroduced in July 2000. This location was chosen because it had been fishless for at least 50 years, and aquatic surveys indicated plentiful nutrients and macroinvertebrates to support BCT.

A population survey found 31 BCT in an 85-m two-pass depletion survey. Two groups of fish were found: those longer than 160 mm, and those between 60–110 mm. The lack of fish in the 110–160 mm range is not fully understood, but could indicate that the smallest reintroduced fish did not survive, or that they grew very quickly and are part of the larger size classes. Young-of-the-year (YOY) had not yet emerged from spawning gravels, so were not identified. A flood in late September with excessive sedimentation may have eliminated the year's YOY. A spring population survey will be conducted to determine how the YOY fared.

Future Work

Future work includes continued monitoring of BCT populations to determine if supplemental reintroductions are needed and comparison of macroinvertebrate recovery rates after rotenone and antimycin treatments.

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Estimating Project-Specific Restoration Costs

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Introduction

Golden Gate National Recreation Area has planned and implemented restoration projects for the past 25 years, accumulating a greater understanding about restoration tasks and costs over this time. One lesson learned is that restoration costs are typically underestimated because they fail to address necessary maintenance costs. Often, hidden costs such as plant propagation or transportation are not fully realized until project implementation.

Accurate cost estimation is important for several reasons, including determining necessary replacement costs when mitigation is required, making accurate funding requests for projects, and drawing cost comparisons between the National Park Service (NPS) and commercial vendors. This final reason is becoming more pressing due to the current NPS trend toward outsourcing and contract support, which are often seen as cost-saving measures.

Background

Golden Gate National Recreation Area has the good fortune of a large and active volunteer base to support restoration activities. Volunteer programs in habitat restoration began in 1983 and have grown to levels of 200,000 volunteer-hours per year in natural resources management alone. As volunteers have become integral to the park's restoration efforts, it has become increasingly important to quantify the total effort required for restoration projects—and to estimate the cost savings volunteers provide.

The park's restoration database was designed in 1996. It had five main goals: to better track the status of over 80 restoration sites, to document the different types of work conducted at each site, to document the habitat restoration and monitoring work conducted by volunteers, to demonstrate tangible evidence of the importance of volunteer support within the natural resources program, and to enable communication among staff and volunteers by documenting restoration and propagation techniques and methods.

The initial section of the restoration database, called "work performed," took three months to develop and two years in practice before becoming fully functional and widely used by field staff. It was originally developed in Microsoft Access Version 2 and was converted to Microsoft Access 97 in 2000. Sections on best management practices, monitoring, and nursery activities have since been added. This paper will focus on the database's work performed section.

The work performed section captures three types of data: hours spent working; activity type (e.g., mapping, planting, removing exotic plants, seeding, installing irrigation, installing erosion control, or monitoring); and work group type (e.g., school groups, volunteers, Americorps members, contractors, or staff). All restoration field activities are documented by project site and date on standardized parkwide field forms. Due to the initial inconsistencies in documenting, the first few years of data are not as reliable as those from the last several years. Now that staff and volunteers understand the importance of the database and are better practiced at data entry, approximately 95% of the field work is documented through the database.

Cost Estimating Using the Restoration Database

NPS has used the database to get a better grasp on the amount of field work required for successful restoration. Data were analyzed and compared for three restoration projects in the Presidio: the Feral Dunes restoration, the Crissy Marsh restoration, and the Inspiration Point viewshed enhancement project. Field implementation costs were estimated using average unit costs for staff time based on current (fiscal year 2003) salary scales and an approximated constant to determine the value of volunteer time ($\frac{1}{2}x = y$, where x is the amount of work a typical staff completes, y is the amount of work a typical volunteer completes, and $\frac{1}{2}$ is the approximated constant). This cost tracking has realized several database goals, including:

- Ascertaining the differences in cost between habitat types. From restoration database analysis, we were able to document an approximate 2:7 cost ratio between restoration in dune scrub habitat (the Feral Dunes and Crissy Field projects) and restoration in serpentine grassland habitat (the Inspiration Point project). This is attributable to the differences in soil substrates: dune sand soils are generally uncompacted and easy to work in, while serpentine soils are more consolidated, making the work more difficult. (Serpentine soils often include bedrock conditions, further complicating the planting.)
- Documenting follow-up maintenance needs after restoration. The data reflect both how intensive maintenance is required in the initial years after restoration, and the decreasing yet essential need for maintenance over time. Analysis of the Feral Dunes project suggests that maintenance costs peak in the first two to three years after initial restoration, but persist over time in decreasing amounts. The analyzed projects were all implemented within the last seven years, and continue to show maintenance needs to differing extents. One project in the park at Milagra Ridge was only considered stable after about 15 years.
- Making comparisons between previously conducted restoration projects and proposed projects. With the recent revision of NPS funding call requirements, the database serves a vital new role: to conduct cost comparisons between proposed projects and completed projects of similar scope and scale. For the fiscal year 2004–2006 servicewide funding call, the database's cost tracking analyses were used to estimate the cost of a proposed project in a similar habitat type. By adding current fee schedules from outside contractors to the equation, in-house restoration costs can be compared fairly with outsourcing costs. Conducting this type of cost-effectiveness analysis will become increasingly important as the NPS begins outsourcing the work that is currently conducted in-house.
- Estimating the value of volunteers to the park. The estimated value of the work conducted by volunteers in is now being officially quantified and recorded. The savings in field work from volunteers is substantial, ranging from 20% to 70% in the three analyzed projects.

Restoration Tasks Not in the Database

The restoration database only documents and estimates costs for work performed in the field. Identifying all other project tasks and costs is an important next step. These additional activities might include planning, site analysis, compliance, contracts, public outreach, project management, seed collection and propagation, data entry, reporting, supplies, and equipment. A *restoration costs worksheet* is being developed to capture all the potential elements of a restoration project, from inception through implementation and maintenance (Table 1).

The comprehensive restoration worksheet comprises over 70 tasks, and is designed to address hidden costs up front. It is divided into eight main sections: general planning, site-specific planning, project compliance, pre-implementation, project outreach and education strategy, implementation, maintenance, and monitoring and analysis. Subtasks

Table 1. Comprehensive restoration worksheet

I. GENERAL PLANNING
1) PROJECT MANAGEMENT
2) DATA COLLECTION AND DETAILED SITE ANALYSIS
3) PROJECT MANAGER (GS-9)
4) AERIAL PHOTOS
5) BASELINE SOIL TESTING
6) HYDROLOGIC ANALYSIS
7) GROUNDWATER MONITORING
8) WELL INSTALLATION
9) SUBSTRATE ANALYSIS
10) SLOPE AND ASPECT ANALYSIS
11) BASELINE PHOTO MONITORING
12) SPECIAL STATUS SPECIES INVENTORY
13) BASELINE BIOLOGIC INVENTORY AND MONITORING
14) EXISTING CONDITIONS VEGETATION MAPPING
15) REFERENCE SITE VISIT/MONITORING
16) ARCHEOLOGY
17) CULTURAL RESOURCE INVENTORY
18) LAND ACQUISITION AND/OR PERMITTING
19) BACKGROUND LITERATURE REVIEW AND OTHER INFORMATION GATHERING

II. SITE SPECIFIC PLANNING
20) GOALS AND OBJECTIVES
21) SUCCESS CRITERIA
22) PROJECT IMPLEMENTATION DESIGN (specification development, educational strategy)
23) MONITORING PROGRAM DESIGN
24) PEER REVIEW OF PLAN
25) EXPERIMENTAL DESIGN
26) VERIFY AVAILABILITY OF EQUIPMENT AND VEHICLES
27) CONTINGENCY PLANNING PERCENTAGE
28) PEER REVIEW OF EXPERIMENT DESIGN

III. PROJECT COMPLIANCE
29) NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)
30) CORP OF ENGINEERS 404
31) NATIONAL HISTORIC PRESERVATION ACT (NHPA)
32) MIGRATORY BIRD TREATY ACT
33) ENDANGERED SPECIES ACT (USFWS/NMFS)
34) RESEARCH AND COLLECTION PERMIT
35) ENVIRONMENTAL PROTECTION AGENCY (EPA)
36) CLEAN AIR ACT (REGIONAL BOARD)
37) CLEAN WATER ACT (REGIONAL BOARD)
38) PUBLIC REVIEW AND LOCAL NEIGHBORHOOD INPUT

IV. PRE-IMPLEMENTATION
39) CONTRACT PREPARATION
40) ADMINISTRATION & PROCUREMENT
41) PLANT PROPAGATION
42) PLANT AND SEED PALETTE
43) PROPAGULE COLLECTION
44) PLANT SALVAGING
45) NURSERY PROPAGATION
46) SCHEDULING - COORDINATING COMPONENTS & SEQUENCING
47) TIMING FOR BIRD NESTING, WINTER RAINS, ETC

V. PROJECT OUTREACH AND EDUCATIONAL STRATEGY
48) DEVELOP PUBLIC AWARENESS SIGNS AND BROCHURES
49) PUBLIC AWARENESS ROVING
50) ENVIRONMENTAL TRAINING FOR CONSTRUCTION WORKERS
51) BIOLOGICAL MONITORING & PUBLIC EDUCATION DURING HEAVY EQUIPMENT CONSTRUCTION

VI. IMPLEMENTATION
52) PROJECT MANAGER
53) CONTRACT ADMINISTRATION & PROCUREMENT
54) VEGETATION REMOVAL
    i) SALVAGE AND STORAGE OF LOGS
    ii) CHIPPING, HAULING AND DISPOSAL
    iii) LANDSCAPE FABRIC INSTALLATION
    iv) OTHER PLANT REMOVAL TREATMENT AND DISPOSAL
55) FINAL GRADING
56) SOIL PREPARATION
    i) SOIL TURNING
    ii) SCRAPING
    iii) SOIL IMPORTATION
    iv) SOIL AMENDING
    v) SALVAGE AND STORAGE OF TOPSOIL
    vi) WEED CONTROL IN STOCKPILED SOIL
    vii) REPLACE TOPSOIL
    viii) RIPPING/DISKING
    ix) AUGURING
    x) DRAINAGE AND EROSION CONTROL

57) EROSION CONTROL
    i) SILT FENCE INSTALLATION
    ii) STRAW WADDLES INSTALLATION
    iii) STRAW BALES INSTALLATION
    iv) STRAW MULCH
    v) STREAMBANK PROTECTION

58) REVEGETATION
    i) SET UP PLANTING DESIGN IN THE FIELD

Table 1 *(Continued)*

ii) TRANSPORTATION OF PLANTS
iii) SEEDING
iv) OUTPLANTING
v) HERBIVORE PROTECTION
vi) TEMPORARY IRRIGATION
vii) WATER CONNECTION & BACKFLOW INSTALLATION
viii) ABOVE-GROUND DRIP SYSTEM
ix) ABOVE-GROUND SPRINKLER SYSTEM

59) RESOURCE PROTECTION
i) INSTALL TEMPORARY FENCING AND FLAGGING OF SENSITIVE RESOURCES
ii) INSTALL TEMPORARY PUBLIC AWARENESS SIGNAGE DURING CONSTRUCTION
iii) PERMANENT PERIMETER FENCING
iv) PERMANENT SIGNAGE

60) INVASIVE PLANT COMTROL
i) HAND REMOVAL
ii) MECHANICAL REMOVAL
iii) DEBRIS BOX DISPOSAL
iv) HAULING AND DISPOSAL
v) WEED SUPPRESSION
vi) HERBICIDE APPLICATION

61) EXPERIMENT SET UP

VII. MAINTENANCE
62) PROJECT MANAGEMENT
63) FIELD TECHNICIAN
64) CONTRACT ADMINISTRATION & PROCUREMENT
65) INFRASTRUCTURE MAINTENANCE
66) EROSION CONTROL
67) IRRIGATION AND IRRIGATION
68) FENCE
69) SIGNS
70) PLANT MAINTENANCE
i) INVASIVE PLANT CONTROL
ii) REPAIR HERBIVORE PROTECTION
iii) SUPPLEMENTAL PLANTING
iv) SPOT HERBICIDE APPLICATION
v) INFRASTRUCTURE REMOVAL
vi) EROSION CONTROL, IRRIGATION AND PLOTS

VIII. MONITORING & ANALYSIS
71) PROJECT MANAGEMENT
72) CONTRACT ADMINISTRATION & PROCUREMENT
73) MONITORING
i) PHOTO-MONITORING
ii) RESTORATION SUCCESS CRITERIA
iii) WILDLIFE POPULATIONS
iv) SOIL SITE CONDITIONS
v) SENSITIVE SPECIES
vi) HYDROLOGY
vii) DATA ENTRY

74) DATA ANALYSIS AND FINAL REPORT

can easily be left in broader categories or described in more detail. The worksheet will be continually refined in order to capture all the elements of restoration. Additional research is necessary to develop accurate unit costs for many of the elements presented in Table 1.

Although it demonstrates an attempt to estimate costs objectively, the restoration costs worksheet still requires the subjective input of an experienced individual who can assess staff competency and approximate hours worked. The following factors can significantly influence restoration costs, and are best addressed by experienced staff:

- The location of a project, which affects costs depending on travel involved, equipment access difficulties, or limited access to infrastructure such as roads or water.
- The size of a project, which is subject to economies of scale. The average cost per acre is lower for larger areas.
- The complexity of a restoration, which affects costs depending on whether the project is one of habitat creation or enhancement.
- Site quality and adjacent conditions, which affect costs associated with invasive exotic plant control, trespassing, grazing, etc.
- Compliance issues, which can affect costs depending on the sensitivity of the natural and cultural resources involved.
- Prior experience and knowledge in the type of plant community being restored,

which influences the efficiency of the project.

- Multiple-use factors such as bisecting trails, which can increase project costs.

Conclusion

Using the database to track restoration projects in Golden Gate National Recreation Area has yielded valuable insights into understanding project cost variations and accurate cost estimating, including habitat type factors, post-restoration needs, and maintenance. It has also been a useful tool in making cost comparisons for proposed projects. Using the database to analyze and compare cost effectiveness will become even more important as NPS faces new decisions about outsourcing restoration work. Volunteer work may gain more prominence as a cost-saving measure in these future analyses, and the database will prove invaluable in these comparisons, as it has helped quantify the monetary value of volunteer work conducted in the park.

Although it supplies vital information in terms of simple cost comparisons, the scope of the restoration database remains limited. It only covers some pieces of the restoration puzzle, and requires intense effort to develop and maintain. A more complete picture of restoration costs is still needed. Developing detailed, park-specific restoration cost worksheets may be a more realistic solution for parks across the country.

Restoration of Oak Island Sandscape, Apostle Islands National Lakeshore

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Introduction

Apostle Islands National Lakeshore, located in far northwestern Wisconsin, includes 21 islands and a mainland strip set in a matrix of Lake Superior. The islands range in size from 3 to 10,000 acres. The lakeshore is 42,000 acres in land area. Oak Island is 5,000 acres in size and has the highest elevation of the Apostle Islands.

Apostle Island sandscapes include a wide diversity of coastal features and are among the highest quality in the Great Lakes. Sandscapes within the lakeshore include sandspits, cuspate forelands, tombolos, a barrier spit, and numerous beaches. Four of the lakeshore's sandscapes comprise Wisconsin's Sandscape State Natural Area. These areas include the Outer Island sandspit, Stockton Island tombolo, and Rocky and Raspberry islands' cuspate forelands. The sandscapes within the national lakeshore are very popular visitor-use areas for both day and overnight use and are among the few places available for boats to access the islands. Sandscape vegetation is, however, very sensitive to trampling.

Sandscape monitoring, part of the park's long-term monitoring program, began in 1988. All seventeen of the park's significant sandscapes are regularly monitored. Monitoring of each sandscape is done every three to five years, depending on visitor-use levels at each site. Monitoring includes vegetation monitoring using the point step method and mapping of the sandscape and trails using a GPS (global positioning system). Vegetation monitoring enables the park to determine trends in basal cover and species composition of individual species, as well as percent bare ground, percent vegetative litter, percent total vegetation, and percentage of exotic species. Mapping of the sandscape and trails enables the park to determine trends in informal trail length and width, a measure of direct visitor impact, and long-term trends in sandscape geomorphology.

The Oak Island sandscape is a cuspate foreland 1.6 acres in size. It has had a long history of human use, dating back to the 1850s. It was the location of the earliest settlement in the Apostle Islands and one of the earliest episodes of logging. Oak Island's sandscape is currently a very popular visitor-use area for both camping and day-use and is on a popular kayak route. There is both an individual and group campsite adjacent to the sandscape.

Monitoring results over a ten-year period (1988–1998) indicated that Oak Island's sandscape was the most threatened of the park's sandscapes and in need of restoration. Over the ten-year period, there was a steady decrease in vegetative cover, an increase in vegetative litter, and an increase in exotic species abundance. The abundance of exotic species, already very high compared with other park sandscapes, increased from 15% to over 30%. Exotic species composition on most of the sandscapes is less than 5%, and some of the sandscapes have less than 1%. The Oak Island sandscape also offered an excellent opportunity as a pilot location to test methods and restoration techniques due to its level of historic and current disturbances and small size.

Objectives of the restoration effort included: (1) determining the best techniques for restoring native species, including determining the feasibility of gathering, propagating, and establishing site-specific plant materials; (2) restoring vegetative species composition, diversity, and cover; (3) reducing the total percentage and cover of exotic species; and (4) developing protocols to guide future restoration efforts.

Methods

In 2000, funding was obtained from both the National Park Service's (NPS's) disturbed-lands restoration program and the U.S. Fish and Wildlife Service's (USFWS) Great Lakes Coastal Program. An interagency agreement was developed with the Natural Resource Conservation Service's (NRCS's) Rose Lake Plant Materials Center in Rose Lake, Michigan, to utilize NRCS's technical expertise in restoration. NRCS gathered native plant materials and began to propagate fifteen species.

During 2001, additional floating boardwalk was installed. Floating boardwalks are made of wooden boards drilled through their ends and connected with a stringer of cable. The boardwalk lies directly on the sand, following natural contours, and can be laid straight or curved. These boardwalks have been very effective in directing visitor traffic on sandscapes. Restoration signs were also installed to minimize visitor traffic on the sandscape and to inform visitors of the restoration effort.

Eighteen plots were established to determine how well propagated plants could be established and the effect of various lighting conditions. A set number of plants of nine different species were planted. Seven of the plots were in sun, seven in partial sun, and four in shady conditions. The plots were monitored during the fall of 2001 and in spring, summer, and fall of 2002. Data collected for each plot included survival, colonization, and vigor.

During 2002, on-site restoration occurred, with the primary effort coming in late May. More than 3,200 propagated plants of fifteen species were planted. The restoration was very much a cooperative effort between park staff, NRCS (which provided plants and technical guidance), and a Northland College field ecology class. As many as eighteen people at any one time assisted with the planting, enabling a large number of plants to be planted quickly. Although restoration occurred throughout the sandscape, most of the planting focused on bare areas. Distance between plants in these areas ranged from one to two feet. In ten of the heavily planted areas, 20 randomly placed 1x1-m monitoring plots were established. Data collected for each plot included the number of plants, aerial cover by species, and percent of bare ground and vegetative litter.

In addition to planting native species, the most abundant exotic species on the sandscape, orange hawkweed *(Hieracium aurantiacum),* was treated using both manual and chemical control. Plots (20x20 ft) were established to determine the effectiveness of both techniques. The sandscape and all monitoring were also mapped utilizing a global positioning system (GPS).

Some of the challenges included harsh planting conditions and inaccessibility. The impacted areas were nearly pure sand, having lost the thin layer of vegetative litter that provides some protection to plants in non-impacted areas of the sandscape. Although the plants were well watered during planting, it was not feasible to water after planting. Logistics are always a challenge in the Apostle Islands. Weather conditions on Lake Superior are the determining factor as to whether or not work can be accomplished. Oak Island is 5.5 miles from the mainland. The number of plants and people involved required numerous trips, and the sandscape is only accessible during fairly calm conditions and favorable wind directions.

Results

The plots established in 2001 were used to determine how well propagated plants had become established on the sandscape and the effect of various lighting conditions on survival. Under ideal conditions, planting would have been done in late May or early June to take advantage of cooler, moister conditions. Because of schedule conflicts, the 2001 plots were not established until early July. Even under these harsher conditions, plant survival rate during the first season was 85% under shady conditions and 50% under conditions of partial or full sun. During 2002, the survival rate remained similar in plots exposed to partial or fall sun. However, plants under shady conditions dramatically increased, especially common horsetail *(Equisetum arvense).* Of the nine species planted, six increased during the second (2002) season; these were *Equisetum arvense, Vaccinium angustifolium, Rosa blanda, Carex pensylvanica, Anaphalis margaritacea,* and *Elymus canadensis*. Both *Equisetum arvense* and *Vaccinium angustifolium* began spreading. Two species, *Juniperus communis* and *Fragaria virginiana*, decreased. The only species that did not become established was *Aristida dichotoma*.

Some species that were somewhat difficult to grow in the greenhouse, such as *Vaccinium angustifolium* and *Rosa blanda*, did well onsite. Other species, such as *Fragaria virginiana* and *Anaphalis margaritacea*, were easy to growth in the greenhouse, but had a lower success rate after transplanting.

The 2002 plots were established to determine the effectiveness of the restoration effort. Current results are preliminary, since they can only provide information on how well plants had become established by the end of the first growing season. To enable the park to determine how well this restoration effort worked over the longer term, future monitoring will be critical.

The 2002 plot data were analyzed by grouping results using the following components: planted natives (greenhouse-propagated material), non-planted natives, and non-native. By the end of the first growing season, results were encouraging and indicated that native species, especially planted natives, were filling in at a higher rate than non-natives. When analyzing changes in plant count, non-native species increased 43%, as compared with an increase of 108% for non-planted natives, and 241% for planted natives. Changes in percent aerial cover showed a decrease in non-natives, as well as bare ground, compared with increases in both planted and non-planted native species.

The response of each plant component under various light conditions was also analyzed. Results based on both plant count and percent aerial cover indicate that the planted native species had the best competitive advantage under partially sunny conditions, non-planted natives under sunny conditions, and non-natives under sunny conditions. Overall, planted native species did better than non-native species under all lighting conditions. This information will be useful in planning restoration projects on sites with a similar species composition by helping to determine which areas may have a greater problem with non-native species. The species which most influenced these results were non-native *Poa compressa* and *Agropyron repens*, non-planted native *Ammophila breviligulata* and *Carex pensylvanica*, and planted native *Ammophila breviligulata* and *Anaphalis margaritacea*.

Discussion

Preliminary results from both sets of monitoring plots were encouraging and indicate that plants propagated from local plant material could be established successfully and were effective in increasing the native plant population. Results also showed a greater increase in both number of plants and aerial coverage of native species as compared with non-native species. On plots established to determine the effectiveness of hand-pulling hawkweed compared with chemical treatment, preliminary results indicate that hand-pulling is more effective. In an area as small as the Oak Island sandscape (1.6 acres), hand-pulling may be feasible; however, that may not be the case in larger areas due to the amount of labor involved. As discussed above, future monitoring will be important to determine the overall success of restoration.

Lessons learned were: (1) late May or early June are better planting times, because of cooler, moister conditions; (2) watering plants at the time of planting is important; (3) plants in peat pots tended to pop up when planted in sand; and (4) deer seemed to be attracted to perlite, pulling out the plants, but not eating them. This project was an excellent example of one that greatly benefited from having a large number of people working together over a short period of time, enabling plants to be put in the ground quickly.

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Tools of the Trade: How Protected Area Managers Can Protect Our Night Sky

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Introduction

Night is a vital part of our environment, worthy of preservation just as any other natural or cultural resource. It involves both the night around us and the view we have of the stars and the universe in which we live.

Today, two-thirds of the USA's population live where they no longer have naked-eye visibility of the Milky Way (Cinzano 2001). The current generations are the first in history to grow up without the awe-inspiring view of a canopy of stars above their heads. Over the millennia, this view inspired art, music, poetry, folklore, science, technology, and so much of our culture. The grandeur of the stars challenges us to explore and invites us to ponder our place in the universe. It is an essential part of our very nature as well as our culture. As important in our history as it is integral to our future, it is our heritage.

Sky glow from low-quality outdoor lighting robs us of that heritage. Fortunately, there are straightforward, workable solutions. Improved practices will allow a functional, comfortable, and beautiful night-time environment, one friendly to humans, wildlife, plants, and the night sky. To preserve and protect our night-time environment, we must educate people about the value of high-quality outdoor lighting.

Building Relationships with Nearby Communities

As leaders on environmental issues, protected area managers must help raise awareness and protect endangered resources. Similar to watersheds or air quality, our night sky is affected by practices both inside and outside of protected areas. To address external threats to these resources, managers must work collaboratively with nearby communities.

The benefits of better lighting practices offer communities practical reasons to support improved lighting. Resultant economic savings and improved property values, for example, augment the motivation for and support the goal of resource protection. Communities care about this issue and addressing it means identifying community values, priorities, and shared interests, thus laying essential groundwork for building relationships.

Educating a community and developing a consensus on outdoor lighting builds many educated allies. Ordinances promote good lighting and good business, limit obtrusive or trespass lighting and sky glow, address community issues, and help everyone see better. Hundreds of communities and ten states (Arizona, California, Colorado, Connecticut, Maryland, Maine, New Mexico, Texas, Virginia, and Wyoming) have adopted lighting regulations, and many more are considering them. (Three countries, Australia, Chile, and the Czech Republic, have national-level lighting regulations.)

- Better-quality lighting provides a *better night-time ambiance* that improves property values and quality of life and encourages night-time activity, business, and a sense of community.

- Correcting low-quality lighting leads to *energy and economic savings* for businesses and the community.
- The *improved visibility* of better lighting design promotes safety, security, and the utility of night-time activities.

Correcting low-quality lighting is clearly a win–win proposition and a non-partisan issue. When protected area managers work with communities on these issues it helps build the relationships so critical to long-lasting resource protection.

Good Lighting has Great Value

Before lighting, one must ask: Why is the light needed? Is it needed? What is the task? Driving a vehicle, walking up to a building, playing basketball, pumping gas, recognizing faces, and enjoying an evening stroll are very different tasks with different lighting needs. Once one understands the task, use the right amount of light, in the right place, at the right time, with *energy-efficient sources.*

Use levels of lighting that are rational for the task, not too much or too little. The Illuminating Engineering Society of North America publishes recommended practices for lighting design, including appropriate lighting levels for specific tasks. Problems arise when installations use 5, 10, and even 100 times the recommended levels. That not only creates waste, but poor visibility and insecure situations.

Appropriate lighting levels take into account lighting levels in the surrounding environment. While our eyes can see over a wide range of lighting levels, they need time to adapt to changing levels. The adaptation time is longer when going from bright to dark (than vice versa) and increases as the eye ages (International Dark-Sky Association {IDA} information sheet nos. 136 and 156). Good lighting design provides reasonable transitions between the brightest and darkest areas, allowing our eyes to adapt so we see better in all areas. The solution is not to raise lighting levels in all darker areas but to use rational levels in brighter areas. Rational lighting levels improve visibility. Too much light wastes energy and can hinder visibility.

Direct the light only where it is needed. Light directed upward may light birds and clouds, but is that a useful purpose? It creates much of our urban sky glow, the bane of astronomers and anyone wishing to enjoy the beauty of the night sky. Shield lights to prevent direct uplight (wasted energy) and minimize glare. We should see the effect of the light, not the source.

Unshielded luminaires create glare and highlight the source rather than the area to be illuminated. Glare is the sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted to cause annoyance, discomfort, or loss of visual performance and visibility—or simply, "blinding light." The elderly are particularly susceptible to glare. Glare hinders visibility in the illuminated zone so it is difficult to see obstacles or recognize faces, for example. Glare prevents our eyes from adapting to see into nearby areas, thus creating insecure situations. Criminals use glare to their advantage, hiding in shadows before using the bright light to act quickly. Shielded luminaires with rational lighting levels allow us to see better by reducing glare, thus improving visibility and promoting safety and security. Good outdoor lighting design should minimize glare.

Good lighting design guides us by helping us identify where to go and what to avoid. Too much low-quality lighting creates clutter and confusion, ruining the night-time ambience rather than adding to its value.

Light that shines where it is not wanted or needed is "obtrusive" or "trespass" light. Street lighting, for example, should light the streets, not the interior of houses or neighboring ecosystems. Light trespass occurs whenever the light shines beyond the intended target and onto adjacent properties. It can be annoying; it wastes energy; it can adversely affect neighboring ecosystems.

Use light only when it is needed. Turn lights off when activity ceases, or change lighting levels if the activity changes after a certain time. Effective technologies include motion sensors, dimmers, and multi-level lighting. When the light is not being used, it is being wasted.

Wasted light wastes energy and money. The operating cost of a light fixture over its lifetime is significant, especially when compared with the initial cost of the lighting fixture or lamp. In the USA, the waste adds up to more than $1 billion a year, or an annual waste of at least 6 million tons of coal or 23 million barrels of oil (IDA information sheet no. 26). Wasted energy uses limited, precious resources and produces unnecessary environmental pollution.

Light pollution is a form of pollution that costs us more to continue than to stop. Premcor oil refinery in Texas found that shielding and lowering wattages in 20,000 unshielded fixtures saves more than $350,000 annually (at the low, bulk energy rates of 3.3 cents per kilowatt hour that they receive) and improves the visibility in the facility while meeting Occupational Safety and Health Administration (OSHA) standards (Taylor 2003). Shielding the lights improved visibility by minimizing glare. Shields redirect more of the lamp source's light in the direction needed; they put more light where it is needed so one can reduce the lamp wattage and save energy while maintaining the illumination levels that existed before the shielding.

In the last few years, the diversity of well-shielded lighting fixtures and energy-efficient technologies has improved dramatically. A helpful sampling is illustrated in the IDA's "Good lighting fixtures and where to get them" web-based tables. In May 2003, 70 manufacturers and well over 150 fixtures were represented in 21 categories. Many architectural styles are available, including period lighting now available in better-shielded versions that mimic historical styles but offer better light control and less glare.

Unshielded, historical fixtures (e.g. globes, post-tops) are beautiful in the daytime, but usually become "glare bombs" at night. The new, shielded versions are one alternative. Another is to use lower lighting levels in these historical fixtures while providing the majority of illumination from supplemental, energy-efficient, shielded luminaires in unobtrusive locations. The pedestrian enjoys a soft, comfortable ambience from the historical fixtures plus good visibility from the shielded fixtures.

Low-quality lighting has crept up on us, but there are straightforward technological and social solutions that offer significant cost savings. Shielded luminaires can improve efficiency and offer better visibility. Lighting practices are improving. Good design requires asking, "Do we need the light, and why?" Then we must use rational lighting levels, direct the light only where needed, use the light only when needed, and use energy-efficient sources. With better lighting we improve visibility, promote safety and security, conserve energy, and preserve our night-time environment.

Photobiology: Health and Wildlife

Life on our planet evolved with a daily, monthly, and seasonal cycle. We need periods of both light and dark. These cycles strongly affect patterns of behavior and changing them can affect wildlife behavior and survival in numerous ways. The alteration or extension of the length of the day can diminish habitat function, such as providing shelter or food. Light alters predation habits and effectiveness. It affects reproductive patterns and natural diurnal rhythms. Natural, predictable light regulates natural processes (Falzon and Bonnici 2001).

Circadian rhythm is a powerful one for all wildlife and for humans. For example, during dark hours, many organisms produce the hormone melatonin. Melatonin has been linked to the immune response. Exposure to small amounts of light suppresses melatonin production. Light at the wrong time can stimulate jet lag and sleep disorders. Our day/night cycle is ingrained, and changing it stresses our systems (Pauley 2001).

As with noise pollution, obtrusive light also can cause stress. Our systems need a break. To maintain health, balance, and the ecological integrity of systems, we need both adequate, natural light during the day and darkness at night.

Raising Awareness

Incorporated in 1988, the IDA is a non-profit educational and research organization that addresses an environmental issue: the preservation and protection of the night-time environment and our heritage of dark skies. Spanning 70 countries and every state in the USA, its diverse membership includes organizations, city officials, lighting professionals, architects, professional and amateur astronomers, environmentalists, educators, and concerned members of the public. Their combined expertise has created reliable information on the diverse topics related to light pollution. The IDA offers educational activities and outreach tools designed to raise awareness and promote solutions. As leaders in environmental awareness, protected area managers can help educate everyone about the value of our night-time environment and the benefits of improving our outdoor lighting. Everyone benefits.

With growing awareness, many people are contributing to solutions. Lighting professionals are rewriting recommended practices to address related items such as glare, maximum recommended illumination levels, and the effects of obtrusive light and sky glow. Manufacturers have responded to the demand for better-quality shielded fixtures. Communities around the world are implementing ordinances requiring environmentally responsible and economically sensible lighting practices. After all, good lighting has great value.

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How Much Do Visitors Value Scenic Quality? Results from the Blue Ridge Parkway Scenic Experience Project

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Introduction

National parks face difficult budget decisions. The reality of scarce budget resources implies that parks need to maximize the benefits of their expenditures. Contributing to this difficulty is the fact that the value of many national park resources and amenities are not priced in markets, yet their maintenance has costs that managers, policy makers, and taxpayers must incur. Nonmarket valuation is an economic tool that is used to estimate the value of goods and services that are not exchanged in the market, such as improved visibility, endangered species, scenic quality, or ecosystem services (Mathews et al. 2001). The Blue Ridge Parkway Scenic Experience Project uses nonmarket valuation to inform management decisions by helping parkway managers learn the value of their most important resource: the scenic quality views along the parkway.

The Blue Ridge Parkway's Challenge

The Blue Ridge Parkway is a 469-mile scenic motor road, a linear park connecting Shenandoah National Park in Virginia and Great Smoky Mountains National Park in Tennessee. In fiscal year 2002, the Blue Ridge Parkway reported 21 million visitors. Previous research indicates that the primary reason people visit the parkway is to "see the views" (Brothers and Chen 1997). On average, the park is 800 ft wide, which implies that most of what visitors see from the Parkway isn't under the park's control. The scenic views along the parkway are changing. Since 1948, 75% of farmlands along the parkway have changed to alternative uses (USDA 1997); for example, some rural valleys have filled in with manufacturing, and private campgrounds now occupy what were formerly farm fields.

Blue Ridge Parkway managers know that visitors come to see the views, and that what visitors see from the parkway is changing. They also know that scarce resources are required for view preservation (using techniques such as purchase of conservation easements and land) or for vista clearing. What the parkway did not know before this study was the benefit of view preservation, which views visitors might be willing to lose, or if visitors would be willing to give up trails and campsites in order to maintain or improve the scenic quality along the parkway. In addition, managers need to know how changes in scenic quality along the parkway will impact visitation to the park. The Blue Ridge Parkway Scenic Experience Project was designed to answer these questions for park managers.

Results from the Scenic Experience Project

There are two phases to the project. Phase I was implemented in the southwest Virginia section of the parkway in 2000. This section of the parkway, in an agricultural plateau, is particularly at risk for scenic quality change and thus was selected for research priority. Phase II was implemented in the northern North Carolina section during 2002; those results are pending.

The remainder of the paper outlines the results from Phase I of the study. A complete discussion of the specific methods used and the full set of results are available in the final report (Kask et al. 2002), which is available from a link to the parkway's website. The survey was implemented at Mabry Mill, the most visited activity area on the southwest Virginia section of the parkway, over several days during summer and fall 2000. To avoid overburdening each respondent, we used a split-sample design that accommodated three slightly different versions of the survey, which were randomly assigned to respondents. The survey was implemented using laptop computers with a paper version offered as a backup. Over 860 observations were collected.

Scenic Experience Project results generally correspond to two management questions; each provides a distinct opportunity for visitors to express the value of their experience. The first of these is, if the Blue Ridge Parkway changes, what is the value that visitors put on this change? We use the nonmarket valuation method of choice modeling to provide a vehicle for respondents to indicate the value of the satisfaction of their visit (Mathews et al. 2001). In other words, respondents directly indicate the value that they put on the deterioration (or improvement) of the Blue Ridge Parkway. The second management question that the study answers is, how will visits change if scenic quality changes? This allows visitors to indicate how they will behave if the views change (something economists call *contingent behavior analysis*); this allows us to estimate the potential economic impact of changing views, which is of interest to communities along the Parkway.

With respect to the first question—if the Blue Ridge Parkway changes, what is the value that visitors put on this change?—respondents indicated that a decrease in parkway amenities will imply significant losses in satisfaction. For example, on average visitors indicated that if all overlook views degrade to low quality, they will lose $359 in satisfaction from their visit. Similarly, if all roadside views degrade to low quality, $240 is the value of the lost satisfaction that the average visitor will incur. If all amenities (including roadside and overlook views, number of overlooks, miles of hiking trails, and the number and condition of activity areas) degrade to the lowest feasible condition, the average visitor will incur a satisfaction loss of $1,014. In other words, the value that the average visitor puts on this deterioration is $1,014. Knowing that there are approximately 7.6 million visitors to this section of the Parkway each year, the total loss in satisfaction from a decrease in all amenities from current to low quality is $7.7 billion. In particular, the lost satisfaction that would accrue to visitors in this section of the Parkway if overlook view quality degraded from current to low quality is approximately a third of this, or $2.7 billion. The aggregate value of lost satisfaction when roadside view quality declines is $1.8 billion.

How will satisfaction be improved if Parkway amenities improve? Our results indicate that the gain in satisfaction to the average visitor is equal to $53 if overlook scenic quality increases from current to high quality, and $116 if roadside scenic quality is increased. If the number and condition of activity areas increases to the highest feasible quality level, then respondents indicated their satisfaction increase will be valued at $396. For an increase in all amenities, the average visitor incurs a satisfaction gain of $584. Aggregating these numbers to reflect the total number of visitors implies that $402 million is the gain in satisfaction that will occur from improving overlook scenic quality; and $881 million is the gain in satisfaction that will occur if roadside scenic quality occurs. Overall, if all parkway amenities improve, visitors to this section would experience a $4.4 billion increase in satisfaction.

These numbers have policy implications for the parkway. For example, let's say that we know the cost of preserving roadside view quality is $1 billion. We can compare this with the benefits that visitors stated they would lose if this preservation does not occur, which is $1.8 billion. This yields a net benefit of $0.8 billion, which from an economic perspective implies that this is a wise investment. On the other hand, if we know that the cost of increasing overlook view quality is $1 billion, comparing this with the benefits that visitors are willing to pay to experience improvements in overlook scenic quality, $402 million, yields a net cost of $598 million. This would not be a wise investment of parkway funds.

The second general question addressed in this research is, how will visits change if scenic quality changes? On average, visitors report making 2.5 trips to this section of the Parkway per year, and indicated they would visit more in the following year (2001)—on average 4.7 trips per year—if there were no changes in scenic quality. A majority of respondents to this question (87%) indicated they would change the number of visits they make if scenic quality changes; however, less than half of all respondents will reduce their visits with scenic quality decline. With a small decline in scenic quality, 31% will visit less; with a larger decline in scenic quality, 41% will take fewer visits. If scenic quality increases, 34% of respondents stated they will visit more frequently. Interestingly, with some scenic quality decline, visitors stated they would still increase their visits next year compared with this year—3.1 trips up from 2.5—but this represents a decline from their stated increase in visits to 4.7 trips. In other words, the growth in visitation slows as a result of scenic quality decline. If more scenic quality decline occurs, there is a stated reduction in visits, from 2.5 trips to 1.3 trips. This implies that the decline in visitation is not directly proportional to a decline in scenic quality. With scenic quality increases, there is very little increase in visitation over the stated increase in visits expected for next year: 5.5 trips with significant scenic quality improvement compared with 4.7 stated trips in 2001. Of course, these trips yield spending in the communities adjacent to the Parkway, and expenditures will change as visitation changes (see Kask et al. 2002 for detailed estimates of these changes under various scenarios).

The overall study conclusions are that visitors are very satisfied with the Parkway, and that a decline in Parkway amenities will lead to significant loss in visitor satisfaction. Visitors value improvements in Parkway amenities such as views and activity areas, but greater return on investments will occur if the Parkway spends its money on maintaining current quality rather than improving amenities. This makes sense given that respondents indicated they are currently very satisfied with the scenic quality along the Parkway. Visitors are very loyal to the Parkway, and they do not want to see scenic quality decline. However, they will continue to visit even if some scenic quality declines occur. Visitor expenditures in local communities may not actually decrease with small changes in view quality, but the growth in future expenditures will slow if view quality along the Parkway declines.

How Are These Results Being Used by the Parkway?

The Blue Ridge Parkway is incorporating the results of the Scenic Experience Project into their management activities in several ways. In the first-ever parkway general management plan, results are used to calculate impacts of adding or deleting overlooks and to document public support for preservation of views identified in the scoping phase. In the park's business plan, results justify position management and operational funding system requests, and help to describe strategies and priorities for future protection. To report on the Government Performance and Results Act goal 1A ("natural and cultural resources and associated values are protected, restored, and maintained in good condition and managed within the broader ecosystem or cultural context"), economic values are used to describe the success of vista clearing contracts and park protection efforts to preserve views. To encourage the use of park monies to clear vistas and maintain overlooks in competition with maintenance and ranger division requests, Scenic Experience Project results are used to leverage support. The results have also led to project management information system statements for vista clearing. Comparing the Scenic Experience results on visitor satisfaction with the 2000, 2001 and 2002 Visitor Satisfaction Survey Card results, concurrence suggests where to make improvements relative to other park assets. Within the park's land protection program, these research results add value to priority parcels, and strengthen justification for an increased budget for conservation easements and land acquisition. In addition, the parkway is evaluating an Adopt-an-Overlook Program to connect local residents who appreciate individual views and overlooks to join the park in their stewardship. The Scenic Experience Project results can help the parkway to identify which overlooks are particularly important to visitors. In sum, these research results add statistical weight to management plans—justification which was previously undocumented or absent.

How Are These Results Being Communicated to the Communities Adjacent to the Parkway?

The parkway is creating a series of 44 one-page profile sheets on each county and municipal jurisdiction and will add information about the Scenic Experience Project. These profile sheets are posted to the park's electronic directory for the planners in adjacent communities to review. At regularly scheduled meetings of six of seventeen regional planning organizations along the parkway, park officials are presenting the results to elected officials and staff. These organizations include Planning District Councils 3, 4, 5, and 12 in Virginia and Councils of Government B and D in North Carolina.

A parkway press release was sent to 25 newspaper and media contacts, and 8 congressional offices. Follow-up articles were published in several newspapers, including those in Roanoke Virginia, and in Brevard, Blowing Rock, and North Wilkesboro, North Carolina. Park officials will present the results of the Scenic Experience Project at the 2003 American Planning Association Summer Institute in western North Carolina, a conference for elected officials, planners, and municipal and county staff. Results will be also shared with three associated land trusts to promote greater understanding of the need for increased funding for conservation easements along the parkway, both through private donations and federal appropriations. In addition, results will be shared with 8 affiliated partners, in National Park Service seasonal training, with 5 park concessionaires, and with 15 state and federal partners in various forums during spring 2003.

Conclusions and Implications

Economic studies using nonmarket valuation can be used to improve park management decisions (Turner 2000). In the case of the Blue Ridge Parkway Scenic Experience Project, this means the parkway should concentrate on maintaining scenic quality rather than improving conditions in the southwest Virginia section. Results for the northern North Carolina section, which is visually distinct from southwest Virginia, may have different implications; those results are anticipated by the end of 2003.

Each park faces different issues and thus it is likely that custom-designed nonmarket valuation studies will be most helpful to park managers. The nonmarket valuation methodology is flexible and can be modified to capture information about values and trade-offs that are relevant to each park. For example, if wilderness character is particularly important to visitors in your park, a nonmarket valuation study could be designed to estimate the value of wilderness character. However, since nonmarket valuation studies are expensive—in terms of both dollars and time it takes to design, conduct, and incorporate a study into a park's management plan—it may be that the most significant constraint to using nonmarket valuation studies to improve park management is finding the resources required to conduct the study in the first place. Recent work on the transfer of benefits conducted in one study to another study area may help (Smith et al. 2002), though for parks with unique resources there may not be sufficient substitutability for effective use of this transfer technique.

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Integration of Social Science into Protected Area Stewardship: Challenges and Opportunities

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Introduction

That the stewardship of protected areas remains a contentious and challenging task is not news to any manager, scientist, or citizen confronting the complex, contentious, and often confusing realities of stewardship today. Protected areas exist within a social and political dynamic that is as difficult to understand and predict as any situation. A variety of threats and relationships that are complex, often obscure, and involve a wide variety of forces at different scales, leading to consequences at later times and other places, challenge even the most competent park steward. Increasing calls for science-based decision-making are centered at least partly on the argument that science can provide meaningful information upon which policy is formulated and decisions are made. Indeed, a number of commissions and reports over at least the last 40 years have recommended increased attention to the sciences by the National Park Service (NPS) in order to better understand the values and processes protected within the National Park System (e.g., the Advisory Board on Wildlife Management chaired by A. Starker Leopold).

The social sciences are one of the scientific legs upon which successful protected area stewardship relies. This stewardship involves decisions that protect, enhance, or restore not only the values for which parks, wilderness, and other types of protected areas are established, but also the degree of care and concern for the people and communities that are inevitably linked to and affected by stewardship decisions. The social sciences help stewardship by creating knowledge concerning the values protected, the decision processes used in stewardship, the beliefs people hold by these values, and recreation opportunities and the connections people and communities hold with parks and other protected areas.

Originally, much of the social science involving protected areas was focused on creating a scientific base for management of visitors. This was critically important, for in the very early 1960s there were cries that the national parks were increasingly crowded and not meeting the expectations held by visitors. Despite NPS attempts to increase the physical capability of the parks to handle more visitors through Mission 66, issues of use density, quality of experiences, and impacts to the natural and cultural heritage from such use demanded considerable and continuing research attention.

From the early focus on recreation, the social sciences have expanded to assist in a broader arena of stewardship issues. And yet, despite the potential for improving the quality of stewardship, substantial barriers to the social sciences remain. In this paper, I wish to discuss the major challenges facing use of social science research. In doing so, I will specifically discuss the criticism that the social sciences are "subjective" and therefore not credible sources of knowledge. I then suggest the potential of the social sciences to address six fundamental areas of protected area stewardship.

The Research Applications System

Social science research, like other forms of science, exists within a complex, interactive and vibrant social and institutional system that involves scientists, managers, and technology transfer specialists working for agencies that have both responsibilities and agendas. This system, represented as shown in Figure 1 and defined in Table 1, provides us with a framework to portray and understand the challenges confronting use of the social sciences in protected area stewardship (Havelock 1972; McCool and Schreyer 1977). The fundamental assumption of this model is that research

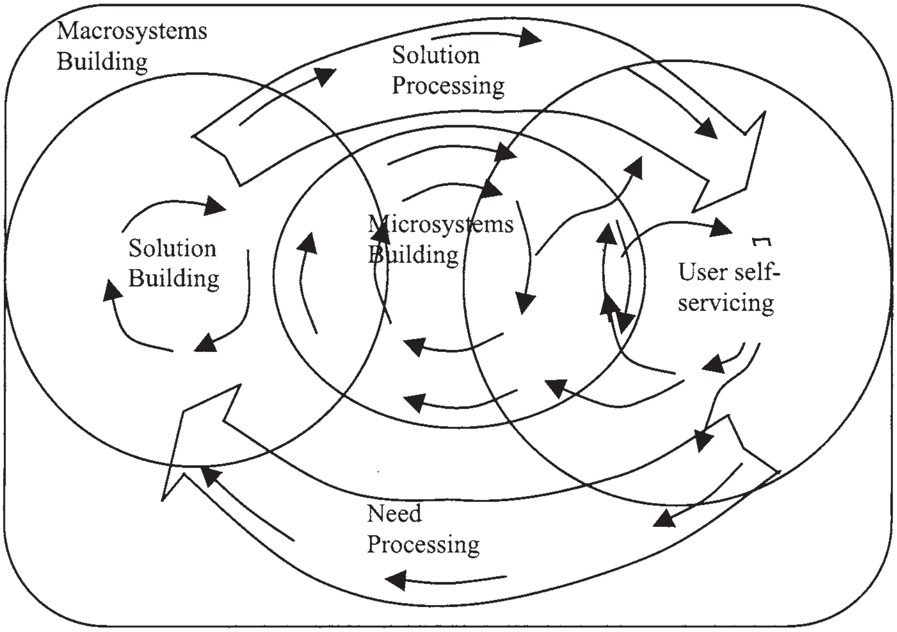

Figure 1. The research applications system (source: Havelock 1972)

exists to improve the human condition—in this case to raise the quality of protected area stewardship so that the values for which they are designated are indeed shielded from various threats and inappropriate uses.

Current Challenges Facing the Social Sciences in Protected Area Stewardship

Figure 1 provides an overall framework for understanding where challenges occur in research and applications; it certainly shows that there are countless potential challenges in every aspect of protected area stewardship involving the use of science. For the purposes of this paper, however, I would like to focus on three particularly thorny challenges that are pervasive, influential, and affect how social sciences are viewed and used. These challenges help frame the criticism that social sciences are subjective and thus there is an issue of their legitimacy in science-based processes.

Institutional and systemic barriers to change. Major macrosystem changes influence what research is conducted, how it is conceptualized, and how it might be used. Several of the more significant and salient changes are depicted in Table 2. Our notions of protected area stewardship derive primarily from 20th-century Progressive Era perceptions of the role of government and experts in policy development and decision-making: planners employed by public agencies were presumed to represent the public interest (McGarity 1990), which at one time appeared to be unified and of one voice. The Progressives sought to instill a political system that utilized scientific management guided by "neutral and objective" experts to serve the public interest; in a sense, the application of science would reveal this interest. Agency decision-making would be both professional and objective to avoid the appearance of bias while relying "upon professionals to set policy based upon a congressional goal and an examination of the facts" (Poisner 1996:76).

Moreover, Progressive Era approaches still dominate natural resource planning today, as demonstrated by natural resource agencies' faith in scientific expertise (e.g., the Forest Service planning rule proposed in fall 2000 to

Table 1. Definitions of terms used in Figure 1 (source: Havelock 1972)

Macrosystem building provides the context for social science and its application. Macrosystems involve the institutional context that provides incentives for social scientists to conduct research and solution processing, and for managers to apply social science information. In addition, the beliefs held by both managers and scientists structure how problems are framed; how problems are framed determines what "answers" are provided.

User self-servicing represents the ability of the manager to address problems and develop solutions to them. While this initially appears to be a totally managerial function, social scientists play at least three significant roles here. First, social scientists help managers identify, define, and frame these issues. Second, through two-way interaction, the scientist helps managers translate a problem into a testable hypothesis and thus provide the framework for adaptive management approaches. Third, scientists help managers become more familiar with existing literature and problem-solving approaches used elsewhere.

Need processing involves communicating the "felt pain" of a problem or issue to the scientist. This inherently means that managers must acknowledge that there are social science dimensions to the problem (most protected area stewardship issues have these dimensions), have an awareness that social science is an appropriate tool, and recognize that there are scientists available that can be utilized. Such need processing requires a substantial investment in translating challenges into testable hypotheses; these investments are needed by both managers and scientists.

Solution building entails scientific activity to develop responses to the problem, usually in the form of data and information and sometimes in the form of knowledge. Solution building is the knowledge acquisition component of the research applications process, and it is here where the charge that social science is subjective is leveled.

Solution processing means that the data collected and analyzed by the scientist must be transformed into information and knowledge useful for the resolution of the problem confronting the protected area manager. In many natural resource situations, such solution processing is done in conjunction with extension agents, who work closely with both scientists and users. However, the protected area management system generally lacks the structural equivalent of extension agents and thus social scientists must often assume that role.

Microsystems building includes small-scale, small-group interactions, generally with researchers and managers collaborating on projects and problems. It is here where the relationships necessary to knowledge utilization are built. The extent to which the participants in such interactions develop common languages, overlapping perspectives, and shared paradigms encourages not only the transfer and application of knowledge but also increases the probability of science developing information useful to managers and managers using such information to resolve problems.

Table 2. Changes influencing the use of science in protected areas

- Era of change in our notions of protected area stewardship—larger spatial, temporal, and social–organizational scales
- Recognition that we cannot continue to treat protected areas as isolated entities in a sea of development
- Broadening expectations of protected area functions, particularly natural ones
- Changes in systems of planning governance, involving primarily increased demand for intimate public engagement in decision-making

increase the role of science in national forest planning) and the reluctance of agency planners to relinquish control and involve the public in a substantive and meaningful way in stewardship decisions. Advocates of synoptic planning continue to encourage divorcing decision-making from politics and to only allow public participation in a manner that conforms to an expert-based model (i.e., public participation serves primarily as a method of information collection and education).

These foundations remain immensely influential, not only in designing planning processes but also in the realm of science, the views managers hold on science and how science is used. Progressive Era science is viewed as an "objective" endeavor: problems only require the application of more science to be solved, and through science the public interest can be exposed. These fundamental assumptions conflict with the reality of protected area stewardship today: what science is done and how it is conducted often is a result of political pressures; many problems of stewardship are those of conflicting values, problems which science is ill-suited to solve; and the public interest can only be *constructed* through serious, deliberative consideration rather by being *revealed* by science.

Management of parks is a socially problematic challenge; as such its basis is in how values may conflict, collide, and reinforce each other. Struggles about park management are essentially political and value-laden. The extent to which synoptic views of planning and science are held in an increasingly messy and tumultuous world suggests the extent to which we will have failures in identifying and framing problems, conducting relevant research, and resolving the problems and challenges of protected area stewardship.

Methods and approaches to stewardship that marginalize non-quantitative knowledge. Twentieth-century park science could be described as one in which empiricist approaches emphasizing quantitative measurements and analysis dominated. Quantitative methodologies have benefited stewardship greatly, contributing to significant understanding of the processes and places land management agencies have been mandated to protect. And while our understanding has greatly advanced, there has been a tendency to marginalize other approaches to science, specifically approaches in the social sciences that are based on qualitative research. Qualitative approaches are often criticized as being not representative, subjective, and uninformative.

But, as Thomas Kuhn (1970) has noted, paradigms of science change. In the social sciences, there has been an accelerating interest in qualitative approaches to stewardship issues. Qualitative social science has been around for a long time (as has qualitative methodology in biology), but the recent rise in interest results from some dissatisfaction of the quantitative model and an interest in approaches that provide scientists opportunities to explore deeper understandings. Qualitative approaches help map out the dimensions of research questions (e.g., what makes public participation successful, what meanings people attach to landscapes, what were critical events in a stewardship issue) and provide both scientists and managers with important information about how people perceive various issues and challenges.

Discipline-based decision-making. As our knowledge of stewardship has advanced, we have also come to understand that the current dominance of disciplinary-oriented research and management is no longer adequate in resolving the contentious issues confronting park stewards. Rarely is a problem the sole domain of a particular discipline. Managing bison in Yellowstone National Park is an example. Bison populations interact with snowmobiling and other visitor activities, but how is neither clear nor definitively understood. Creating knowledge that will assist park managers requires not only biology, but landscape ecology, sociology, psychology, and management science as well.

Discipline-based decision-making and research results in a reductionistic, fragmented view of protected area issues. Such perspectives, when generated by research, leave managers unable to fully access the consequences of their decisions and result in protected areas continuing to be vulnerable to various threats. Integrated research—across scales, disciplines, and forms of knowledge—shaped by common problem framing, provides decision-makers with a more holistic understanding.

The Issue of Subjectivity in Social Sciences

Social science research is often criticized as being "subjective" and thus does not have the validity of the biophysical sciences. If science is viewed as the acquisition of knowledge, subjectivity must mean that there are distortions in the "reality" portrayed by that knowledge. To be subjective, those distortions would be a function of the individual perspectives and value systems of the scientist. Each of us observes the world, either as a regular guy or as a scientist through the lens of a particular paradigm. Those paradigms definitively determine what we see, what variables are chosen to be observed, and how the resulting data are used to describe the so-called real world.

The distortion of reality would occur in three ways. First, the scientist has used personal judgment in the process of acquiring knowledge rather than relying on some "external" criterion. Yet the personal judgments of any scientist enters into the research process in terms of problem definition, choice of methodologies, selection of variables and how they will be measured, data analysis and interpretation of results. This view of subjectivity in science would apply to the biophysical sciences as well, but in a way that is somewhat different. Thompson (2001:65) notes that "the positivist model simply obscures the values inherent in all science." Thus, measurement of things such as animal populations, tree diameters, coliform colonies, reproductive rates, and soil types gives the appearance of objectivity, when in reality the choices made in the research process are as subjective as in the social sciences. As scientists in any field we tend to use shared paradigms to determine what variables are measured and how. And, indeed, when there are conflicts in paradigms, there is much debate over which variables are measured. The scientific method requires that the choices made by scientists be made public; and it is this very explicitness that is one of the foundations of any scientific enterprise.

Second, subjectivity may occur when the variables being measured are intangible. Intangible variables are those that "are based on observations but that cannot be observed directly or indirectly" (Babbie 2001:121). An example might be attitudes toward use density. These variables are known as *constructs* (Kaplan 1964). And while constructs cannot be measured directly and there may be some questions about them being *real* in the sense of a rock or tree, they can be *useful*. Babbie argues that these types of variables "can work this way because while not real or observable in themselves, they have a definite relationship to things that are real and observable" (2001:122).

I note here that the biophysical sciences also rely on constructs that are not real in the sense of being directly observable and are constructed from measurements of other variables. These include such concepts as biological diversity, forest health, succession, and spatial scale. Thus, in this sense, the charge of subjectivity applies to social and biophysical sciences as well.

Third, subjectivity may connote that the meaning of a concept or variable is highly personal, depending on the perspective of an individual scientist. A concept—crowding, for example—may evoke different images in different scientists. The only way in which we can effectively communicate what we mean when we say the term "crowding" is by explicating the characteristics of this term: large numbers of people, small area, inappropriate behavior, goals and objectives explicit, and so on. By making our conceptions explicit and deliberating on them, we as scientists and managers come to agreement on their meaning, and thus, while the concept may be termed a subjective one, it may enjoy wide agreement on its meaning. So, the concept "crowding" may come to mean a "negative normative evaluation of use density."

In summary then, the criticism of subjectivity may indeed by valid, but it is by no means limited to the social sciences. The biophysical sciences are also equally subject to this charge. More importantly, the challenge for scientists is developing mechanisms to explicate and provide rationales for decisions and apply the test of usefulness to their constructs.

Table 3. Opportunities for social sciences in stewardship of protected areas

- Understanding the values protected
- Developing decision and planning mechanisms
- Framing the question of protected area stewardship
- Providing the knowledge base to ensure that stewardship decisions can be implemented
- Understanding the consequences
- Challenging paradigms of stewardship

Expanding Domains of Social Science Research

At the same time that the social sciences are faced with changes in research paradigms at the macrosystem level, the roles of these sciences are enlarging. The reasons for this expansion are complex, but probably most influenced by changing expectations of the goods and services parks provide, deepening understanding of the purposes of protected areas, realization that protected areas and communities are inevitably and strongly linked, an interest in ensuring that plans that protect these special places can be implemented, and an expanding definition of the stewardship needs of protected areas. These encompass three primary goals: (1) protecting the values for which an area was designated; (2) providing for the quality-of-life needs of citizens; and (3) enhancing economic opportunity.

The potential contributions of the social sciences to accomplishing these three goals involve six areas as shown in Table 3.

Conclusions

Protected area stewardship is at a critical junction. The issues confronting these areas have grown not only increasingly complex but have accelerated in contentiousness. The social sciences can make significant contributions to their resolution, but only if large-scale social and institutional systems encourage deeper manager–researcher interaction, recognize the validity of research, and reward effective use of integrated approaches.

All research is subjective at some point, so this criticism, frequently pointed toward the social sciences, is not limited to them but encompasses other sciences as well. Scientists can attack this criticism by both pointing out its weaknesses, by making research assumptions more explicit, and showing the utility of major constructs in predicting and understanding other variables of interest.

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Advancing the Dialogue of Visitor Management: Expanding Beyond the Culture of Technical Control

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Introduction

In its simplest sense, visitor management involves the application of both art and science in producing opportunities for people to experience the benefits of a park or protected area. However, in the case of national parks, monuments, and similar areas, management objectives also involve the protection of biophysical and cultural values; often, these values were the original basis of the protected area's designation. The inevitable tension between these objectives—"use vs. preservation"—has fostered much debate among park professionals and interested citizens, yet it remains unresolved and seemingly intractable.

At one level, it would seem that resolving this conflict simply requires identifying and clarifying the public interest in the management of protected areas. Although the language contained in the organic legislation establishing the protected area clearly provides clues to this interest, its suitability for providing guidance for both operational and strategic decisions is limited by two factors. First, such language typically is vague and abstract, lacking detail and explicit definition about the conditions deemed appropriate to the area. Second, the idea that such language provides insight into *the* public interest is flawed because there is no single, unitary voice to which management is responsible (Schubert 1960; Rothman 1979; Pierce et al. 1992). Indeed, such legislative language often represents the results of accommodation and compromise among competing interests. In reality, the "public interest" is a transitory phenomenon, shifting in response to changes in the power and importance of contending interests (Schubert 1960). In other words, there is no *single* public interest, resulting in a search for a basis for policy action driven by the need to frame a working approximation of consensus not only among plural interests, but among multiple, often dissenting scientific perspectives as well.

An obvious implication of attempting to serve multiple interests is that sharp disagreements regarding the specific goals of protected area management will emerge. However, the problems don't stop there. The search for appropriate policies and strategies is further confounded by scientific disagreements concerning cause-and-effect relationships. Despite the common image of science as the source of clarification and truth, in reality, conflicting interpretations always exist about system interactions and effects, making implementation of "sound, scientifically rigorous" policies problematic at best.

In this paper, we discuss how this turbulent context—social ambiguity regarding the goals of protected area management and high levels of scientific complexity—combine to plague efforts to frame and implement appropriate management policies. Despite a tradition of reliance upon expert- and science-based planning, such approaches are ill-equipped to deal with the value-driven conflicts confronting protected area management today. We critique how technically based models of visitor management constrain efforts to advance the art and science of the field. We offer an argument and a framework for a more inclusive decision-making process and conclude with suggestions for building an improved capacity to frame policy and management questions.

Visitor Management: A Wicked Problem

Protected area managers face many complex problems; e.g., developing strategies to protect endangered species, managing increasing use levels, understanding the distributional consequences of restricting use, accommodating differing interpretations of preservation, working with indigenous populations in land claims agreements. Despite their complexity, however, many of these problems are solvable, given sufficient time, money, and technical assistance. What makes the task of protected area management particularly challenging are a class of problems that are not only complex, but also resistant to effective resolution. Such problems have been described as "wicked" (Rittel and Webber 1973; Allen and Gould 1986) and are characterized by both *scientific uncertainty* about cause–effect relationships and *social conflicts* over goals. As Thompson and Tuden (1959) have noted, traditional technical–rational decision-making processes are not well-suited to resolving such problems, yet they nonetheless dominate efforts to address them.

Wicked problems are common in protected area management. First, disagreement over management goals is common (e.g., should Yellowstone National Park provide opportunities for motorized winter recreation?). Second, cause–effect relationships often are poorly understood, meaning that both the efficacy and consequences of actions taken to resolve problems are never clear. Third, both the causes of problems as well as attempts to remedy them are regulated by complex, often non-linear, dynamics (Roe 1998), confounding both prediction and effective management. Fourth, although the issues associated with visitor management in protected areas clearly have technical aspects, at their core, they are dominated by conflicts over values. Such conflicts are seldom amenable to resolution through technical–rational analyses, but instead require, judicious application of collaboration and negotiation oriented toward accommodation of competing interests.

Such characteristics limit the ability of traditional scientific-based, expert-driven management paradigms to facilitate construction of the public interest and fashion useful solutions. Yet, despite these limitations, there is still significant reliance upon such models. Whether this is because of the perceived lack of alternatives, institutional inertia, or simply an unwillingness to admit the limits of such technical–scientific models is not clear; nonetheless, the search for technically rigorous, objective approaches to visitor management in protected areas continues.

However, close examination of the underlying assumptions of rational–comprehensive planning reveal important limits. For example, it assumes a single objective about which there is a consensus. Further, it assumes a comprehensive search for alternatives, requiring huge amounts of information for evaluation, despite the reality that rarely the budget, time, or political willingness to permit this exist. Perhaps most importantly, it implicitly treats problems as technical and value-free—and thus subject to technical–rational analysis and resolution—when increasingly the value-based, political nature of such problems is acknowledged as the primary driver. For instance, in developing management strategies to deal with excessive use, the tendency is to focus on techniques such as use limitation policies, but such policies, in turn, inevitably lead to distributive impacts on visitors (some win, others lose), revealing the intrinsic value-based nature of the issue.

Such characteristics make it doubtful that even the most open debate and discussion among managers, scientists, and other technical specialists is an adequate means of fostering an awareness and understanding of the multiple interests that compete for definition as *the* public interest. Nonetheless, the "culture of technical control" tends to dominate this discourse.

The culture of technical control, Yankelovich (1990) explains, is grounded in several assumptions: (1) policies depend on specialized knowledge; (2) only experts possess this knowledge; (3) citizens not only lack this knowledge, but are generally apathetic to the policy process; (4) where the public does have a view, it is accurately reflected in opinion polls; (5) elected officials know these views and represent them well; (6) when public understanding and support are critical, public education experts can share knowledge with citizens; and (7) the media can impart the necessary information to citizens. The dominance of this model, Yankelovich goes on to argue, has contributed to serious consequences, as it has resulted in the miscasting of many socially problematic challenges. The socio-biophysical systems that comprise protected areas are sufficiently complex, diverse, and dynamic that relying upon technical–rational-based decision systems simply is inadequate for constructing the public interest. As noted above, the public interest is simply not a matter of scientific discovery or developing the technically optimal solution to a problem, but rather of constructing it from the dialogue among those interested in, and affected by, protected areas.

Wicked problems and messy situations—imbued with high levels of scientific uncertainty and conflict over goals—require new ways of thinking and acting. They highlight the need for decision-making grounded in *learning*, as a means to enhance understanding of both biophysical and social relationships; in *accommodation*, to address the multiple interests invested in the decision; and in *consensus-building*, to develop the necessary political understanding and support to facilitate effective implementation. These three elements are central to many of the issues facing protected area managers, but reliance upon technical, scientific, and expert-driven modes of inquiry limits our ability to fashion effective responses. What alternatives exist?

Expanding the Dialogue

We argue that a basic responsibility of protected area managers is to facilitate construction of the public interest as well as to protect the interests and values identified in the enabling legislation creating the area. However, as discussed above, many problems constrain meeting this duty. Williams and Matheny note that within the culture of technical control, the "search for correct public policies is seen as similar to the search for scientific knowledge.... [T]his search assumes there is a single answer to public policy problems, that this answer can be found within a single language, and that this language is one of scientific expertise" (1995:39).

We suggest that more open, inclusive planning processes built upon the notion of a series of "transactions" among the various interested parties (Friedmann 1973) be brought to bear on the wicked character of visitor management. Broader inclusiveness in protected area management has been advocated for a long time. For example, the growing interest in sustainable natural resource-based forms of tourism development includes calls for participatory and collaborative forms of decision-making (Lindberg and Hawkins 1993). In Australia, efforts to promulgate a co-management regime between commonwealth agencies and the Aboriginal community have attracted attention (Weaver 1991). In the United States, there is a growing body of experience related to the resolution of a variety of recreation management issues within designated wildernesses utilizing various collaborative processes.

However, it is important that we not lose sight of the fact that wicked problems are so defined because of both their goal-conflicted nature *and* the uncertainty surrounding scientific understanding of cause-and-effect. In other words, we must be careful that in our haste to find a constructive alternative to the technical–rational model and its limitations, we turn to a model that simply replaces one limitation with another. Discourse and pluralism are important qualities of any needed revision in our models of land use planning and management, but so too is competent scientific inquiry. For example, Rayner (1996) compared the relative efficacy of planning undertaken by the Forest Ecosystem Management Assessment Team (FEMAT) in the Pacific Northwest with the Commission on Resources and Environment (CORE) in British Columbia. He noted that while FEMAT overemphasized science and neglected the social dimensions involved in implementing ecosystem management, the CORE effort failed to match innovative approaches to shared decision-making with a sufficiently rigorous scientific basis for its recommendations. In short, he concluded, integration of science and human values remains the key challenge for innovative institutions for environmental management.

The key, it seems to us, is integration, but this a challenge on which demonstrated progress is limited (Clark et al. 1999). Nonetheless, the bases upon which an improved ability to bring disparate perspectives to bear on wicked problems are grounded have become more clear. For example, Roe (1998) argues that such problems require an approach grounded in the notion of "triangulation." That is, in a world of ambiguity and uncertainty, we require perspectives that offer sharply distinctive (orthogonal) perspectives as a means of restating the underlying problem (i.e., require a fresh way of thinking about the problem).

Williams and Matheny (1995) also argue for a planning framework within which multiple and distinctive perspectives—scientific, communitarian, pluralism—are explicitly acknowledged and contrasted with one another. They suggest that such a model would have four distinctive characteristics: (1) equal access to usable information; (2) decisions being part of a broader pattern of engaging the public in policy development and implementation; (3) venues that encourage deliberation and a recognition that "answers" are always provisional (scientific knowledge is always tentative and because contexts change, problems never stay solved); and (4) federal leadership that ensures interaction among affected parties regarding distributional consequences at the local level.

How can we translate these characteristics into relevant, productive dialogue focusing on visitor management in protected areas? First, we believe that it is important that we take care to frame questions in a thoughtful manner reflecting the underlying character of the issues. For example, in debates about appropriate levels of recreation use in protected areas, the traditional question guiding inquiry has been some variant of "How many is too many?" This question, we contend, invites a technical–rational form of inquiry, as opposed to one such as, "What are the appropriate or acceptable conditions that we seek to provide?" This latter question shifts attention from solely the technical issue of computing "how much is too much" to a more inclusive question embracing not only technical aspects, but also a variety of social and prescriptive issues that require dialogue in order to reveal the values and concerns that compose the public interests. Use of the terms "appropriate and acceptable" imply that the public interest needs to be derived rather than discovered, that social values are involved, and that venues that facilitate interaction among scientists, managers, and the public are required. Shifting the question also moves it from the domain where the culture of technical control is all that is necessary to one where technology, science, values, and preferences are joined and where dialogue among the various participants becomes the vehicle through which mutual learning takes place and where resolutions are effected (Friedmann 1987).

Second, we suggest initiation of longer-term and broader-spatial-scale public engagement processes to help reveal and develop the contextual learning that underlies understanding of the complex issues of visitor management. These are characteristics similar to those specified by ecologists as necessary to more informed understanding and management of ecosystems. Currently, public engagement concerning visitor management tends to focus on specific issues, such as a park management plan, and become embedded in procedural-bound processes such as environmental impact statements. Such public engagement is not directed toward learning and is inherently reactionary and adversarial. As a part of this process, we suggest future-oriented thinking, such as scenario planning that is directed toward creating a public interest in defining desired futures as well as the means through which such futures might be attained.

Third, we encourage the use of innovative processes of citizen engagement, such as citizen juries, to assimilate, process, and deliberate on protected area issues and science. These more formalized types of engagement can be effective in building additional learning, creating innovative resolutions, and stimulating higher-quality, more relevant science.

Fourth, we suggest that federal park agencies engage in planning processes that are more cooperative and collaborative, engaging the public in such a way that fundamental objectives of public participation, such as representativeness, learning, responsibility, and relationship-building are achieved.

Finally, we suggest using the strengths of formalized planning processes, such as VERP (visitor experience and resource protection), LAC (limits of acceptable change), etc., to structure public engagement. Such processes force consideration of major elements and values in visitor management, such as goals, zoning, etc. By following these planning processes in an open, inclusive environment, the public provides information in a timely and constructive manner in the planning process.

Conclusion

Science and technology retain important roles in integrating visitor management goals with those related to biophysical goals in protected areas. That role shifts, however, from one of fashioning mechanistic, rule-bound "answers" to one of informing the dialogue regarding alternatives, consequences, and implications associated with various constructions of the public interest. Public engagement becomes more than simply a way of collecting additional data or of satisfying procedural requirements: it is the principal pathway to learning, consensus-building, and the appropriate accommodation of varying interests. This means that the discourse surrounding visitor management must not be limited to the technical concerns demanded by a carrying capacity approach, but inclusive of the inherent pluralistic character of contemporary society as well.

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Transportation Noise and the Value of Natural Quiet

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Introduction

The transportation system in the U.S. creates noise, and since the 1970s analysis and mitigation of this noise where people live has become a routine part of the transportation planning process. This analysis generally focuses on specific projects for specific transportation modes. It is, in the author's experience, rare that a systems approach has been applied to examine multimodal trade-offs in transportation performance and environmental effects. The focused analyses aid in limiting the most significant effects of noise in the immediate vicinity of the source, and feasibility considerations always play a role in determining the area over which noise effects are examined and mitigated. The result is that there has been little or no real attention given by either government agencies or the acoustics community in the U.S. to the summed effects of all sources of noise over wide areas of the country.

This is not to say that there are not many professional individuals and organizations worldwide that are concerned with a broader perspective of the "soundscape." This broader perspective may address the quantifiable effects of all noise sources on people living in built environments (see, for example, Berglund and Lindvall 1995; Berglund et al. 1999; Miedema 2001), on developing a coordinated approach to use of noise indicators and assessment methods for examining environmental noise (CEC 2000), on the qualitative values and effects of the soundscape (Schafer 1977), or on soundscapes in national parks (NPS 2000). These types of professional efforts are significant and necessary if we are to develop an understanding of the relationship of the sound environment to human health and well-being, and if the soundscapes are to be managed to preserve or improve the quality of life.

This paper suggests yet another perspective on soundscapes. The complexity and extent of the modern transportation system, and the ways in which that system is planned, modified, and expanded, mean that, in the U.S., there is little attention given to the countrywide extent of its influence on the acoustic environment or soundscapes across the country. Further, if the extent of acoustic influence of the transportation system were better understood, there might be, on the one hand, more emphasis on total system acoustic design and, on the other, the public perception of the value of managing and preserving natural soundscapes might be altered.

The goals of this paper are to: (1) estimate the geographic extent of transportation noise in the U.S.; and (2) raise the question: What is the value to society of seeking to manage natural soundscapes for restoration and preservation?

Geographic Extent of Transportation Noise in U.S.

The method used here for estimating the geographic extent of transportation noise is based on separately examining the layout and noise "influence" of each of the three major transportation networks. These networks may be defined as: (1) highways, including primary limited-access highways, primary roads, and secondary roads; (2) freight railway lines; and (3) commercial air carrier jet routes.

In order to generalize the noise "influence" of these three transportation systems for the U.S. (for simplicity, this examination focuses on only the contiguous forty-eight states), a simplified calculation method is used. The method used here is based on several assumptions:

1. All calculations are done county-by-county.
2. All calculations are for a typical daytime hour.
3. Population density is used to derive a "baseline" sound level.
4. This baseline level, produced primarily by

the local vehicular transportation network, serves to determine the area in which the noise of the three major networks will be "noticed." A transportation source is assumed to be noticed when its sound level equals the background or baseline level (in A-weighted decibels; for background, see Green and Swets 1988; Miller 2000; Potter et al. 1976).

5. The higher the baseline sound level, the smaller the area over which the transportation networks will be noticed, and conversely, the quieter the baseline, the greater the area over which the noise of the three networks is noticed.
6. "Influence" by the noise of each of the three networks is determined by: (a) determining the maximum distance from the transportation corridor at which the transportation noise source can be noticed; (b) multiplying this distance by the length of the corridor in the county, giving an area within which the noise of the particular transportation corridor can be noticed; (c) comparing the area in each county over which each of the three transportation networks can be noticed with the total area of the counties to compute the percentage of each county in which each network can be noticed.
7. Nationwide, the degree of influence is depicted by categorizing the counties by the percentage of land in which each transportation noise can be noticed.

In the U.S., there are federally approved mathematical models for computing the sound levels produced by any of these types of transportation (Anderson et al. 1998, for highway traffic noise; DOT 1995, for rail noise; FAA 1999, for aircraft noise). For present purposes, however, the approach is to use only the source sound levels and propagation algorithms of these models to produce estimates of the maximum distance at which the source can be noticed.

Baseline sound levels. The baseline levels used to determine the maximum distances at which the various transportation types can be noticed are derived from a long-standing simple relationship between community sound level and population density. The relationship of day–night sound level, Ldn (a measure of the sound in an average 24-hour day) to population density was investigated by the U.S. Environmental Protection Agency in 1974 (EPA 1974), and recently reconfirmed (Stewart et al. 1999). This relationship is:

$$L_{dn} = 22 + 10\log\left(\frac{\rho}{\rho_0}\right) \quad (1)$$

where ρ

is population density in people per square mile, and ρ_0

is 1 person per square mile. It is intended to estimate the day-night sound level due to general community activity, and assumes that no major highways or airports are affecting the sound environment.

The relationship of equation (1) was applied to the population densities of U.S. counties to produce Figure 1. As might be expected, higher sound levels are in the counties with significant urban/suburban populations. Because of the map size, some areas of high baseline sound levels, notably San Francisco and metropolitan New York, cannot be distinguished.

For determination of areas of noticeability, the comparison made is between the sound level of the specific transportation source (highway, rail, aircraft) and the "baseline" sound level derived from the levels given in Figure 1. The best representation of such a baseline level is assumed to be the daytime median sound level, or L50. Equation (1) yields Ldn, so this value must be transformed to L50. Using information collected in 18 communities (Wyle Laboratories 1971), the following approximate relationship was derived:

$$L_{50} \approx L_{dn} - 5dB \quad (2)$$

Hence, for each of the transportation sources, the comparison is between the maximum sound level of the source and the base-

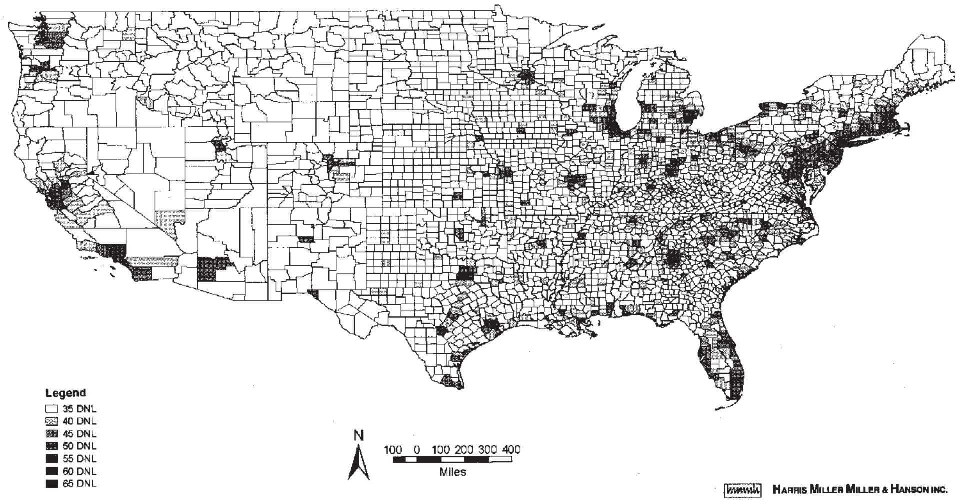

Figure 1. DNL by county, developed from population density, equation (1)

line of Ldn – 5 dB. The distance from the transportation track to the point where the maximum level equals Ldn – 5 dB is the distance of noticeability.

Highways. Figure 2 shows the results of the noticeability calculations for highway traffic noise. The specific divisions that depict the percentage of county area where the noise is noticeable were chosen assuming that the greater the estimate of noticeable area, the higher the likelihood that the estimates are inaccurate. As the area of noticeability

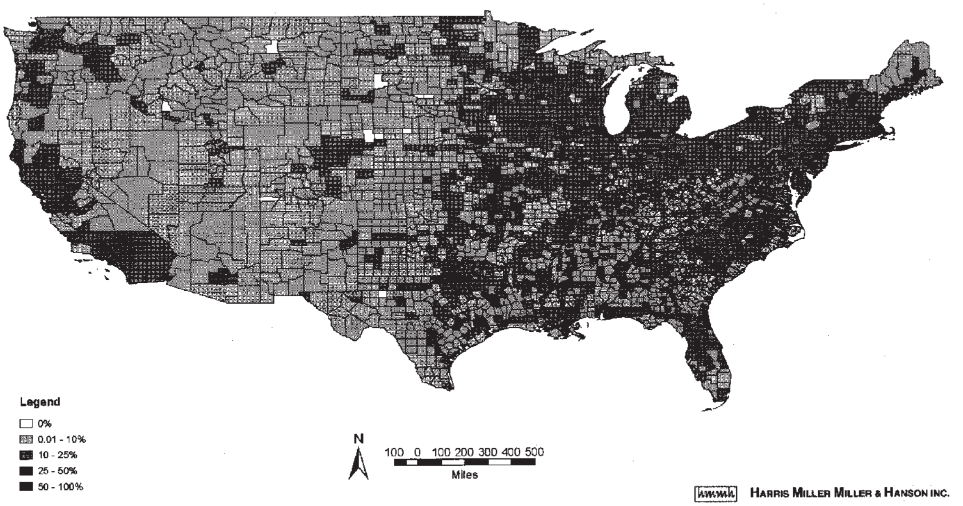

Figure 2. Percentages of county areas in which highway traffic noise is noticeable during the day

increases, the greater the probability that individual noticeability areas from different transportation segments will overlap. Hence, the divisions increase in size, as the percentage increases.

The percentage of a county in which noise is noticeable depends upon two variables: (1) the number of transportation corridor segments in the county, and (2) the baseline sound level in the county. Thus, a county may have a low percentage of noticeable highway noise either because the baseline level is high or because there are few highways in the county.

Railways. Figure 3 shows the results of the noise influence calculations for railway noise.

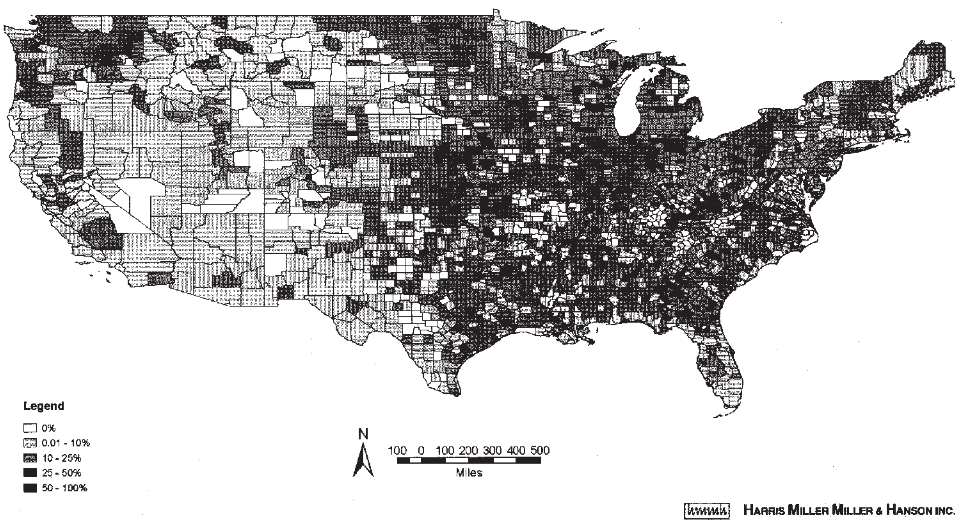

Figure 3. Percentages of county areas in which rail traffic noise is noticeable during the day

Commercial jet routes. Figure 4 shows the results for high-altitude jet routes. Unlike traffic on highways and railways, each jet follows a unique path. Though in some cases there are fairly distinct corridors, for much of the country the paths are quite dispersed.

The tracks used for the calculations of Figure 4 are all jet departures that occurred between 3:00 PM and 4:00 PM on October 17, 2000, using the full track to the first destination. The period 3:00–4:00 PM was chosen as typical of the numbers of flights during the day, and should include most common routes.

There are a few areas of the country where the estimation method is probably inaccurate. For some locations, the method likely overstates the extent of the audibility of jet traffic. Those areas that have several flights following a relatively narrow corridor are likely to have overestimates of areas. In areas that have both high baseline levels and airports, such as Los Angeles, Dallas–Fort Worth, and Atlanta, the method is likely to underestimate the noticeability. For simplicity, all tracks are assumed to be at 30,000 feet, and hence there are no climb and descent portions so that these segments around airports have predicted sound levels that are lower than the actual levels. This combination of high baseline sound levels and aircraft sound levels, which are too low, probably results in underestimation of the area affected.

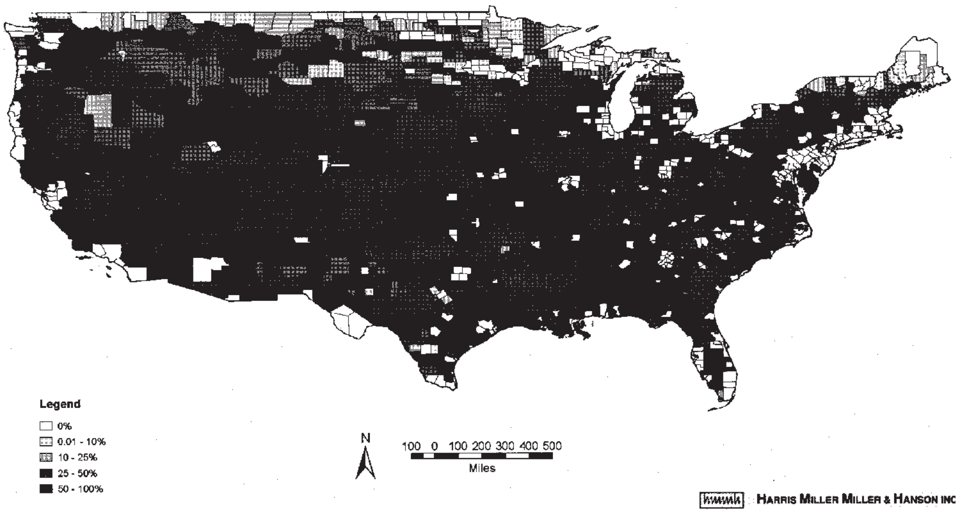

Figure 4. Percentages of county areas in which jet traffic noise is noticeable during the day

Interest in Preservation of Natural Soundscapes

Can knowledge of the extent of transportation noise alter our perceptions of the value of preserving, restoring, and managing selected natural soundscapes? As we continue to strengthen our transportation systems, making them more effective in geographic reach, will recognition of the nationwide spread of the associated noise alter how the public (and our government) views the value of managing to preserve areas where natural soundscapes can be experienced? Will it matter if there are no locations in the U.S. where one can sit for an hour and hear only the sounds produced by the natural environment?

It can be said that there is currently no national consensus on the value of natural soundscapes. On one hand, the U.S. Congress (supported by various interest groups) and various federal agencies have traditionally demonstrated a commitment to preserving natural settings, including the natural soundscapes. On the other hand, some businesses that provide motorized park activities, such as snowmobile rides or air tours, and their associated user/interest groups are concerned that preservation of natural soundscapes will prevent the businesses from meeting park visitor needs and make these recreational activities unavailable to those who want them.

U.S. public lands are designated through acts of Congress. These acts identify the purposes to be served by the specific land or type of land, and several types of public lands carry the mandate of preserving, restoring, and providing for an experience of the natural soundscape. National parks can be established for many different purposes, but overall, the National Park Service (NPS) was created primarily to preserve the resources of national parks (cf. National Park Service Act of 1916 and Redwoods Act of 1978). Although NPS management policy has identified the importance of preserving natural sounds, the director of NPS recently issued Director's Order 47, which states that:

> The purpose of this Director's Order is to articulate the National Park Service operational policies that will require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources (NPS 2000).

The Wilderness Act of 1964 established a process to identify specific areas as "wilderness," each of which would be an "area of undeveloped Federal land retaining its primeval character and influence ... which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation...."

The Wild and Scenic Rivers Act of 1968 also established a study process to identify and protect free-flowing rivers. Two relevant management objectives for the system are: (1) provide recreationists with the opportunity to experience a river setting similar to that seen by the first explorers, and (2) ensure that the rivers retain an essentially wild and pristine nature (BLM 1980).

Federal areas of the continental U.S. that might be the subject of soundscape management account for about 3% of the 48 states; these are national parks, national seashores, wild and scenic rivers, designated wilderness areas, and areas considered to have the potential to be designated as wilderness.

These different public lands have been established for various reasons, most of which are preservation-oriented, and NPS has specifically identified natural soundscape preservation as a management objective for national parks. Users of these public lands and associated interest groups, however, can have a wide range of expectations that may or may not include experiencing the outdoors in a natural state. The popularity of snowmobile use in Yellowstone, the use of personal watercraft in parks or recreation areas such as Glen Canyon National Recreation Area, and the many passengers on air tours over Grand Canyon National Park and over the Hawaiian parks suggest that many visitors seek experiences other than witnessing natural settings free of the effects of "man's work."

The validity of such park experiences is not in question here, but these experiences conflict with another view of the purpose of parks, as expressed by Joseph Sax (1980). In this view, parks are to provide the opportunity for members of the public to experience nature on its own terms. Visitors should be able to temporarily leave behind their to-do lists, their pursuit of objectives, even if recreational, to discover what they themselves are like when surrounded by the natural environment. Clearly, to provide opportunities for both this type of experience and for the more active motorized recreational experiences (bus, air and car tours, power boats, snowmobiles, etc.), management of park soundscapes is required.

Can Natural Soundscapes be Preserved?

It has long been recognized that portions of the nation's natural heritage should be preserved, and the extent of transportation noise throughout the U.S. emphasizes the importance and difficulty of this preservation as applied to natural soundscapes. Yet several current attempts to preserve/restore natural soundscapes in national parks are being strongly resisted through both political and legal means. From an acoustical perspective, the technical complexities of characterizing and assessing natural soundscapes are significant and open many opportunities for dispute. This combination of significant resistance and significant complexity suggests that development of a uniform, feasible, and effective soundscape management approach will at best be extremely difficult and time-consuming.

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Visitor Impact Monitoring in the Coastal and Barrier Island Network

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Introduction

The preservation of the eastern coastal and barrier island protected areas continues to be an important priority for the National Park Service (NPS). These sandy beach coastal areas have a long history of visitor use, as they provide outstanding opportunities for recreation and nature appreciation. Combined with their proximity to the major population centers of the eastern United States, it is no surprise that visitation levels are high, representing an on-going management challenge. Moreover, these areas are unique and dynamic ecosystems, providing habitat to rare species.

This paper reports the findings of the first phase of a three-phase study to test candidate variables for future visitor impact monitoring programs at seven important coastal areas managed by the NPS (Table 1). This project is under the auspices of the larger biophysical monitoring effort of the Coastal and Barrier Island Network.

We initiated this project with the overall objectives of (1) determining which of the coastal NPS units require visitor impact monitoring programs; (2) developing a clear conceptual model of visitor threats to resources, related vital signs, and relevant indicators of resource condition; and (3) developing and testing accurate monitoring and sampling protocols of the indicators of the visitor-affected resources.

Specifically, this paper reports on the results of the initial phase of the study, consisting of site visits to each of the coastal areas and in-depth manager interviews. We had several objectives for this phase of the study. First was to determine which visitor-caused impacts were of concern to managers, and the general magnitude and location of these impacts. Second was to determine a suite of possible indicators to monitor visitor impacts in these environments. And last, we investigated the commonalities of the impact concerns so future protocols could be applied consistently across all network areas. Future phases of this study will develop and field-test specific monitoring protocols.

Table 1. Coastal and Barrier Island Network areas

NPS Unit	State
Assateague Island National Seashore	Maryland
Thomas Stone National Historic Site	Maryland
Cape Cod National Seashore	Massachusetts
Fire Island National Seashore	New York
Gateway National Recreation Area	New York
Sagamore Hill National Historic Site	New York
George Washington Birthplace National Monument	Virginia
Colonial National Historical Park	Virginia

Project Context

Considerable research has been conducted over the last 40 years on the consequences of recreational activities on natural resource conditions (Leung and Marion 2000) but, interestingly, relatively few studies have been conducted in sandy coastal areas (for a complete review, see the paper by Ingle et al. in these proceedings). Two recent monitoring efforts, one at Cape Cod National Seashore (Marion and Cahill 2003) and another at Boston Harbor Islands National Recreation Area (Leung 2002) have developed extensive visitor impact monitoring protocols, and these projects provide a basis for this effort.

Visitors to coastal parks are engaged in a wide array of recreation activities, most of which generate some level of impact. While visitor activity impacts may occur in many areas, impacts occurring within sensitive, natural/pristine, or protected zones are of most concern because of the ecological and social value of these areas. Monitoring visitor impacts in these areas is consistent with the objectives of the NPS Vital Signs Program (Fancy 2002) and would provide valuable input to the program, as the impacts may constitute a significant threat to ecological health.

In contrast, visitor activity impacts in developed or high-use areas are expected and can be controlled through intensive facility development and site hardening. In this case, monitoring visitor impacts is less beneficial. We also restricted our focus to impacts that occur in the terrestrial zone, within which indicators can be more effectively defined and measured. Some visitor-caused impacts, such as water pollution, were not included because they are more effectively monitored under other programs. Our approach parallels the efforts at Cape Cod National Seashore (Marion and Cahill 2003) and is supported by the findings of the visitor use management working group of the Coastal Monitoring Network (Marion et al. 2001).

For this initial phase of the study, we conducted extensive manager and field staff interviews and site visits to each of the NPS areas. Our objective was to become familiar with the visitor impact issues and concerns at each area, determine the approximate magnitude of these impacts, and begin the process of selecting field sites for the testing of field methodologies during subsequent phases of the project.

Impact Commonalities

Visitor impacts on coastal resources are a significant concern to managers in all areas visited, although the degree of concern and the potential for significant impact is highly area-dependent. For example, Gateway National Recreation Area, located within the limits of New York City, sees over 8 million visits per year, with many of these visitors engaged in activities that can potentially affect coastal resources. Conversely, at Sagamore Hill National Historic Site, the majority of visits occur in the museum facilities, with very little current activity on the trails and the small beach area. Given these differences in visitor activities, the nature and extent of monitoring activities will be highly area-specific, but all areas could benefit from some level of visitor impact monitoring.

For the purpose of this study, we have identified two categories of visitor impact concerns: (1) those applicable to the development of monitoring indicators in the context of this study (*Study Impact Concerns*), and (2) those beyond the scope of this study but raised by managers (*Additional Impact Concerns*).

Study Impact Concerns

Visitor impacts to vegetation and soils. All areas reported and we observed both current and potential impacts to beach and upland vegetation communities as a consequence of day and overnight use. Vegetation and soil disturbance is primarily caused by foot traffic, and, in Colonial National Historical Park, by mountain biking. Managers report that little if any information exists on the location and extent of these impacts and whether impacts are changing over time. In some cases these impacts are site-specific, in areas where use is concentrated (e.g., campsites, coastal access points for fishing), and off hardened or resistant substrates (i.e., boardwalks and sand, respectively). In other cases these concerns are more widespread, such as the impacts of beach visitors to coastal sea beach amaranth, a federally listed plant species.

Wildlife impacts. Although some area-specific impacts on wildlife are occurring in the network, two impact concerns were common across the network. First was the impact of visitors on piping plovers (*Charandrius melodus*) and their habitat. Piping plovers occupy sand beaches and tidal flats and their numbers have been declining in recent years due to the extensive beach disturbance. Although significant management efforts are in place to limit visitor disturbance and preserve habitat during nesting season, it is not clear in all cases how much visitors are responding to interpretive information and complying with exclosures.

The second overall concern raised was the illegal harvesting of and interaction with wildlife. Assateague Island National Seashore and Gateway have concerns about the harvesting of fish, crabs, clams, and horseshoe crabs. Gateway experiences the illegal poaching of these animals and managers do not know the extent of the impacts or exactly how to prevent such activities. Managers at Assateague are concerned with the feeding and contact that visitors have with the wild horses.

Additional Impact Concerns

Off-road vehicle (ORV) use. Managers at Assateague, Gateway, and Fire Island National Seashore have raised concerns about the impacts of ORVs on coastal dune flora and fauna. At each of these areas, ORVs are limited to designated zones, specific trails, and/or travel corridors. In most cases total numbers of ORVs are limited by permit systems. Managers' observations would suggest that the nature and extent of ORV use has changed substantially at these areas over the last 10–20 years, with increases in numbers of visitors and shifts in visitor activity preferences. At Assateague, for example, previous ORV use was limited to a large extent to visitors engaged in sport fishing activities. As such, visitors would drive to an area above the tide line and park. Recently with the popularity of sport utility vehicles, more visitors are coming just to drive the beach, picnic, have campfires, swim, or to day-hike into the nearby dune and forest communities. Given the scope and extent of this project, we will not be developing monitoring indicators to address specific issues within the designated ORV zones, trails, or corridors. Monitoring protocols will address any impacts in natural areas adjacent to ORV zones where visitors may be traveling on foot or (illegally) by vehicle.

Proposed Indicators and Future Project Goals

"Vital signs" are key elements, processes, or features of the environment that can be measured and that indicate the condition of an ecosystem (Fancy 2002; Marion and Cahill 2003). In the forthcoming phases of this project, we will seek to address the study impact concerns as highlighted by managers and as outlined in the overall project plan by developing specific monitoring protocols for the measurement indicators identified below.

Vital signs, approaches, and measurement indicators appropriate to address the above concerns from a monitoring perspective fall into three categories: visitor use (Table 2), vegetation and soil degradation (Table 3), and disturbance of wildlife (Table 4). In order to appropriately address visitor impact concerns, initial information on the types, amounts, and distribution of impacts is essential. Technically, these elements are the actual agents of change, each with associated indicators (Table 2). The soil and vegetation and wildlife elements are vital signs of resource condition, again with associated indicators (Tables 3 and 4).

In the forthcoming phases of this project, we will examine the effectiveness and feasibility of the proposed indicators. More specifically, our immediate efforts are focused on the development of a conceptual visitor impact monitoring model for coastal ecosystems, additional monitoring methods development, follow-up site visits, gathering of GIS (geographic information systems) and visitor-use data from specific areas, and some preliminary field assessment. More long-term efforts will

Table 2. Agents of change, approaches, and indicators for changes in visitor use in natural zones

Agents of Change	Approach	Measurement Indicators
Types of recreation use	Managers' survey Direct field observation Entry point visitor survey	Use type
Amount of recreation use	Managers' survey Direct observation Trail/vehicle counters	Scale ratings of use frequency Observed number of visitors by activity type Number of hikers along selected trail segments
Distribution of recreation use	Managers' survey Direct observation Trail/vehicle counters	Location and extent of recreational use

Table 3. Vital signs, approaches, and indicators for extent of vegetation and soil degradation in natural zones

Vital Sign	Approach	Measurement Indicators
Vegetation loss	Direct on-site measurement at recreation sites and along trails	Relative cover loss (%) Changes in bare ground (%)
Vegetation compositional change	Direct on-site measurement at recreation sites and along trails	Individual species cover (%) Presence/absence of invasive plant species
Unintended trail formation	Direct on-site assessment and mapping	Location, extent, and mapping of visitor-created trails
Unintended site formation	Direct on-site assessment and mapping	Location, extent, and mapping of visitor-created sites
Shoreline disturbance	Direct on-site assessment and mapping in sensitive areas	Location, extent, and mapping of shoreline disturbance sites

Table 4. Vital signs, approaches, and indicators for disturbance of wildlife in natural zones

Vital Sign	Approach	Measurement Indicators
Disturbance type	Direct behavior observation	Type of visitor activities affecting wildlife (e.g., shorebirds)
Disturbance time	Direct behavior observation	Length of time of disturbance events
Attraction behavior	Direct behavior observation	Number of occurrences of wildlife feeding Number of occurrences of attraction behavior

lead to the completion of specific visitor impact monitoring protocols for all applicable areas in the Coastal Monitoring Network.

Conclusions

Managers throughout the eastern coastal and barrier island areas managed by NPS have raised concerns about visitor impacts on natural resources. These concerns can be categorized broadly as impacts on vegetation and soils, on wildlife, and of ORV use. Monitoring suggestions for these impacts consist of narrowing the scope of assessment to areas of the highest resource protection, where free-ranging, unregulated visitor use is occurring. Recreation ecology research indicates that this is of the most concern, as initial use can result in the majority of the impact. In this case, monitoring the agents of change, the visitor use and distribution, and specific indicators of soil, vegetation, and wildlife disturbance will address the majority of managers' concerns and will be applicable at the majority of NPS areas in the Coastal Network. Forthcoming field testing of specific protocols for the indicators will determine their appropriateness at and applicability to individual areas.

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Facts, Values, and Decision-Making in Recreation Resource Management

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Scientific management was a foundation of the resource management professions through the 20th century and remains our guidepost for the 21st. The concept served us well, halting the rapacious resource use of the late 19th century and ushering in a new era of more rational management. Yet the phrase is problematic—science deals with objective scientific facts, while management concerns values, and values are traditionally excluded from science. Phrased differently, management is done to achieve some goal, to accomplish some end that can, and will, be judged in value terms: as good or bad, right or wrong, beautiful or ugly, etc. At some level, scientific management conflates facts and values, often trying to transform difficult value issues into technical matters. Yet such transformations can leave us in murky waters that increase, rather than decrease, public criticism.

To illustrate, consider the case of Komar and Melamid, two dissident Russian artists who emigrated to the United States. Reasoning that, in a democracy, ordinary people's opinions about art mattered, Komar and Melamid conducted a scientific telephone marketing survey of 1,001 adults in 1993 (Komar and Melamid 1997). They asked their respondents to assume that they were going to buy a painting to hang in their living room. What should its dominant color be? Should it be modern or traditional? A landscape or a portrait? Indoor or outdoor? A seascape or a forest? What should be in it: Other people, animals? Which animals? What season? How should it be painted? The artists examined the preferences of both women and men, as well as people in various geographic, ethnic, and income groups. They used their results to identify the painting most preferred by Americans, and then they painted it!

The results, of course, are ridiculous, just as the art world had predicted. As described by Dissanayake (1998:487): "This painting was a 44% blue landscape showing water, clouds, distant hills, a highly treed foreground, casually dressed human figures, George Washington, a yawning hippopotamus, some children, and a male and female deer—all painted in a conventional, all-purpose nineteenth century realist style."

I have little doubt that Komar's and Melamid's tongues were well lodged in their cheeks. However, they have indeed performed a signal service by pointing out the danger of treating our research too literally. After all, all they did was to take the equivalent of one of our visitor surveys and treat the results verbatim. What they failed to do (intentionally, no doubt) was to interpret their survey-based "facts" within a broader, value-based context. I believe that recreation research and management suffers from a similar, but unintentional, failure. In the remainder of this paper, I discuss the uneasy relationships between facts and values, the various categories of value judgments, and the need to systematically enhance our ability to reason about value conclusions.

Facts, Values, and Fallacies

Facts and values have a complex, uneasy relationship with a long history. People have written about values—the good, the just, the beautiful—for over three millennia, but in modern (i.e., post-Renaissance) times, the person who cast the issue most clearly was David Hume, the great 18th-century Scottish philosopher. Hume noticed that his contemporary scientists described their world factually with statements about the nature of what is. However, as their discussion progressed, they gradually, almost imperceptibly, shifted from statements about what is (facts) to claims about what ought to be (values). What Hume demonstrated was that, under standard systems of logic, "ought" statements (values) cannot be derived from "is" statements (facts). Put differently, facts alone never tell us what we ought to do because the "ought" derives from a different source—from human goals and objectives.

Hume's writings set off two centuries of intense argument about the relationship between facts and values (which probably would have pleased him immensely). Although many philosophers have proposed solutions, Hume's logical analysis has held and, within the empirical tradition, there is an unbridgeable gulf between facts and values. It is this gulf which makes concepts such as "scientific management" dicey.

To understand the fact/value relationship, we need to examine both concepts more closely. Facts are objective—they inhere in the object and are considered to be independent of any particular observer. For example, the desk at which you work can be described factually. If we agree on measurement, it will be described as having a specific length, width, surface area, number of drawers, color, and so on. These attributes will remain unchanged no matter who is sitting at it. But often, what we really want to know is if it's a *good* desk, and that depends upon the needs of a specific person. A good desk for you may be a poor fit for me. Value relationships are thus subjective—specific to the individual—and involve *evaluation.* There are many ways to evaluate real-world objects and situations, and so we have multiple values. A traditional psychological classification includes economic values, moral values, aesthetic values, spiritual values, and rational values. Put simply, economic values are standards for judging goods and services; moral values provide standards for judging conduct; aesthetic values are standards for beauty; spiritual values are standards for meaning; and rational values are standards for judging truth. The next section briefly considers each of these values in relation to park management (for a more thorough discussion, see More et al. 1996).

Five Value Categories

Economic values are the standards we use to judge goods and services. Throughout their lives, people have to judge many different goods and services. Economic values are the standards we use to make such judgments, and economists have developed an elaborate system based on utility that quite literally enables us to compare the values of apples and oranges. Goods and services acquire utility simply because they help us fulfill goals. And, since not all goals are equal, goods and services differ in their value.

Parks, too, have utility since they help us to fulfill individual and societal goals. However, it is difficult to estimate this value in economic terms since parks are not trades in markets. Over the past quarter-century economists have devoted great effort to develop proxy measures of economic value for these resources. For example, it is possible to make a decision based on cost/benefit analysis, but people still may wonder if it is kind or just. Actually, moral values often trump economic values, so it is to these values that we turn next.

Moral values are standards for judging conduct. Honesty, fairness, altruism, kindness, justice, and so on form the general substance of this value category. Ordinarily, these values—which constitute the core of ethics—are applied to interpersonal relationships; they are lubricants for the social world.

Many park problems can be considered in moral terms. For example, is it fair to price parks when we know that such pricing excludes low-income people? Are park employees treated justly in their relationships with the agency? Do public involvement efforts incorporate a fair attempt at listening to all sides in a dispute? These and similar issues are frequently discussed from a moral perspective. Also important are the meta-ethical, decision-making criteria: Should a decision be made on the basis of the greatest good for the greatest number (utilitarianism), or is it more appropriate to consider individual rights (Kantianism). These latter questions are generally discussed under the heading of meta-ethics.

While traditional ethics concerns interpersonal relationships, environmental ethics has been concerned with evaluating our conduct toward the Earth and its various species. Many highly charged park issues concern the management of infrahuman elements of nature. But, while rights and duties are the very essence of human ethics, their extension to the infrahuman world is controversial.

A full treatment of moral issues in recreation resource management would require a textbook rather than a brief article. What is important is to recognize just how many park issues have powerful moral components. We need to increase our sophistication dealing with such issues.

Aesthetic values—the concern of Komar and Melamid's critique—are standards for appreciation. Natural environments can produce awe-inspiring beauty. But whether something is considered beautiful or not requires a judgment. By what standards do we judge something to be beautiful or ugly or simply commonplace? Actually, aesthetic judgments nicely illustrate the distinction between facts and values. We all know the phrase "Beauty is in the eye of the beholder," but few of us realize that that view is only 300 years old, a product of the intellectual revolution of the 17th and 18th centuries. Prior to that, in the period generally termed *classical,* beauty was very much an attribute of the object, a factual matter of form, line, and proportion. However, the Enlightenment produced a new emphasis on internal experience, so factors such as internal absorption, fascination, and intrinsic appreciation became important (see Averill et al. 1998). Aesthetics became a broad category that included the fascinating and grotesque as well as the beautiful, and distinguished between the aesthetic object (what is "out there") and our internal aesthetic experience. Research on natural aesthetics has focused on the object, asking what qualities make a scene or vista beautiful. Unfortunately, we have failed to understand the category's breadth—nature contains many fascinating things (predator–prey relationships, fungi, etc.) that may not be traditionally beautiful but that are important to people nonetheless. We misunderstand the power of aesthetic values at our peril.

Spiritual values are standards for judging meaning. As biological creatures, people are born with an enormous, but unstructured, cognitive capacity. Consequently, we are all motivated by an intense need to search for meaning—by the desire to interpret the events and circumstances of our lives within a context. Spiritual values provide the standards by which we judge such meaning. As such, they are the overarching set of values within which the other values operate.

Work in this area is just beginning and it is unclear how it will develop. Can we design opportunities for spiritual experiences or manage for them in some way? Or, given the First Amendment, should public agencies even be concerned with them? What is clear is that spiritual values are powerful determinants of attitudes and behavior. While we may not be able to manage for them, neither can we neglect them.

Rational values provide the standards we use to judge truth. While it may seem odd to consider rationality a value, there is a generic quality of "oughtness" to it—rational decisions are good decisions, and irrational decisions are bad. However, the standards by which we judge rationality are normative. For example, have we been logical (i.e., objective and impartial, internally consistent, and in conformity with the rules of inductive and deductive influence)? Have we been willing to consider alternative explanations and subject our ideas to tests of falsification? And are our goals realistic, and our methods appropriate? These are the normative criteria that represent rational values; when decisions meet these criteria, they are considered rational and no further work is needed.

Each value category is represented by specialists with their own intellectual approaches. For example, rational values are the domain of scientists, while economists specialize in economic values. Moral values, including environmental ethics, are the concern of ethicists. In the future, we may see the development of a "recreational ethics" to deal with applied problems in recreation management, just as medical ethics helps physicians think through difficult problems. Landscape architects are concerned with aesthetic theory, while spiritual values are the province of theologians. To date, I know of no specialists in "natural theology," but who knows how this area may develop?

From Facts and Values to Decisions

How, then, should we integrate science and values in decision-making? Komar and Melamid's (1997) results suggest the folly of failing to place the scientific facts into the broader context of aesthetic theory. It is interesting that their "art of the commons" reflects a mid-19th-century aesthetic. Historically, great art has tended to be produced by avant-garde artists who stretched the boundaries of contemporary style to create something new. A similar argument exists in the landscape literature. Carlson (1977, 1984) argues that great landscapes are created by individuals like Capability Brown or Frederick Law Olmsted, and that all the public research on aesthetic preferences has only led us to the conclusion that the public likes the kinds of scenes that are printed on postcards—something we already knew. Ribe (1982), by contrast, argues in favor of an egalitarian aesthetic.

So, should aesthetics be elitist or egalitarian? Disputes of this kind usually have some truth on each side. The opinions and aesthetics of ordinary people matter, but preferences change with the times so that our management can only be improved by interpreting the results of public opinion polls within the broader context of aesthetic values theory.

A similar situation arises with carrying capacity. It is commonplace to advocate use restrictions to preserve quality. But such restrictions raise other questions: How they can be implemented *fairly* is a moral issue, at least in the public sector. Higher fees are one rationing mechanism, but fees have a substantially greater impact on low-income people than on upper-income people (More and Stevens 2000; Reiling et al. 1994). Lotteries or other complex rationing schemes raise similar questions. Perhaps more importantly, current projections suggest that the U.S. population will nearly double by the year 2050 (U.S. Census Bureau 2003). If this occurs, it is likely that it will alter the entire way we construe parks and their social functions in society.

I also am concerned that our emphasis on capacity may lead to an undue emphasis on protection and visitor regulation and control, especially when coupled with programs such as the fee demonstration program. Unless we consider their broader ramifications in a value context, such programs have the potential to return us to the elitism that characterized the start of the American park and recreation movement. To love natural areas, people must be encouraged to participate. More than 20 years ago, Joseph Sax (1980) argued that the focus of national park policy ought to be to get people to take the first few steps away from their cars and toward the wild. Sax's argument is even more pertinent today and we ignore it at our long-term risk.

In sum, rote, rule-based decision-making of any sort is likely to prove overly simplistic. The facts in a situation are both important and illuminating, but they must be interpreted within the broader goals of recreation management, which are value-based and will likely shift with the times. Ultimately, science is still no substitute for simple dithering, trying to think as broadly as possible about the context and consequences of a decision and wondering if it is good or bad, right or wrong, beautiful or ugly.

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Evaluating Carrying Capacities for Protected Areas

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This paper discusses the concept of carrying capacity and proposes a new carrying capacity method for protected areas. What is considered the first documented concern about carrying capacity in national parks occurred in the mid-1930s when the National Park Service (NPS) posed the question: "How large a crowd can be turned loose in a wilderness area without destroying its essential qualities?" and the retort that recreation use be kept "within the carrying capacity" (Sumner 1936). The 1978 National Parks and Recreation Act (P.L. 95-625) requires carrying capacities to be determined for each park as part of the process of developing a general management plan. Specifically, amendments to Public Law 91-383 (84 Stat. 824, 1970) require general management plans developed for national park units to include "identification of and implementation commitments for visitor carrying capacities for all areas of the unit" and determination of whether park visitation patterns are consistent with social and ecological carrying capacities. Amendments to the National Trails System Act (Public Law 90-543, 1968) mandate "an identified carrying capacity of the trail and a plan for its implementation" be developed in comprehensive trail planning. Regulations implementing the National Forest Management Act of 1976 dictate that, in wilderness management planning, provision be made "for limiting and distributing visitor use of specific areas in accord with periodic estimates of the maximum levels of use that allow natural processes to operate freely and that do not impair the values for which wilderness areas were created." Similarly, the National Outdoor Recreation Plan requires "each federal recreation land managing agency [to] determine the carrying capacity of its recreation lands" (Bureau of Outdoor Recreation 1973).

Two forms of carrying capacity are relevant to protected areas: *human,* or social, and *biological,* or ecological (Seidl et al. 1999). Thomas Malthus gave, perhaps, the earliest analysis of human carrying capacity. He postulated that human population growth would outstrip the land's capacity to produce food resulting in food shortages (Malthus 1986 [1798]). In range and wildlife management, biological or ecological carrying capacity is defined as the maximum population of a particular species a habitat area can support in a given period of time without reducing the future ability of the area to support the species or damaging the area (Miller 1990; Hawden and Palmer 1994; Hanley et al. 1999). Leopold defined it as the maximum density a range is capable of supporting (Dhondt 1988). Exceeding a protected area's ecological carrying capacity increases the risk of irreversible ecosystem change, such as declines in plant community structure or species diversity (Caughley 1979; Wallace 1999). Other ecological effects include loss of soil and vegetation and damage to trees and wildlife disturbance (Manning 1998; Leung and Marion 2000). However, these definitions oversimplify the dynamic interactions between animal populations and landscapes, which are characterized by nonlinear dynamics and population thresholds (Seidl and Tisdell 1999).

In the mid-1960s the carrying capacity concept for protected areas was expanded beyond ecological effects to include human or experiential effects of visitation (Wagar 1964). Examples of such effects include crowding, use conflicts and excess resource degradation (Manning 1998; Leung and Marion 2000). Visitor carrying capacity for protected areas is defined as the maximum number and type of visitors an area can sustain without causing irreversible deterioration of the physical environment and appreciable loss of visitor satisfaction (Shelby and Heberlein 1986; Seidl and Tisdell 1999). Since the human, ecological, and economic components of visitor carrying capacity differ, carrying capacity is difficult to define. Biophysical characteristics of an area (e.g., vegetation type, topography and climate), human factors (e.g., location and mode of travel, season of use, group size, and behavior of other visitors), and management policies (use limitations) are more important determinants of ecological and social (visitor) carrying capacities than simply the size of the population or number of visitors. Accordingly, contemporary definitions of carrying capacity consider the acceptability of human, ecological, and economic impacts of visitation. In addition to these impacts, increased use of a protected area can alter management actions. Specifically, increased use is likely to result in more intensive management practices, such as periodic rest and rotation of degraded areas, construction of new roads and trails, and others (Manning et al. 1996b). In general, carrying capacity depends on value judgments, institutional arrangements, technologies, consumption patterns and human goals (Seidl and Tisdell 1999).

Carrying Capacity Methods

Several quantitative measures of carrying capacity have been developed and applied. The three most common ones are Limits of Acceptable Change (LAC), Visitor Impact Management (VIM), and Visitor Experience and Resource Protection (VERP). Rather than defining carrying capacity as the maximum number of visitors allowed in an area, the LAC method evaluates the acceptability of visitor impacts on key biophysical and social processes (Stankey et al. 1985; McCool and Cole 1997). Impact acceptability is judged by comparing a set of indicators of biophysical and social processes to standards of quality that "define the minimum acceptable condition of indicator variables" or limits of acceptable change (Newman et al. 2001). The latter define the desired future conditions for resource, social, and managerial settings (Merigliano 1990; Manning 1999; Newman et al. 2001). In essence, limits of acceptable change articulate the management objectives for an area (Frissell and Stankey 1972; Manning et al. 1996a; Manning 1999). If indicators exceed established standards, then a management action is taken to bring indicators into conformance.

The VIM method is very similar to the LAC method. It evaluates visitor impacts by comparing standards for key indicators of natural resources, cultural resources, and visitor experiences with values of those indicators measured under existing field conditions, and identifies and implements appropriate management action when standards are violated (Graefe et al. 1990). LAC and VIM have been applied to backcountry management planning in Shenandoah National Park (Marion et al. 1985).

In 1992, NPS established the VERP method to evaluate carrying capacity in developing general management plans for park units (U.S. Department of the Interior 1997). The VERP method was first implemented in Arches National Park (Hof et al. 1994; Manning 2001) and a number of other national parks in the United States (Vande Camp et al. 2001). Like the LAC and VIM methods, the VERP method determines the amounts and kinds of visitor use a management zone can sustain without causing unacceptable resource and social impacts (Shelby and Heberlein 1986, Manning et al. 1996a). Resource impacts include loss in vegetation, tree damage, soil erosion and compaction and wildlife disturbance, and social impacts encompass crowding, use conflicts (e.g., snowmobiling vs. cross-country skiing), reduced quality of visitor experiences due to excessive resource degradation and other factors that diminish visitor satisfaction (Leung et al. 2002). Other carrying capacity methods include Visitor Activity Management Planning (Nilsen and Grant 1998) and the Tourism Optimization Management Model (Manidis Roberts Consultants 1997).

Implementation of the VERP method requires managers to (1) select appropriate management objectives for different zones within a protected area; (2) translate the objectives for each zone into indicators and standards of quality for resource and social impacts; (3) implement a monitoring program to measure indicators; (4) design and implement a new management action when the standards are violated; and (5) monitor the new management action for compliance with the standards (Manning 2001; Leung et al.

2002). The LAC, VIM, and VERP methods have several elements in common, namely (1) determining the types of recreation opportunities to be provided in different zones; (2) defining opportunities in terms of specific indicators and standards of quality; (3) monitoring indicators for compliance with standards; and (4) implementing appropriate management actions when standards are violated (Manning 1999).

Proposed Method

The proposed method for evaluating carrying capacity is called the Multiple Attribute Scoring Test for Capacity, or MASTEC (Prato 2001). MASTEC integrates elements of the LAC, VIM, and VERP methods. It allows managers to quantitatively determine whether the current state of a protected area ecosystem is in compliance with established standards for ecological and social carrying capacities when there is uncertainty regarding the state of the ecosystem (phase 1) and, if the standards are violated, uses a multiple-attribute evaluation method to identify the best management action for achieving compliance with the standards (phase 2). Consider a unit of the National Park System that encompasses an ecosystem that can be in one of four mutually exclusive states of compliance with biophysical and social carrying capacities: M_1 (highly non-compliant), M_2 (moderately non-compliant), M_3 (moderately compliant), and M_4 (highly compliant). Prior probabilities of states are $p(M_1)$, $p(M_2)$, $p(M_3)$ and $p(M_4)$, which sum to 1 and represent expert judgment about the current probabilities of different states of compliance. Suppose the park manager believes states M_1 and M_2 indicate non-compliance and states M_3 and M_4 indicate compliance with carrying capacities.

Let the ecosystem's current state of compliance be evaluated in terms of two ecological attributes (percent of native species present and habitat suitability for an endangered species), and two social attributes (level of congestion on backcountry hiking trails and the length of time visitors have to wait for in-park transportation). In addition, let the state of the ecosystem be assessed in terms of four measured ecosystem conditions as follows. R_1 represents significant losses in native species, highly degraded habitat for endangered species, high congestion on trails, and very long waiting times. R_2 represents moderate losses in native species, moderately degraded habitat for endangered species, moderate congestion on trails, and long waiting times. R_3 represents most native species present, good habitat for endangered species, low congestion on trails, and short waiting times. R_4 represents widespread abundance of native species, excellent habitat for endangered species, no trail congestion, and very short waiting times. Ecosystem conditions improve from R_1 to R_4. Bayes' theorem, which comes from Bayesian statistics (Peterman and Peters 1988), is used to minimize the occurrence of two kinds of decision errors that the park manager can make in determining the current state of the ecosystem. The first error is that manager decides the ecosystem is M_3 or M_4 (compliant states) when it is really M_1 or M_2 (non-compliant states). When this error is committed, the manager takes no corrective action when such action is warranted. The second error is that manager decides the ecosystem is M_1 or M_2 (non-compliant states) when it is really M_3 or M_4 (compliant states). When this error is committed, the manager takes corrective action when no such action is warranted, which implies unnecessary expenditures.

An outcome is defined as a combination of an ecosystem state and condition. For example, the outcome (M_1R_2) represents ecosystem state M_1 and ecosystem condition R_2. Since outcomes are mutually exclusive, the prior probability of an ecosystem condition, say R_2, is the sum of the joint probabilities:

$$p(R_2) = p(M_1R_2) + \ldots + p(M_4R_2) = \Sigma_i p(M_i)p(R_2|M_i),$$

where $p(M_i)$ is the prior probability of M_i and $p(R_2|M_i)$ is the likelihood function or the likelihood of observing R_2 given the ecosystem state is M_i. The posterior probability is the probability that the ecosystem is in state M_1 given the condition is R_2. It is determined from Bayes' theorem as follows:

$$p(M_1|R_2) = p(M_1R_2)/p(R_2) = [p(M_1)\, p(R_2|M_1)]/[\Sigma_i p(M_i)p(R_2|M_i)].$$

The posterior probability combines the prior probabilities and the likelihood functions. The importance of the prior probability relative to the likelihood function in determining the posterior probability decreases (increases) as the amount of new data provided by management actions increases (decreases).

An example of how Bayes' theorem is used to calculate posterior probabilities is given in Table 1. The example shows posterior probabilities for four hypothetical ecosystem states with ecosystem conditions R_1 and R_3. The fourth column of the table shows that ecosystem state M_1 has the highest posterior probability (0.63) when the ecosystem condition is R_1. Since M_1 is not compliant with carrying capacities, then the second stage is needed to determine the best management action for achieving compliance with carrying capacities.

The second-stage decision is modeled as the following mathematical programming problem, which for simplicity contains only one ecological and one social attribute:

$$\text{Max } U(A) = w_j\, e_j^* + w_k\, s_k^*$$
subject to:
$$p(e_j^* \geq e_j^{**}) \geq 1 - \alpha_j \text{ and } p(s_k^* \geq s_k^{**}) \geq 1$$

$$- \beta_k 0 \leq w_j \leq 1,\ 0 \leq w_k \leq 1 \text{ and } w_j + w_k = 1$$
$$0 \leq \alpha_j \leq 1 \text{ and } 0 \leq \beta_k \leq 1.$$

where A stands for management action for complying with carrying capacities, U(A) is the utility provided by A, e_j^*, and s_k^* are normalized mean values of the ecological and social attributes of management actions, respectively, w_j is the weight for the j^{th} eco-

Table 1. Posterior probabilities for four hypothetical ecosystem states with ecosystem conditions R_1 and R_3

		R_1		R_3	
Ecosystem state	$p(M_i)^a$	$p(R_1\|M_i)^b$	$p(M_j\|R_1)^c$	$p(R_3\|M_i)$	$p(M_i\|R_3)^d$
M_1^e	0.4	0.5	0.63[g]	0.1	0.19
M_2^e	0.3	0.3	0.28	0.2	0.29
M_3^f	0.2	0.1	0.13	0.4	0.38[h]
M_4^f	0.1	0.1	0.06	0.3	0.14

a. Prior probabilities of ecosystem states
b. Likelihood functions
c. $[p(R_1 \mid M_i)\, p(M_i)]/[\Sigma_i p(R_1 \mid M_i)\, p(M_i)]$

d. $[p(R_3 \mid M_i)\, p(M_i)]/[\Sigma_i p(R_3 \mid M_i)\, p(M_i)]$

e. States not in compliance with carrying capacities
f. States in compliance with carrying capacities
g. Maximum posterior probability for condition R_1
h. Maximum posterior probability for condition R_3

logical attribute, w_k is the weight for the k^{th} social attribute, and e_j^{**} and s_k^{**} are the normalized standards for ecological and social attributes, respectively. Chance (probabilistic) constraints require the best management action to provide biophysical attributes that are at least as great as the biophysical standards for carrying capacity with reliability $1 - a_j$ and social attributes that are at least as great as the social standards for carrying capacity with a reliability $1 - b_k$. Suppose the management action determined by solving the above mathematical programming problem is implemented and leads to ecosystem condition R_3. As Table 1 illustrates, the highest posterior probability given R_3 is for ecosystem state M_3. Since M_3 complies with carrying capacities, there is no need to alter the management action until ecosystem conditions change.

Mathematical optimization models, like the one given above, have been used to address a variety of natural management problems. Prato and Wu (1995) used a chance-constrained linear programming problem to determine the economically efficient farming systems for improving water quality in an agricultural watershed in north-central Missouri. Peterson et al. (1994) used mixed-integer programming to implement a multiple-objective planning process for inventory and monitoring programs in Olympic National Park in the state of Washington.

Conclusion

Units of the National Park System are managed to conserve their natural and cultural resources for the benefit of future generations, and allow public enjoyment by the current and future generations. This dual mandate and the legal requirement to identify and implement visitor carrying capacities for park units pose a major challenge for park managers. Meeting this challenge requires defensible, quantitative procedures for assessing and complying with ecological and social carrying capacities. The carrying capacity method proposed here (MASTEC) incorporates Bayesian statistics, multiple-attribute decision-making, and mathematical programming. Implementation of MASTEC requires considerable information. This feature alone is likely to discourage its use by park managers. Implementing MASTEC using a spatial decision-support tool would significantly increase user accessibility. In addition, the tool would facilitate public understanding and hopefully acceptance of the procedures used by protected areas to comply with carrying capacities.

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Who Will Keep the Night?

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No sight that human eyes can look upon
is more provocative of awe than is the night sky scattered thick with stars.
— Llewelyn Powys, philosophical poet

Parks across the country have been set aside to preserve a diversity of natural and cultural resources, from the impressive thermal features in Yellowstone to the historic Liberty Bell in Philadelphia. However, one resource historically has been overlooked; it is both natural and cultural and can be found in every park. It can even be found in your own back yard: it is the night sky. For millennia the night sky has remained unchanged, but within the past hundred years it has become filled with airplanes, satellites, and the glow of city lights. When we go out and look at the stars, planets, and moon, we are seeing essentially the same sky that ancient peoples once saw. The night sky is our best link to all human cultures that have gone before us, providing a way for us to better understand them. Although it has been affected by the technology of humans, of all the resources on Earth it is the one we have the most power to restore.

All over the world human beings have been sky watchers for thousands of years. The sky and objects within it have appeared as magical and faithful companions integrated into daily life. In many canyons and valleys, on buttes and mesas, and in many of the cultural remains across the southwestern United States, we find evidence of astronomical activities. Sun, moon, and star images are carved into or painted onto rock faces. Some of these images interact with celestial objects throughout the year, revealing light and shadow events that display and mark the passage of time. Some buildings are aligned to the solstice or equinox and entire communities may have settled in certain locations based on a distinct horizon in order to obtain an accurate calendrical cycle. Based on deductions from archeological sites and by understanding present-day American Indians, we know this calendrical cycle was important for determining many events, such as when to plant and harvest crops, perform certain ceremonies, and hunt. These are basic societal activities that need to be done at certain critical times in order to sustain human life. It is also apparent that observation of celestial objects and phenomena was fundamental in the ancients' mythology, possibly giving them a way to identify their role and place within the universe and to connect them with their entire surrounding environment.

Chaco Culture National Historical Park is a unique place located in the northwest corner of New Mexico. By about 900 AD, this canyon was bustling with people. Archaeologists believe that up to 6,000 people lived here at one time, and thousands more would travel through. In many ways, life would have been very similar to our lives now. These people had the same mental abilities and hence the same power of imagination we have. They spent a lot of time and effort building vast roadways extending hundreds of miles. They constructed homes and buildings, both public and religious, some containing hundreds of rooms. They were farmers who worried about what they were going to eat and when. They were also astronomers who would sit under the immense sky at night and ponder over all they saw there. They left behind for us many clues demonstrating how they tried to give order to what might have seemed like chaos in the sky.

Fajada Butte is a very distinctive landmark at Chaco and can be seen from up to 40 miles outside the canyon, serving as a beacon for travelers then and now. Atop this butte is one of the most complete solar markers in the world. It has become known as the "Sun Dagger" (Figure 1). This site consists of three sandstone slabs that lean on their side against the cliff face. Beneath these slabs two spirals have been carved and strategically placed to physically interact with the sun at special times throughout the year. The summer solstice is the longest day of the year, when the sun will rise at its northernmost position along the horizon. On this day, when the sun reaches its highest point in the sky (around noon), light at the Sun Dagger will shine through the gaps between the three slabs and project a dagger of light that completely bisects the larger of the two spirals. On the winter solstice, when the sun is at its southernmost position, two daggers of light will bracket the large spiral. Then, on the vernal and autumnal equinox, the sun's position is directly between the two solstices. It rises due east and sets due west, when there is equal amount of daylight and darkness. On this day the two daggers of light bisect both spirals. From the first sliver of light to the last, the daggers move quickly and very accurately mark these special times, giving all those who are privileged to witness it a feeling of living on a moving planet. We can be sure the order and magic of this event was greatly anticipated year after year.

The Sun Dagger is a beautiful example of how sites interact with the sun. However, the stars were also an inspiration in developing these markers. Many of the walls of the buildings in Chaco Canyon align directly north–south or east–west. It has been suggested that not only was the North Star used to give direction, but was also used in the planning of individual buildings and to precisely lay out the civilization as a whole. At least four buildings lay on the north–south line, one of which is Casa Rinconada, a ceremonial kiva. All great kivas have a doorway either on the north or south side. The northern doorway in Casa Rinconada was built of extra-large proportions allowing those inside to see the North Star at night.

In Canyon de Chelly National Monument, Arizona, you may find hidden in many rock shelters what archeologists first called "ancient planetariums"; a more appropriate term today would be "star ceilings" (Figure 2).

Figure 1. This dagger bisects a carved spiral to mark the beginning of the summer solstice; the Sun Dagger, Chaco Culture National Historical Park.

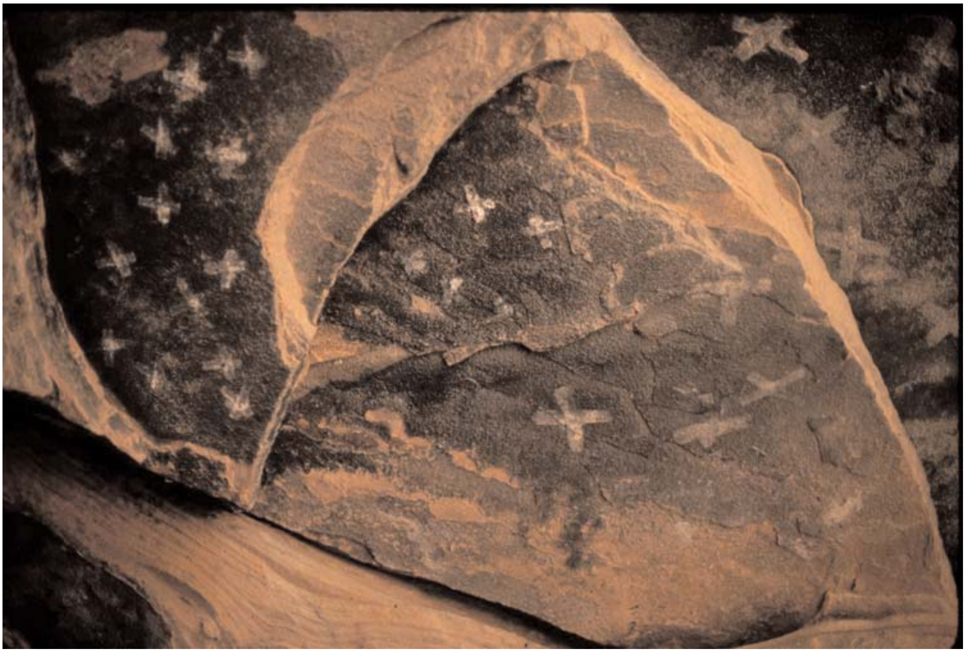

Figure 2. The ceilings of many of the alcoves scattered around Canyon de Chelly National Monument are adorned with stars.

The ceilings of such rock shelters have four-pointed stars painted on them. Some of these images were shot up with an arrow dipped in paint. Some believe they functioned somewhat like a planetarium of today, displaying the stars during the day in order to tell stories and mythologies under them. We can never be completely sure of the intended purpose of such places, but we do know the Navajo created these star ceilings, and most Navajo rituals were performed for protection. In addition to looking to the stars for protection, the Navajo used certain star patterns to symbolize many of their moral codes. The Fire Star (North Star), Revolving Male (Big Dipper), and the Revolving Female (Cassiopeia) serve as a reminder of how life should be inside a hogan as each of these constellations revolve around one another and revolve around the center fire. Dilyéhé (the Pleiades star cluster) are carefully observed to know the proper time to plant crops. A farmer must wait until this star pattern can no longer be seen in the evening sky in the spring or a late frost will likely destroy the crops. They also must be sure to plant before Dilyéhé can be seen rising in the morning sky or it will be too late for the plants to mature before winter. When the tail end of Scorpios, which is known as the Rabbit Tracks, reaches a certain position in the sky, it signals the beginning of hunting season. Even with all our modern comforts we can still see how these star patterns serve as a guide to plant gardens or to hunt.

Not only for the Navajo, but also for many of the Pueblo Indians, astronomical activities flourished for decades in their communities. Modern-day Puebloans believe the night sky is an important resource to preserve and protect, not only for the connection to past generations, but also for the teaching of future generations. Some still teach their children about the sky in the home environment. Many tribes across the country are aware of their cultural past and take pride in connecting their youth and themselves to their ancestors through observations and oral histories.

Although the sky is usually dependable, if you watch it long enough, it can still throw in an element of surprise, such as the random shooting star, to more uncommon things like comets or supernova. In Chaco Canyon just seven miles west of the Sun Dagger, there is a pictograph placed in a thoughtful location to shelter it from weathering. It consists of a handprint, crescent moon and star burst (Figure 3). Some believe this to be a recording of a supernova. In 1054, at the height of the Chacoan civilization, a supernova occurred that could be seen for 23 days during the daytime before slowly fading out. Those living in Chaco at this time could have read by it at night. We can be sure that they noticed it. What a mysterious event to occur in an otherwise constant sky. They probably understood it differently than we do today, and perhaps it scared them a little. It could have been interpreted as a sign from their gods or as an omen that a change was about to happen. The first day the supernova appeared and when it was at its brightest, a crescent moon could be seen next to it. The handprint might be the artist and historian's signature. Others who have visited this rock art panel suggest it represents Venus and the moon, which frequently align in the sky. Still others believe it to be the sun and moon, which would mark a sun-watching station. No matter how one chooses to see these symbols, they are still of astronomical significance.

There is another symbol located at this site, which I believe makes it even more powerful. It is placed on the vertical wall just below the others. There are three concentric rings with a large tail of red paint protruding away from them. It has been suggested that it looks like a comet. In 1066, Halley's Comet could be seen in the sky over New Mexico, only 12 years after the appearance of the supernova, making it possible for the same

Figure 3. The upper three images are painted on an overhang about 25 feet high. Some believe that they may represent a supernova that appeared in 1054. The concentric circles painted below may represent Halley's Comet, which appeared in 1066.

person to have recorded both events. How sad it would be if such a rare event were to happen today and most of the people living on this planet would not be able to see it.

To help connect visitors to the astronomical past, some of the staff in Chaco Culture National Historical Park and volunteers from the Albuquerque Astronomical Society have developed an on-going astronomy program. The geologic formations found there make a scenic backdrop for the observatory located just behind the visitor center. Telescopes, research-quality computers, and cameras are available to visitors to extend their experience of the night sky beyond unaided vision. Park staff and volunteers are experts in sharing the sky with today's sky watchers. Those who participate in the program have the opportunity to look through a telescope, or to sit in the darkness and be overwhelmed by the pristine sky. Many who visit Chaco can have new experiences with the sky, like seeing the Milky Way or the moons of Jupiter for the first time. They will also learn of the ancient astronomy once practiced there. Connecting to the past culture at Chaco can help visitors understand their own culture and how they fit into the universe today. What else could be a more appropriate national park experience?

It is a feeble light that comes to us from the stars, but without it what would be the present condition of Man's mind?
— Jean Perrin, physicist

The sky hasn't changed much with time, and our reason for viewing the sky hasn't changed: we still want to pontificate how we fit into the universe. The Ancestral Puebloans were astronomers too, just using different tools of science to gain this universal understanding. With modern technology, professional and amateur astronomers alike have been able to look deeper into space, and therefore further back in time, than ever before. With powerful telescopes and cameras, astronomers can conduct research and obtain beautiful images of deep-space objects. However, with the encroaching light pollution, now astronomers of all kinds have only a few places they can go to observe a high-quality sky. They travel high atop mountain peaks, they have sent telescopes into space, and they have discovered the dark skies in our national parks. Some will drive hundreds of miles to escape a city to observe the sky in a national park. The Anasazi merely had to step outside their doors.

After becoming aware of the importance of the night sky to national park visitors, the National Park Service (NPS) started a small project dedicated to preserving the night sky. The NPS Night Sky Team is using CCD (charged couple device) cameras to take baseline measurements of light pollution affecting certain parks nationwide. Some parks, such as Petroglyph National Monument, which borders the large metropolis of Albuquerque, has already lost a large portion of their night sky. Other parks throughout the American Southwest are under serious threat of losing their night sky in the near future if urban expansion continues at its current rate. Satellite images of the Earth at night taken over the past 40 years show the steady increase of light pollution. Scientists have estimated what the night sky will look like in the next 20 years if we continue to ignore it; the amount of sky that will be lost is disastrous. We have a great opportunity now to educate people and save the night sky from disappearance.

For years now we have recognized the importance of preserving sites such as the Sun Dagger at Chaco, or the star ceilings at Canyon de Chelly. By preserving these sites, we are preserving a piece of the people who made them. However, we have forgotten to preserve the thing that inspired them. If the Ancestral Puebloans, or even our own ancestors, faced the same problem of losing the night sky as we do today, how dramatically different their lives would have been and hence how different our lives would be. We have already lost the pristine sky where most of the world's people reside. We have a responsibility to preserve this resource for our children, and it is imperative we keep at least a few places where people can go to be inspired by the sky. There is hope; we haven't completely lost the sky yet.

Yellowstone Wildlife Watching: A Survey of Visitor Attitudes and Desires

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Background

For 60 years or so, Yellowstone was the place where visitors came to feed the bears. People got hurt, bears got killed, and the National Park Service (NPS) got sued, but still the park's managers failed to see how it would ever be possible, or even desirable, to end the roadside feeding that was at once so desired and so detrimental. In 1968, Yellowstone's rangers finally started enforcing the no-feeding regulations that had existed in the park since 1902, and roadside feeding was ended within a couple of years. By 1971 or so it was uncommon to see a roadside bear, and unhappy visitors were demanding to know where they had all gone. The park generally provided a prescriptive response to these queries, informing visitors that seeing fewer bears leading natural lives was a preferable experience to seeing many bears being denigrated by begging. Did visitors believe it? Some did, some didn't; the process of convincing visitors to "think like an ecosystem" in the wake of the vast policy changes of the past 35 years has been a long one, and the goal of this work was to gauge how far we've come, and catch a glimpse of how far we might have to go.

The Survey

Over the course of 13 days during the period May–August 2001, I administered a 15-question survey to a random sample of 150 visitors in the Old Faithful viewing area. The survey assessed attitudes and desires in regard to a number of issues related to wildlife watching in Yellowstone. Responses were coded and recorded using qualitative analysis software.

Expectations

Question: What do you most hope to see while in Yellowstone? If you could name three things.

There were a fairly wide range of desired sights, but most could be categorized in terms of either wildlife, thermal features, or natural scenic features. Figure 1 shows responses that occurred at least 10% of the time, demonstrating that among those interviewed for this proj-

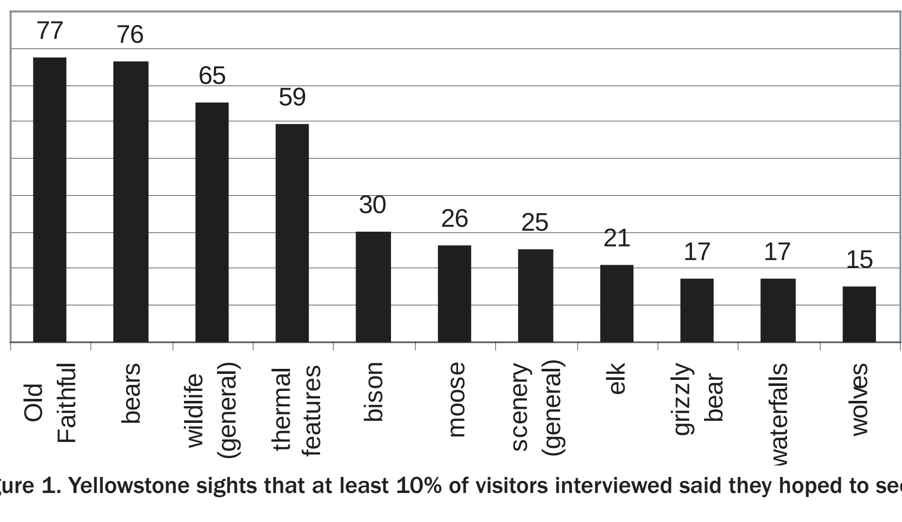

Figure 1. Yellowstone sights that at least 10% of visitors interviewed said they hoped to see.

ect, Yellowstone's most desired sights were Old Faithful, bears, wildlife, thermal features, bison, moose, scenery, elk, grizzly bears, waterfalls, and wolves, respectively. Old Faithful and bears appear to remain the park's most popular sights by far, with a little more than half of all respondents naming them as one of the three things they most wanted to see while in the park.

Question: On a scale of 1–5, with 1 being "not very important" and 5 being "very important," how important is it to you to see a bear during your visit?

In spite of the fact that an impressive one-half of the visitors interviewed had stated, unprompted, that a bear was one of the three sights they most wanted to see, it was not crucial to most people that they see one. The overall average answer to this question was 3.29—somewhere in the middle. Overall, it appears that visitors come to Yellowstone today to see the things they have always come to see: extraordinary thermal features, wildlife—bears in particular—and beautiful scenery. The only average importance of seeing a bear to the overall quality of one's trip would seem to indicate that although visitors still commonly associate bears with Yellowstone, seeing a bear is no longer a driving reason for making the trip, in spite of the fact that they still appear to be one of the park's main attractions in the visitor mind.

Collared Wildlife

The debate over whether wild animals living in national parks and wilderness areas should be collared for scientific monitoring purposes has raged almost since the Craighead brothers pioneered the technique in Yellowstone during the 1960s. Collars and other markers have gotten smaller and less conspicuous over the years, but some people maintain that any visible marking is deleterious to the viewing experience and makes the marked animal seem "less than wild" because it is an indication of interaction with humanity. In this way, collaring shakes the façade of untouched nature that many people attribute to national parks and wilderness areas.

Proponents of collaring maintain that the amount and quality of knowledge that can be obtained from monitoring certain members of an animal population far outweighs the negative visual effects. Among other things, researchers can now learn the extent of an animal's range, measure its length of life, discover what sorts of food sources might hold it in a certain place for extended periods of time, track its reproductive history, and find out how it uses land throughout the day and night—all of which is valuable information for managers charged with making land use decisions within the Greater Yellowstone Ecosystem.

Question: (a) Have you seen any park animals wearing radio collars or ear tags?

Roughly 23% of the visitors interviewed believed that they had seen an animal wearing a radio collar or an ear tag (Figure 2).

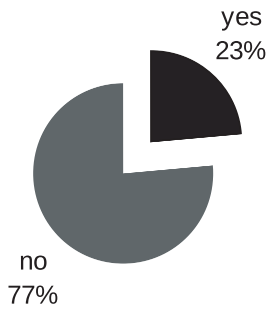

Figure 2. Percentage of visitors interviewed who said they had seen a park animal wearing a radio collar or ear tag.

Question: (b) If yes (or "if you did see that"), did that affect (or "do you think that it would affect") your experience of viewing that animal, one way or the other? Make it better or worse?

Of the 23% who believed that they had seen an animal wearing a radio collar or an ear tag, 77% said that seeing the marking had had no adverse impact on their experience of viewing that animal. Visitors who had not seen any animals wearing radio collars or ear tags were asked to imagine their reaction to seeing such an animal. Of those, 86% believed that seeing an animal wearing a collar or a tag would have no impact on their experience of viewing that animal (Figure 3). Although those who said

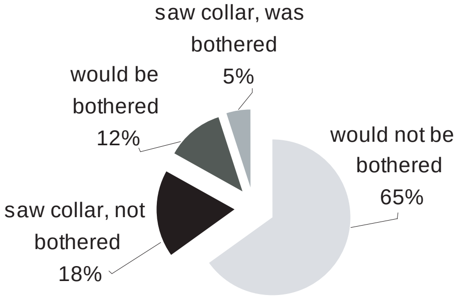

Figure 3. Percentage of people who had been, or imagined that they would be, bothered by seeing a park animal wearing a radio collar or ear tag.

that seeing a collared animal would not depreciate their experience were not generally prompted to explain why not, 17% volunteered that they wouldn't be bothered because they knew why collaring was done and believed it to be a positive thing. One man went so far as to say that seeing a collar would actually enhance his viewing experience for that reason.

Twenty-three percent of visitors who had seen a marked animal said that seeing the marking had adversely impacted their experience of viewing that animal. Of those visitors who had not seen a marked animal but were asked to imagine their reaction, 14% said they thought that their viewing experience would be adversely impacted by the marking. Half of the people who said that they had been or would be bothered by seeing collared wildlife said that it was because it seemed "unnatural," with one adding that collared wildlife were unsuitable for wildlife photography for this reason. Three people said that they thought the collar would be uncomfortable for the animal to wear, and two each said that "wildlife should be left alone" and that "animals should be free." Two people said that they would be bothered by seeing traces that the animal had interacted with humans, and two people said that they would be bothered because they wouldn't know why the animal was wearing a collar.

Overall, this research shows that more than four out of five visitors surveyed said that seeing an animal marked for scientific purposes either had had or would have had no impact on their experience of viewing that animal. In some instances, the long-held contention by some scientists that far from being a bad thing, visitors' seeing marked animals was a positive byproduct of research because it generated public interest in science and wildlife conservation, proved to be true.

Awareness of Bear Feeding

Question: Are you aware that several decades ago, it was common for people to see many bears along Yellowstone's roadsides, begging for food?

About three-quarters of visitors surveyed (76%) answered that yes, they were aware that people used to feed bears at the roadsides. Overall, 37% of those who were not aware of roadside feeding were aged 18–29 (this age group comprised 28% of the total sample), 28% were 30–45 (27% of the total sample), 19% were 46–55 (22% of the total sample), 5% were 56–65, and none were over 65 (combined, 23% of the total sample). Awareness was low among those from outside the U.S., especially among the younger age groups.

Would You Want to Feed a Yellowstone Bear?

Because enforcement appears to have been the driving force behind ending bear feeding in Yellowstone, and I was interested in finding out whether visitors still had any desire to feed the bears, I asked them whether they would want to feed a Yellowstone bear if they did not have to fear being caught or punished for doing so.

Question: Today, the rules against feeding bears are strictly enforced. But during the years of the roadside bears that I just mentioned, they weren't. If we existed in a kind of vacuum here today, and you could feed bears in Yellowstone today without being afraid of getting caught or punished, do you think that's something you would want to do?

Although there are, of course, gaps between what people will say they might do when queried out of context and what they might actually do when placed in the midst of a situation, the results were overwhelming;

95% of visitors surveyed said that no, they would not want to feed Yellowstone's bears, even if they would suffer no legal consequences for doing so. Eight people (5%) stated that yes, if they could do it without fear of reprisal, they would want to feed a bear in Yellowstone.

Question: Why not?

"That's unsafe." Asking these people "why not" frequently earned me incredulous looks. In sum, 43% of all those who answered "no" cited safety reasons (see Figure 4). Notable responses falling into this category included, "A bear can attack me," "It might kill me or scratch my car," "You don't mess with bears," "I'm chicken," and "You can't have people going around getting themselves killed." It seems clear that 21st-century visitors to Yellowstone are fairly well aware of the risks associated with bear feeding. Ten percent of all people interviewed said that they would not want to feed the bears for safety reasons alone. Eighty-nine percent of people who said they would not want to feed a bear provided more than one reason why not.

"That's bad for the bears." The second-most popular explanation for not wanting to feed the bears related to the idea that bear-feeding is bad for bears. Concerns cited in this category included, accurately, the popular adage that "a fed bear is a dead bear;" ten people explained that bears that gain access to human foods have to be either relocated or killed, because they will invariably return in search for more and then become hazardous nuisances. Others knew that bears that were fed would become dependent upon human foods, and some worried that they would be unable to survive in the winter, "when there's no one there to feed them." Eleven percent mentioned the possibility that they might even lose their natural instincts and skills for foraging altogether. A third supposition was that human foods would be unhealthy for bears; that they are "not the right food." In all, 32% of the people who said they would not want to feed bears alluded to the fact that to do so would be to the detriment of the bears.

"That's unnatural." Sixteen percent of those who would not feed said they were opposed to the idea because it was "unnatural" in some way. Thirteen percent said they would not feed the bears because they were "wild," and eight percent said that they wouldn't feed because the bears would cease to be wild if they were fed.

"That's bad for people." Fifteen percent indicated that feeding had negative effects on

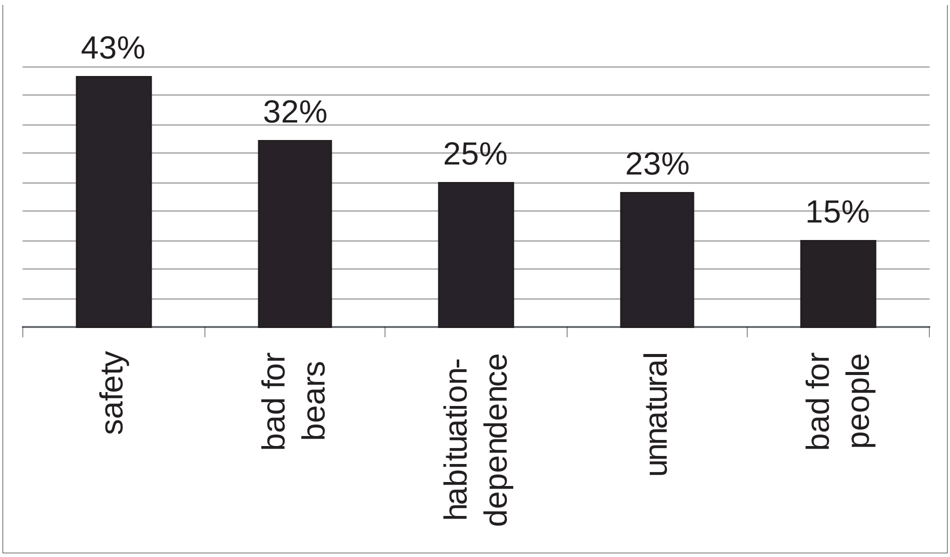

Figure 4. Most frequent answers to the question, Why would you not want to feed a bear in Yellowstone?

people. The most common responses here had to do with the idea that people feeding the bears today will cause trouble for those who visit tomorrow, in that they will leave behind a habituated bear who may cause property damage or bodily injury in its search for human foodstuffs.

Other reasons for not feeding included "We just want to look, not to touch;" "Wildlife should not be fed;" a desire to follow the rules; "That's stupid" (once accompanied by, "If I saw someone doing that, I would hit them"); "That would make it like a zoo;" a concern that human feeding would disrupt the cycle of nature; an overall feeling that feeding is "just not right;" and a simple lack of desire to feed.

As with the question of collaring, there was some ambivalence among those who said that they would not feed. In a clear case either of conflicting internal philosophies or of saying what one thinks one should say and then what one really feels, one woman commented, "I know human food is not appropriate for wildlife—wildlife needs to be with the ecosystem as it is ... have they ever thought about selling food that could be used for that?"

Question: Why?

Of the eight people who said they would want to feed a bear in Yellowstone, five said that they would do it in order to be able to get close to a bear. The remaining three said that they would feed because "They're hungry," "It seems like the humane thing to do," and "I've just always fed animals. Like squirrels." Four were men and four were women, and half were in the 18–29 age group. Two were 30–45, and one each was 45–55 and 56–65. Three of these visitors lived in Idaho, with the others hailing from Colorado, South Dakota, Wisconsin, New Jersey, and Georgia.

At least 95% of those interviewed agreed that there are legitimate reasons why people should not feed bears in Yellowstone, and were aware of what some of those reasons are. This conclusion, however, should be taken with the earlier caveat telling us to mind the gap between decontextualized statements and contextualized action, and keeping in mind a 1953 visitor survey by researcher Donald Bock, in which almost everyone claimed to have seen someone else feeding a bear but almost no one would admit to having done it themselves.

It also does not bespeak any need to reduce either the numbers of staff available to patrol bear jams, nor the wildlife warnings that are conveyed via interpretive materials, as this question did not address whether people would approach a bear without the intent to feed. In fact, two people, in the course of emphatically stating that they would want to stay far away from bears, named "50 feet" as being the proper distance—a full 250 feet closer than the 100-yard distance required by law. The continuing need for both education and vigilance is shown by the fact that half of those who wanted to feed the bears were in the lowest age group and by the decrease in awareness of past feeding as age increases. In other words, the practical management implications of my results for this question are minimal, except for the fact that we have learned that people are generally aware, at this point, of at least some of the reasons why they shouldn't feed bears. What is more important here are the indications for changing visitor expectations, experience, and attitudes that these results show, as well as the fact that residual desire for bear feeding still exists.

The Resource Challenges of America's National Trails System (Session Summary)

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Participants included staff from Appalachian National Scenic Trail, Nez Perce National Historical Park, the Idaho State Historic Preservation Office, and Yosemite National Park. Even with this small sample of eight people, we covered a lot of ground.

The 23 national scenic and national historic trails, created under authority of the National Trails System Act (16 U.S. Code 1241–51), total almost 42,000 miles in combined length—at least three times the total trail mileage in all National Park Service (NPS) units. They link together hundreds of significant natural and cultural resources, at least 90 national forests, and 62 national park areas. Several examples of standard or innovative resource management were discussed.

For each trail, when first established, a comprehensive management plan (CMP) is written, similar to a park's general management plan (GMP). Many of these trail plans are over 20 years old, but have not been updated or revised. CMPs should include a comprehensive list of resources—especially those of high value that contribute to the trail's purpose. Often these inventories are incomplete, sketchy, and hard to update. For the national historic trails, these resources (often containing historic structures, trail ruts, etc.) are called "high potential sites and segments."

Only one trail so far has benefited from a full inventory of natural resources (completed 20 years after the CMP). Kent Schwarzkopf described how, over the past 10 years, at a cost of $260,000, the Appalachian National Scenic Trail has been inventoried across 14 states. Although the trail crosses several NPS areas and national forests, the survey also included the 260,000 acres acquired for the trail since 1978. Details of this inventory are outlined in the 1999 George Wright Society conference proceedings (Schwarzkopf and Buchanan 1999). Long-term success of this inventory process relies on volunteer monitors—generally from trail clubs along the route. This requires an on-going training program because monitor turnover is averaging 3–4 years. A parallel inventory of the Appalachian Trail's cultural resources is proving more difficult and costly.

One historic trail organization, the Oregon–California Trails Association, has a developed a five-class typology of historic trail condition (unaltered, used, verified, altered, and approximate) that is now being accepted on an interagency basis. This classification system is called MET (Mapping Emigrant Trails).

Group discussion was organized to address three fundamental questions:

What is Working Best for Protecting Significant Trail Resources?

- Comprehensive resource inventories are critical if significant trail resources are to be protected. (This can be a problem for a newly established trail where planning budgets can only afford cursory inventories. If CMPs can be seen as a compact among partners, commitment among those partners for top-quality resource inventories may help address this problem.)
- The recent cultural landscape report for the Nez Perce National Historical Park (perhaps the only one conducted so far for resources associated with a national trail) has been very helpful in setting priorities for protection and management.
- Natural and cultural resources should be inventoried separately because of the different approaches of each set of professional disciplines, yet merged into synthesized maps and management products to

show crosscutting interactions.
- Full-time trail staff are needed for an adequate commitment to resource management.
- A crisis or two to make people realize how vulnerable many of these trail resources are could prove helpful.

What are the Obstacles to More Effective Resource Protection?

- National trails may be "administered" by NPS, but on the ground "management" is often carried out by others. Resource management may be difficult in this two-level system.
- These trails often cover great distances, touching many states, and may not even be known or recognized by local communities along them. They are thin, without boundaries, and therefore, extremely vulnerable.
- Sometimes, just after a trail is established by Congress, threats appear, putting trail administrators in a crisis mode, rather than allowing them to accomplish long-term, proactive works, such a comprehensive resource monitoring.
- There is great variability from trail to trail in practical experience, support, resource conditions, resource threats, and partner capabilities.
- Partners, such as tribal groups, are nervous if increased visibility and promotion bring increased visitation, in turn raising threats to sacred sites.
- Trail budgets are small, so little research and few inventories are conducted.
- The identity of these trails is unclear within NPS (three are officially "units," the rest are not). Therefore many do not qualify for agency programs and funding sources.
- Partnerships are critical to the well-being of these trails, yet many of our partners are clueless about resource monitoring and the value of on-going training.
- Few yet recognize the trails themselves as "historic fabric," so they are vulnerable to re-enactments and other inappropriate uses.

How Can Success in Sister Programs in Natural and Cultural Resource Management be Extended to National Trails?

- GIS (geographic information systems) offers tremendous promise to synthesize resource information for each trail and the National Trails System as a whole.
- Use the cultural landscape report for the Lolo Trail as a model for other national historic trails. (It was used as background information in setting up a permit system for this important overland stretch of the overlapping Lewis & Clark and Nez Perce national historic trails.
- Skill building through the interagency National Trails Training Partnership (NTTP) is important, as is recognition of state stewardship and other programs that assist the national trails.
- Foster the educational value of these trails—see them as a "nursery log" of future conservationists.

Reference

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Ruins Preservation: More than Stuffing Mud

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Ruins preservation efforts in the American Southwest have mainly focused on the treatment of historic fabric (i.e., walls). The practice of preservation was left to the masons, with some direction from archeologists. Early on, archeologists thought they were masons, doing much of the work themselves. Sidewalk cement and creative reconstruction best describe their early efforts at stabilization. In the last 10 years, National Park Service (NPS) specialists have embarked on an ambitious program of ruins preservation under the title "Vanishing Treasures." Although this program has provided much-needed preservation treatment for masonry ruins, more could be done to better understand and interpret prehistoric culture through the study of architecture as artifact. The underlying value in ruins preservation is the interpretation of culture—that the details revealed through architectural documentation may hold a window to the past that has yet to be opened.

The Past

Over the past 70 years, NPS has embarked on a ruins preservation program that was more stabilization than preservation, and more creative reconstruction than accurate portrayals of historic properties. This practice can be found throughout the Southwest; examples primarily from Grand Canyon National Park will be used here to illustrate that point. The first archaeological excavations and stabilization at Grand Canyon occurred in 1930 at Tusayan Ruins. This site, located 23 miles east of the South Rim Village, was one of the first sites excavated and treated by an archeological research group called Gila Pueblo. Emil Haury, then a graduate student, was instrumental in the excavation and stabilization of the site. Harold Gladwin, later associated with the Museum of Northern Arizona, also played a prominent role in the project. As we look at the site today, we can see a small pueblo, constructed of unshaped Kaibab limestone boulders, with considerable portland cement visible at the mortar joints. The kivas, identified as "A" and "B," bear little resemblance today to those described during the archeological excavations (Haury 1931). As a matter of fact, Tusayan Ruins is the proud owner of a cement sipapu in the reconstructed kiva, along with a central fire hearth completely out of scale with the size and construction described by Haury. The features are more likely reconstructions based upon the notions of the workers in 1930 rather than interpretation of the features based upon archeological evidence. Common past interpretation of the site also suggested a second story, something unlikely given the lack of substantial foundation rocks.

The early classification of structures likely provided an inherent bias toward a particular way of thinking about the architecture, potentially limiting the possibilities based upon the system in use. While early archeologists focused on architectural style as one element of attempting to classify archeological sites, they recognized the differences in puebloan architecture and its inferences toward clan societies. In *A Study of Pueblo Architecture in Tusayan and Cibola* (first published in 1891), Victor Mindeleff attempted to describe the various architectural styles he observed at the Hopi and Zuni villages, looking specifically at construction style in his analysis. In his discussion of the site of "Tebigkihu (Fire House)," he says:

> As the plan clearly shows, this pueblo is very different from the typical Tusayan villages that have been previously described. The apparent unity of the plan, and the skillful workmanship somewhat resembling the pueblo of the Chaco are in marked contrast to

> the irregularity and careless construction of most of the Tusayan ruins. Its distance from the center of the province too, suggests outside relationship; but still the Tusayan traditions undoubtedly connect the place with some of the ancestral gentes... (1989:57).

In describing Shumopavi, Mindeleff states:

> [T]he stonework of this village also possesses a somewhat distinctive character. Exposed masonry, though comparatively rare in this well plastered pueblo, show that stones of suitable fracture were selected and that they were more carefully laid than in the other villages. In places, the masonry bears a close resemblance to some of the ancient work, where the spaces between the longer tablets of stone were carefully chinked with small bits of stone, bringing the whole wall to a uniform face, and is much in advance of the ordinary slovenly methods of construction followed in Tusayan (1989:75).

From all accounts, in Mindeleff's opinion, the masonry work in Zuni far exceeded the work in Hopi, although both groups represented puebloan communities.

The Present

Let's look at the range of masonry ruins at Grand Canyon identified archeologically as puebloan, primarily late PII–early PIII. If one looks at the architecture (similar to how one looks at projectile points or ceramics) as artifact, how would one be able to classify all of the sites being examined as ancestral puebloan? Some masonry ruins, tens of miles apart, show remarkable similarities, suggesting the same cultural traditions, if not the same people, were responsible. Other masonry structures, some in close proximity, show no similarities at all. From the ruins at Tusayan to the granaries at Nankoweap, the granaries in Marble Canyon to the pueblos at Unkar, the only common thread in the architecture seems to be that they are made of stone. Material types differ, mortar styles differ, masonry techniques differ, yet all are looked at as representing ancestral puebloan occupations sometime between AD 1050 and 1200. Surely, there is more to the architecture than just expedient construction. And more to the Kayenta Branch of the Ancestral Puebloans than the 60% stone and 40% mud described by Dean (1969).

Vanishing Treasures

The Vanishing Treasures program has allowed NPS to focus much more heavily on the specifics of architecture than ever before. But has the emphasis been on the people who made the structures or is there too much focus on the rocks and mortar joints? Can the level of documentation done for Vanishing Treasures provide a window on greater understanding of the prehistoric inhabitants of these places, possibly allowing us to discretely identify subgroups within the Kayenta family?

Vanishing Treasures is an NPS ruins preservation initiative focused on forty-one national parks, monuments, historic sites, and recreation areas in the arid West. The initiative aims to address the backlog of maintenance work needed on the resources, and at the same time develop a permanent, professional work force to manage and maintain the sites. In general, Vanishing Treasures resources are in a ruined state, have intact architectural fabric, are not occupied or utilized for their original function, and are part of a park's enabling legislation or are listed or eligible for listing on the National Register of Historic Places (NPS 2002). Typical Vanishing Treasures resources include pueblos, cliff dwellings, churches, and forts. The long-term goal of the initiative is to develop a sustainable infrastructure capable of maintaining the Park Service's ruins.

Between its inception in fiscal year 1998 and the end of fiscal year 2001, the initiative added 48 new permanent archeologists, masons, craftspeople, architectural conservators, engineers, and architects in 22 parks. In the same five years, 65 projects, with a total value of $3,958,500, were implemented in 27 parks.

Understandably, the Vanishing Treasures initiative (and Grand Canyon National Park) has focused on backlog maintenance and putting personnel in place to complete work. Prior to any stabilization, detailed architectural documentation is completed to document the current condition of the resource, previous treatments, and original construction techniques. Many ground-breaking techniques in architectural documentation have been developed within the Vanishing Treasures initiative. For example, photographs are scaled and rectified in CAD (computer-aided design) software, allowing archeologists to produce wall profile drawings more accurate than ever before. Laser "scanning" of structures produces the most accurate and detailed two-dimensional representations of sites and features ever possible. Standardized data collection has produced one of the most detailed and consistent sets of information about prehistoric architecture in the Southwest. Additionally, detailed documentation of past and current treatments enables managers to define original elements and those added during stabilization.

But have we lost the "why" in our rush to develop the "how" of architectural documentation? Vanishing Treasures discussions and publications about documentation tend to focus on technique rather than content. With all of the detailed data being collected about Vanishing Treasures resources, we have a unique opportunity to study architecture in ways that were never possible before. In many instances, documentation standards and techniques that were identified and developed in a few parks have spread to other parks working on Vanishing Treasures projects with only minor modifications. An enormous, and very consistent, dataset is being collected.

In the 1980s and early 1990s, Nordby and Metzger (1991) and others developed a holistic approach to ruins preservation that emphasizes detailed documentation and analysis of architecture as artifact in conjunction with treatments. They developed a series of research questions for both structures and sites. In general, these questions seek to understand construction techniques and original sociocultural organization by recording the elements of architecture, engineering, and construction found in the sites and structures. This concept has guided the Vanishing Treasures program and the research questions in this document have been adopted by many parks.

But in general, preservation guidelines and practice stress treatment and documentation standards with minimal attention to the research questions guiding them. Little mention of research questions can be found in the draft NPS ruins preservation guidelines (Nordby and Metzger 1998). The present authors believe the development of research questions should play a more central role in ruins preservation. Why are we preserving ruins if not to increase our understanding of the people who built them and make sure the story we tell the public is as accurate as possible? We must clearly define what questions remain unanswered and the particular data needed to answer those questions. This is especially true for Vanishing Treasures parks that have had little scholarly study of prehistoric and historic architecture. Mesa Verde and Chaco tradition architecture has been studied extensively while Kayenta architecture remains largely ill-defined. In 1969, Dean described Kayenta architecture as 60% mortar and 40% stone based on work at Betatakin and Keet Seel. Little work has been done since that time to either refute or support this contention.

The research model developed by Nordby and Metzger (1991) provides an excellent foundation for studying architecture in great detail. This paradigm addresses the questions most commonly asked of architecture by archeologists. However, most of the questions focus on the site or structure, not where it fits within a regional perspective. Further, no clear link exists between a particular research question and what data should be collected to answer it.

To build on this foundation, additional questions should be developed based on park-specific research designs and common regional questions. This was touched on earlier in the paper, but a summary of potential questions is appropriate here. The following list focuses on issues that could be addressed by architectural documentation completed in parks in Northern Arizona, but these could easily be expanded to other regions of the West. Many of these questions could be addressed with only minor changes or additions to the architectural documentation currently completed by most parks.

A primary topic of interest is cultural boundaries and cultural identity, both between and within identified archeological traditions. Is there truly a pan-Kayenta architectural style? Does Dean's (1969) characterization of Kayenta architecture as 60% mortar and 40% stone hold true? From the examples from Grand Canyon presented earlier, it does not appear so. If that's the case, can discrete groups be identified through the detailed analysis of architecture? If so, what attributes need to be considered and how should information be collected to address the question? Is it possible to identify specific clans or families based upon architectural style? How can Native American oral traditions enlighten us about the prehistoric architecture? A second broad research category is temporal change. What can we discover from sites with intact architecture that have yet to be excavated? What can we learn from surface artifacts, tree rings, and other datable material?

Finally, the growing Vanishing Treasures dataset should be analyzed with these questions in mind. It is necessary to take a step back from the mortar joints and chinking stones to see the people who made them. In addition to sharing methods for collecting architectural data, publications, conferences, and symposia should discuss why the data are collected and how the data are being used. Outside researchers should be encouraged to use the data to conduct detailed analyses. These analyses should include a re-examination of the full suite of archeological remains from a site—architecture, ceramics, and other cultural material.

As we look at the possibilities for new interpretations of cultural heritage through the architecture of masonry ruins, we may be looking too hard and too far. Maybe the answer to the variety of masonry styles lies in a very simple truth told to Mindeleff by his Hopi colleagues. They related to him that "the Hopituh, after being taught to build stone houses, were also divided, and the different divisions took separate paths. The legends indicate a long period of extensive migrations in separate communities; the groups came to Tusayan at different times and from different directions...." Can we find the remains of those paths running through our parks?

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NPS's Cultural Resource Inventories: Understanding Resources, Improving Stewardship

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This paper will provide an overview of five cultural resource inventories that are currently ongoing within the National Park Service (NPS) and how they are being used to improve preservation and management of diverse cultural resources. They are the Cultural Landscapes Inventory, Archeological Sites Management Information System, Ethnographic Resources Initiative, List of Classified Structures, and Automated National Catalog System. We will examine how each inventory identifies resources and their significance, and how these inventories assist in park stewardship by providing information for master plans, facility development, and natural and cultural resource management and preservation.

The Cultural Landscapes Inventory (CLI) is a comprehensive inventory of historically significant landscapes within the National Park System. It is an evaluated inventory that provides baseline documentation for cultural landscapes. It includes general descriptive information and looks at the history and physical development of a landscape. Information is gathered from secondary sources and through field surveys of the landscape looking at 13 characteristics: natural systems, spatial organization, land use, cultural traditions, topography, vegetation, circulation, buildings and structures, cluster arrangements, views and vistas, constructed water features, small-scale features, and archeological sites. Each characteristic is described in its historic and current condition, and evaluated for its contribution to the significance of the site. The landscape is also analyzed for integrity, which, along with significance, is weighed to determine eligibility for the National Register of Historic Places. The CLI also assesses the condition of the landscape, which is important for accountability under GPRA (the Government Performance and Results Act). The database exists only in regional offices and in Washington, and work is underway to move it to the web.

The CLI provides invaluable landscape information that helps parks manage and preserve both cultural and natural resources. It has been used to improve knowledge of landscape resources and inform planning efforts. At the Delaware Water Gap National Recreation Area, a park created as a recreational area, documenting cultural resources such as villages and farms allowed park staff to develop greater understanding of cultural landscape issues.

CLIs inform planning efforts, such as the general management plan at Appomattox Court House National Historical Park, and raise questions for further study, such as the role of the African American Civilian Conservation Corps. CLIs also provide base information for other studies, such as the National Register nomination for Roberts Farm in Delaware Water Gap, and the cultural landscape report for Eisenhower National Historic Site.

The CLI is used to inform natural resource and maintenance decisions. At Delaware Water Gap, the CLI raised awareness about the importance of vernacular landscape features, and the landscape information is now used to set priorities and establish guidelines, including the historic agricultural leasing program. Another way that natural resource and maintenance decisions have been influenced is by linking the CLI database to GIS mapping. By overlaying current and historic aerials at Delaware Water Gap, it has been possible to establish broad patterns in the landscape to assist in stabilization and treatment decisions. CLIs include a section on impacts that affect landscapes and stabilization measures with cost estimates that can be cited to help justify funding needs. CLI information assists in completing the compliance for stabilization and treatment projects.

Next we'll look at the Ethnographic Resource Inventory (ERI). An ethnographic resource is a landscape, place, object, or natural resource of cultural significance to people traditionally associated with that resource. NPS does not make the judgment whether that resource is significant, since the significance is based on the viewpoint of the traditionally associated people. Ethnographic resources are not driven by National Register criteria, although some ethnographic resources may be eligible National Register properties. NPS defines "traditionally associated peoples" differently from other park visitors "in that they typically assign significance to … places closely linked with their own sense of purpose" (NPS 2001:57). NPS views people as "traditionally associated" with a park when:

- The entity regards the park's resources as essential to its development and continued identity as a culturally distinct people; and
- The association had endured for at least two generations (40 years); and
- The association began prior to the establishment of the park (NPS 2001:48).

The ERI database helps the park document these resources, and the value ascribed to them, by utilizing two categories. First, the park resource management documentation includes common name, type of resource (plant, animal, place, or object), location, NPS-determined condition, relevant treaties and laws, and documentary sources. The database distinguishes these fields from the "group view," which includes vernacular name, sacred and legendary status, and the group's evaluation of condition and preferred treatments. The database also includes fields to document all consultations with the group.

The ERI currently uses Microsoft Access on stand-alone PCs. The regional ethnographers or coordinators train park staff to use the database, and ensure data reliability and validity. In the Pacific Northwest Region, park staff maintains the database, and currently Olympic National Park, San Juan Island National Historical Park, and Fort Vancouver National Historic Site are using the database. This will increase as more parks become aware of the database and staff are trained and assigned to manage its use. The national coordinator certifies that data meet the mandatory requirements for GPRA reporting.

The ERI makes information easier to retrieve and can be used to track changing conditions of ethnographic resources. It is also an easy reference for consultation with park affiliated groups, and can produce reports and data sheets for management queries. The ERI creates a way to "come up to speed" quickly and links ethnographic resources to other resource databases.

So how can another database benefit your park? What are the ethnographic resources in your park and who are the associated people? Are the descendants of the homesteaders who once lived in the park traditionally associated people? What about commercial fishermen who have fished there for generations? This information is an important component of park management actions and community heritage preservation. In order to understand the people who have special relationships with the parks, you need to understand what the resources are and how the people value them. This information is available in some cases; it just needs to be accessible. In other instances, ethnographic studies are a necessary first step. The ERI is part of the process of documenting this information.

The List of Classified Structures (LCS) is another database currently being used by NPS to manage, document, and track resources. However, LCS is the only cultural resource database with real-time, on-line editing capability.

LCS is officially defined as "an evaluated inventory of all historic and prehistoric structures that have historical, architectural, and/or engineering significance within parks of the National Park System in which the National Park Service has, or plans to acquire, any legally enforceable interest" (NPS 2002:1-1). It is a comprehensive resource management tool that allows park personnel to inventory park historic structures, keep complete and concise records of all historic properties, and manage resources for preservation, management, and stewardship purposes.

The LCS includes properties that are listed on the National Register of Historic Places or determined eligible by the keeper of the National Register and/or the state historic preservation officer. Not all buildings within a park are listed on LCS. It is only for those properties that have been formally determined eligible.

In its current web-based form, data are entered, maintained, and updated by individual parks and/or regional offices. Regional LCS coordinators then verify the entered information and send each record to Washington, D.C., for final approval. This hierarchical review system is designed to provide greater accuracy and consistency.

LCS assists preservation professionals and cultural resource personnel with section 106 compliance document preparation, provides all the necessary National Register data on buildings and structures with a few clicks of a mouse, provides a chronological list of physical events (construction, modification, rehabilitation, etc.), and stores condition assessments so one can track how the building's condition has changed over time.

LCS benefits management by recording important treatment information. These data come directly from general management plans and similar documents, while condition assessments are directly tied to GPRA goals. LCS also contributes to resource management decision-making by cross-referencing other databases, especially the Archeological Site Management Information System (ASMIS) and the Facility Management Software System (FMSS).

The purpose of LCS is to provide a web-accessible, user-friendly system for recording and managing buildings and structures. The database assists resource managers that deal with historic properties, and makes management decision-making, funding requests, and infrastructural planning much easier. It may be used in many ways for important decision-making processes regarding impact, condition, and treatment.

Overall, LCS is a functional, useable system with great benefits for cultural resource personnel. The concise nature of the program provides a quick reference source for all historic buildings under NPS management, thereby allowing resource managers to query and compare the significance, condition, and ultimate treatment of related buildings.

The Automated National Catalog System (ANCS+) is the cataloguing database for the NPS Museum Management Program. Originally based on dBase III, the current database is a Windows-based version of the original ANCS that parks have been using since 1987. ANCS+ is the NPS-customized version of re:Discovery, which uses Microsoft FoxPro as its database engine. Each park is responsible for using ANCS+ to record the required information about its museum and archival collections and for submitting that information annually to the National Catalog.

ANCS+ is a collection of closely related databases that use discipline-specific and park-specific fields for cataloguing. A park can create its own fields, although there are already some 60–70 defined fields for each discipline. Up to 999 digital images may be attached to each record for more complete and accurate descriptions.

Individual objects and lists of related objects can be found using the word search function on any and all fields. This is a powerful word search function, but it requires that you use a consistent terminology. Therefore ANCS+ includes several lexicons, including

The Revised Nomenclature for Museum Cataloging.

The collections management module is divided into two sections: cultural resources, which includes history, archeology, ethnology, and archival/manuscript collections; and natural history, which includes biology, geology, and paleontology. In addition, there is a separate archives and manuscript module for detailed archives/manuscript description at the series, sub-series, folder, and item levels.

ANCS+ allows for extensive reporting and associated record-keeping, including: a database for accessions and for associated personnel and institutions; the ability to track loans, exhibits, maintenance, treatments, and deaccessions; and the ability to create location and condition lists, catalogue histories, a finding aid for archives, and housekeeping schedules. It will also print over 40 related NPS forms.

In addition, ANCS+ assists the curator in conducting the annual inventory of museum objects, the collections management report, and the NPS museum checklist for preservation and protection.

The public search mode allows non-museum staff and the public to explore the collections database. To protect sensitive information, the curator controls the fields and records that are available in this read-only mode. For example, provenience information for archeological artifacts is not available to the public.

This same service is being made available to the public on the web (www.museum.nps.org). With its imaging capability, the web catalogue is an opportunity to achieve the NPS mission to provide for the enjoyment of cultural and natural resources in a way that will leave them unimpaired for future generations.

ANCS+ is an essential tool to meet the collection management responsibilities of the museum program. It empowers museum staff to efficiently maintain and preserve collections, and to make those collections more accessible to staff, researchers, and the public.

Conclusion

The inventories and their databases for each of these disciplines are very important for NPS to measure what cultural resources we have, evaluate them for quantity and quality, and track change over time. But for parks, the real importance of our collective information lies in using these systems to make the best possible decisions about the preservation and management of the resources in our care. It is our responsibility to preserve and protect these assets for future generations, and they will decide how well we have done this.

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Innovative Concepts of Cultural Resource Management

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Washita Battlefield National Historic Site was created on November 12, 1996, to interpret the attack of Lieutenant Colonel George Custer and the 7th Cavalry on the sleeping Cheyenne village of Chief Black Kettle in 1868. The attack was waged as reprisal for raids by the tribes on Kansas settlements. Between 50 and 100 men, women, and children were killed during the attack and another 52 women and children were taken as prisoners and held until the following summer. Twenty-three soldiers lost their lives that day at the battle. Washita was established not only to interpret Custer's rise to fame as an Indian fighter, or to talk about the end of a way of life for native peoples, but as a place of consecration and reflection. Cultural resource management plays an important role in all of that.

From the beginning, we were committed at Washita to telling the story from multiple perspectives and being balanced in every way possible. In developing the park's interpretive media, we made every effort to talk about the Southern Plains Indians Wars and the bloody atrocities that were being committed by both the American military and the Plains tribes that led up to the Washita attack. We made extra efforts to engage the Native Americans that are affiliated with this site in the park's development as directed by the park's legislation. This paper focuses primarily on these efforts to gain a tribal perspective and some of the approaches we used to do that. Those were not the only efforts we made to engage the public. But they probably led to the most innovation.

Washita—which is located in western Oklahoma about halfway between Oklahoma City and Amarillo, Texas—was designated as a national historic landmark in 1965 and national park status had been discussed even earlier. With the election of Congressman Frank Lucas who grew up within a few miles of the historic site, the park was established in 1996. The Oklahoma Historical Society worked closely with a few of the elders of the Cheyenne and Arapaho Tribes on Washita's establishment and a Cheyenne elder testified before Congress supporting the park. The legislation for the park was drafted to include the participation of the tribes in the park's development and educational programs. The legislation states that one of the purposes of the park is to:

> Establish the site of the Battle of the Washita as a national historic site and provide opportunities for American Indian groups including the Cheyenne–Arapaho Tribe to be involved in the formulation of plans and educational programs for the national historic site.

And so we were asked from a legislative perspective to be innovative in our management of the park.

When I arrived at Washita I came with the intention of gaining substantive, consistent involvement by the tribes in developing the park. I wanted our Native American partners to be at the table helping to make plans and decisions, not at the receiving end of a draft document that we expected them to approve. We had some successes and we made some mistakes.

One of our initial actions was to begin a *Washita Symposium*, which was a two-day event that allowed a variety of speakers to do presentations on different perspectives of the Washita. This included Indian and non-Indian speakers, as well as costumed interpretation, field trips, and performing arts presentations. Each of the three symposia have built upon each other. For this year's symposium (after I left, I might add), the park did an excellent job working with the local arts council to get a grant for the event and creating the theme, "Through the Eyes of History." Craig

Moore, the park's education technician, was able to bring in a large local Cheyenne population involving a variety of ages and experiences.

We were able to use the original symposium in 1997 as the basis for an ethnographic study for the park. We began with oral histories of the Cheyenne people, followed up with literature searches, and then researched affiliations of the other tribes and the local non-Indian population. Our original intent was to have the Cheyenne tribe perform their own ethnographic work; although we were not able to carry this out, our Cheyenne partners were appreciative of the efforts that we made to do this. The ethnography has preserved and allowed the park to interpret the many connections of the Cheyenne and other people to the site and has given the staff the personal stories that make the attack come alive for visitors.

Because we had such difficulty in engaging the tribe on a consistent basis, we felt like we needed a person to help us to make sure that park issues were being taken seriously within the tribe and that tribal issues were being addressed within the park. The tribe had assigned the tribal Native American Graves Protection and Repatriation Act (NAGPRA) coordinator to work with the park, but when NAGPRA coordinators changed several times within a three-year period—thus also changing our contact person—we tried to find a better way of collaborating. Gordon Yellowman, who was our main contact during most of my time at Washita, and a great person to work with, devised the idea of a cultural liaison position for the tribe who would work with the park. In fiscal year 2001 we received a Challenge Cost Share grant to fund half of the position. The tribe agreed to fund the other half of the salary and benefits. We jointly hired a tribal employee for one year. His main objective was to develop consultation guidelines that were realistic for all parties, affordable for everyone involved, allowed the tribe to tell the park staff how they wanted to collaborate, and to give the park staff the important information they needed to develop the park and educate the public. The position, dedicated to forming a strong bond between the two entities, gained unparalleled good will for both the park and the tribes. The park will be able to fully fund the position beginning this year due to a base increase to the park budget.

We were also heavily involved in a project called the Cheyenne Heritage Trail. The tribe had been very clear on their belief that the park's staff needed to educate the public about the Cheyenne tribe's living culture as well as the event in 1868. They also strongly believed, as did the park staff, that some of Washita's stories needed to be told with a tribal voice. In addition, we felt that it was important to interpret the Washita in context rather than as an isolated event.

We were very fortunate to have in western Oklahoma a man by the name of Lawrence Hart living in the community. He is a Cheyenne, one of the traditional Cheyenne peace chiefs, and serves as one of the four principal chiefs. Hart is also the executive director of the Cheyenne Cultural Center, a non-profit corporation he founded 24 years ago. He has served on the National Review Committee of the Native American Graves Protection and Repatriation Act.

Hart created the concept of developing a Cheyenne Heritage Trail. We worked with him on this trail concept, which envisioned taking visitors throughout western Oklahoma to various sites that were historically important to the tribe. Over the course of two years we developed a partnership that included site managers from federal, state, tribal, and private partners and entities such as the Oklahoma Department of Tourism and Recreation and the Oklahoma Historical Society. The partners determined their purpose to be the protection of the cultural heritage of western Oklahoma and education of the public about the rich Native American occupation there. The goal was to do this through increased and more effective domestic and international visitation to the area, to help those visitors to experience the heritage of the Cheyenne tribe, and to learn about the Arapaho, Kiowa, Comanche, and Plains Apache people.

The Cheyenne Heritage Trail was established as the first Native American Cultural Route in the state of Oklahoma. The trail is a 420-mile route that passes through historic and cultural sites that are significant to the Cheyenne people and to other tribes that lived in the historic tribal lands of western Oklahoma. The trail includes twelve sites that interpret significant portions of the Cheyenne story. The trail gives visitors the opportunity to explore not only Native American culture, but also the idea of westward expansion, cultural conflict, and the Plains Indian Wars as a part of western history.

Visitors may travel the trail in their own vehicles using a brochure as a guide or they may participate in a bus tour provided by companies that purchase a guided program. Each venue along the route has different activities, some of which are interactive, all of which teach visitors about Cheyenne and Native American cultures. Each partner in the Cheyenne Heritage Trail is responsible for orienting visitors to its site and to the overall concept of the trail. Washita Battlefield National Historic Site is, of course, one of the stops on the trip.

Because a project like this had never been done in Oklahoma and because of Hart's relationships with state government, we were able to obtain the assistance of Oklahoma's Tourism Division. They planned and conducted debut tours with Oklahoma dignitaries and media. They retained a consultant to train the tour guides, and they developed the color brochure for the trail.

The Oklahoma Historical Society was an essential partner. They researched a historical chronology of the major events of the Cheyenne Indians in Oklahoma, which was provided for use in training the tour guides so that they could narrate the history of the culture as the coach travels between the sites. This information was also used to develop the brochure.

Hart worked with a state senator to pass legislation directing the Oklahoma Department of Transportation to mark the trail with signing. The signs have a trail logo that we developed by holding a Native American art contest.

Approximately 20,000 visitors per year see some or all of the Cheyenne Heritage Trail, and that number is increasing. Tour groups have included Native American elementary and secondary students, college students from other states, Native American cultural organizations, Elderhostel groups, and museum groups.

The park could never have accomplished alone what this partnership has achieved to interpret this era of American History. Because of that fact, the partnership was awarded the National Park Foundation's 2001 Park Partnership Award for Heritage Education, one of only four national awards given to recognize partnership efforts within the National Park Service. It also received the Oklahoma Redbud Award, which is the state's tourism award.

The benefits of this endeavor have been substantial. The partnership has created a high degree of cooperative spirit between local, state, federal, and tribal agencies in Oklahoma. Collaboration and contact between the partners has created a sense of ownership of the Cheyenne Heritage Trail and a feeling that all parties are concerned with the best interests of educating the public about Native American heritage. This was particularly advantageous to the National Park Service as we worked to develop a new national park site at Washita and looked for creative ways to enhance partnerships.

The trail facilitated an increase in tourism in this sparsely populated area of western Oklahoma, bringing tourist dollars and thus economic development to the communities located there. It gave impetus to structural restoration and rehabilitation at four of the historic sites. It has also assisted with protecting the cultural heritage of the area and educating the public about the rich Native American occupation here. This partnership is unprecedented in Oklahoma. The work that was accomplished on the Cheyenne Heritage Trail is making a difference in the education of visitors. It is a model of how national parks should be working with our partners and what can be accomplished.

And of course, I don't believe that cultural resource management can be separated from natural resource management, or at least without making less sense of either. This is particularly true in a cultural landscape when the resource you are preserving tells the story of a people in a particular place in time. The legislation for Washita directed park staff to return the area to its 1861 appearance. Much of the cultural work being done there will return the park to what we believe was the "native environment," one untouched by Europeans. So what is the implication of thousands of people camping in a riparian area for several months with a large herd of horses grazing on the vegetation in the river bottom? What picture do we want to convey to park visitors? This and other complex questions are still being addressed at Washita, just as they are at many other primarily "cultural" sites. Good planning, strong partnerships, and a strong base in science and information all lend themselves toward a final product of strong cultural resource management.

Innovative concepts and creative approaches are necessary to manage for the health of the park as well as for the best visitor experience that we can provide. After all, that's what we're here for and that's what we have a responsibility to provide for this and future generations.

[Ed. note: The author was superintendent at Washita before moving to her current post.]

Reading the Cultural Landscape at Dyea, Alaska

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If, as folklorist Henry Glassie has written, "history is the essence of place," our literacy in the cultural process of historical landscapes is of paramount importance to the American national parks.[1] Without the ability to "read" landscapes as historical phenomena that continue to evolve, interpreting their stories is largely restricted to an artifactual perspective, rather than that of constant flux and dynamism, characteristics more typically assigned to "natural" resource paradigms rather than those of "cultural"—historic preservation and heritage production. However, as the practice of landscape architecture in historic environments methodologically progresses, the implications for understanding landscapes as critical processes, rather than static fields of artifacts, portends some rather dramatic revision of the ways in which we can view park lands from the interdisciplinary stance of cultural landscapes. This paper is a short introduction to building a mapping infrastructure for a historic cultural landscape to provide park management with an on-going, integrated portrait of history, change, process, and place.

The Dyea historic townsite is located within the larger Klondike Goldrush National Historical Park, with its headquarters in the southeastern Alaskan town of Skagway. Primarily known for its importance as a gateway boomtown for the 1898–1900 gold rush to the Yukon gold fields of interior Canada, Dyea's strategic importance lay in its location at the foot of the Chilkoot Trail, one of only three non-glaciated routes to the Canadian interior. Until overwhelmed by sheer numbers of "Stampeders" and goods waiting to make their way up through the Chilkoot Pass, the native residents of Dyea—the Chilkat/Chilkoot Tlingit—utilized the site for seasonal resource harvesting (salmon and berries as prime examples) and to maintain control over the Chilkoot trail as an important native trade route between coastal Tlingit and interior Tagish communities. After the abandonment of Dyea as a boomtown in 1900, its brief efflorescence as a thriving community became a memory as the former seasonal village, trading post, and gridded townsite transformed into a handful of homesteads. These, too, were relinquished as active vernacular landscapes by the 1940s. Until the creation of Klondike Goldrush National Historical Park in 1976, Dyea's significance was largely that of isolated residences and community recreation by virtue of its open, flat tidelands amidst the steep, rocky fjord topography that characterizes the Taiya River valley.

Now part of a national historic landmark, the remains of Dyea historic townsite are located within a dramatically changing landscape. Situated at the foot of a dynamic riverine corridor, Dyea's landmass exhibits a range of environmental dynamics. The heavily sedimented Taiya River is a braided, continually meandering system which, impacted by natural (e.g., topography) and constructed (bridge and armored banks) factors, continues to erode portions of the site at key points of scouring, bank cuts, and flood zones. Nearly one-third of the historic townsite and virtually all of the Tlingit village are now in the active river zone. In contrast to archeological degradation, numerous sloughs and low-water areas, historically rich habitats, continue as active salmon spawning sites. Isostatic rebound—the decompression of land as glaciers retreat—is another aspect of rapid environmental change. Since the gold rush period of 1898–1899, the Dyea townsite has risen nearly six feet in elevation, continuing to rise at an annual rate of 0.059 inches. Vegetation patterns, too, are part of the landscape story of ecological transition. The advance of a successional forest—no longer subject to logging and left untouched by park management—obscures nearly the entire range of archeological resources still embedded in the landscape from the gold rush and homestead eras.

In order to further park management objectives for the both park and adjacent lands (which include a mix of federal, state, and private parcels), the documentation and analysis of Dyea as a cultural landscape began in 1999, and continues to the present. As an interdisciplinary approach, cultural landscape methodology is ideal for Dyea because it focuses on revealing layers of occupation and use over time in evolving environmental conditions—an integration that suggests powerful insights into how resource contexts for any future development is proposed and evaluated. This work is particularly timely considering the rate of impacts on the site due to increased visitation to Dyea with the rise in cruise ship tourism in nearby Skagway. In addition, larger numbers of rafting, biking, and horse tours, coupled with an increase in vehicular traffic on narrow, winding access roads, further emphasize the need for understanding long-range planning at the landscape scale.

In order to develop a strategy for a master plan for Dyea as a cultural landscape, a major effort to document and analyze the historic townsite and affiliated areas first entailed an intensive research and mapping effort, much of which is still underway. At the outset of the project, the goal was to create a spatial infrastructure in which the history of Dyea could be "read"—namely, the construction of base maps at a workable scale (rather than the 20-foot contours of the existing U.S. Geological Survey topographic quad maps). This series of base maps is the foundation for successive historical layers locating features and resources within more traditionally conceived historical periods (such as the Tlingit occupation, gold rush era, and early-20th-century homestead occupation). Also integrated within the historic layers is an environmental history of the site, particularly showing the extent of river meander, erosion, and deposition, as well as vegetation changes.

Developing a synthetic context for spatial data—ultimately leading to the ability to create elevational models with predictive capabilities—rests on assembling and analyzing an array of historical and contemporary data sets, ranging from rare narrative accounts, period maps, homestead surveys, and an especially pertinent series of aerial photographs from the 1940s, 1970s, and 1990s. Complementing these sources is a 1986 archeological survey map locating artifact clusters and sites (including many depressions associated with lost buildings), and a 2002 Bureau of Land Management cadastral survey of park boundaries. This latter survey is especially important in that it depicts the extent of the river's incursion along the remaining eastern edge of the townsite, a baseline for analyzing the historic aerial photographs from earlier periods.

Seasonal fieldwork during the period 1999–2002 contributed critical pieces of the overall spatial patterning of the site. In the attempt to locate an axis of two major streets from the 1898–1899 boomtown, the first (1999) field survey to address historic street alignment led to a computer-aided design (CAD) composite drawing depicting the series of historic survey layers from 1898 to 1986, complete with notations on the features recorded by the earlier surveyors. During the period 2000–2002, photographic inventories of the site's natural and cultural features were systematically documented for the first time. With the completion of the 2002 boundary survey, the basis for beginning a coordinated effort at GIS (geographic information system) mapping of the site began with the most recent collection of GPS (global positioning system) trail and road data throughout the townsite in the fall of 2002. With the completion of a LIDAR (light detection and ranging) survey in 2002–2003, these data will be further refined to fit a 2-foot contour interval with recording of all features at sub-meter accuracy, allowing for future three-dimensional modeling to suit a variety of park management needs.

The initial importation of the CAD composite drawing of the townsite and cadastral survey into an ArcView environment with the GPS roads and trail data provides the park with a powerful glimpse into the complexity of site's history. For the first time, the park has the beginnings of a "real time" model illustrating the progression of the landscape and its resources—both natural and cultural—within an integrated context. Although only in its earliest stages, the assemblage of data in a GIS model attests to the efficacy of conceiving and documenting park lands as cultural landscapes. And, most importantly, it points to the critical importance of developing a comprehensive spatial infrastructure at the outset of any landscape planning efforts.

The importance of this initial mapping effort cannot be underestimated. First, the only mapping of Dyea during the past three decades has primarily focused on archeological surveys, and those are now nearly twenty years old. The coordinated impetus toward developing the CAD/GIS base map has literally created a "new" Dyea by revealing the extent of landscape scale and change. Certain baseline information is now established: for instance, the park boundaries and extent of riverbank erosion were in question, as were the identity and disposition of many of the less apparent historic features—vegetation and road traces. Discrete features present in historic photos and surveys can now be analyzed within the overall landscape matrix, broadening their interpretation. With the future addition of the LIDAR survey and an analysis of the existing spread of aerial overlays, knowledge of the degree to which this landscape has changed in the past half-century, in particular, will be of immense value to any park development schemes, from potential trail networks to a new visitor contact station.

Additionally, by utilizing an interdisciplinary team to gather, analyze, and compile the spatial data within the context of the cultural landscape, it quickly became apparent that mapping this complex landscape as a process would be a rich field of inquiry. For example, by extending the idea of the historic landscape to recontextualize artifacts within the broader paradigm of environmental change, the history of Dyea as a place begins to shift toward the interaction between culture and nature, historic communities, and the impacts of the powerfully meandering Taiya River. In essence, the fuller landscape story decenters the mythic boomtown (the artifact) as a romantic "golden age" in favor of revealing the continuum of change wrought by the river, and our attempts to reorder ideas of resource protection in light of the inevitability of persistent riverine impacts in the future. The river, then, becomes a force of encounter, a historical agent, that cannot be abstracted from the history of place.

In reality, the on-going mapping and analysis of the Dyea historic townsite reaffirms the inherent value of cultural landscape methodology in attempting to not only "reconstruct" the past on a landscape scale, but to create a historical model that responds to the future. With technological advances in mapping and illustration, the new baseline of knowledge about the Dyea landscape is the foundation for assessing future changes in the landscape and incorporating them into a living model of process, one that effectively illustrates the elliptical movement between time and place in rather enlightening ways. Ultimately, this envisioning of landscape as process is about placemaking—how a *sustainable history* can be created and interpreted from the "bottom up," rather than the typological model implied by the standard historic preservation methodology rooted in the National Register of Historic Places.[2] It eschews the idea of a dramatic discontinuity between past and present, and between past and future, by expanding the story of Dyea past the boomtown allure to one that reflects a world of constant change, and, importantly, how we map and interpret those changes with contemporary technology.

It also begins to ask very important questions about the storied nature of cultural landscapes: how are landscapes symbolically and physically constructed as repositories of a national heritage? Essentially, how are landscapes called into being by their physical representation and symbolic interpretation? How viable is the history we "write" by mapping, by our cartographic views of the world? And perhaps most importantly, how do we design new layers, stratigraphies that future generations will read as stories, voices in themselves?

The implications of a landscape literacy based on cultural landscapes methodology adds a critical dimension to the design process. How we perceive and read cultural process in each unique environmental context, how we construct and map authentic histories of place is based on the revelation of a "deep structure" that can be graphically illustrated in sophisticated ways. But, just as there is no absolute past, but rather one that is contingent upon interpretation, there are no absolute landscapes whose history can be frozen to one time period or another. While this tenet is one that is generally accepted by most practitioners within historic preservation, the extension of the argument leads to the realization that any landscape is a medium of exchange and negotiation. This, in turn, constitutes a fundamental alteration of the historic preservation model. The central question is no longer simply one of "What is it?" (the artifact), but "How is it written?" (process), a challenge to the artificial separation between history and design, nature and culture.

This is particularly salient for the uninhabited landscapes of the national parks where the stakes for interpreting place are much higher. How we understand our designs as not solely ordering devices, interventions, superimpositions upon the land, but as woven into the tapestry of the cultural landscape as process signifies a critical self-awareness that national parks can incorporate to great advantage. As the Taiya River continues to shift and meander, altering the riverbanks by simultaneously accreting and eroding areas of the Dyea historic townsite every year, the proposed resource protection strategy of engineered logjams, as an example, is one that continues the story of human adaptation to place. Rather than being viewed as separate from the history of Dyea, they illustrate a rich window of interpretative opportunity that opens on a sustained process of change and adaptation. Situated within the cultural landscapes context suggested by the comprehensive basemapping project, the construction of engineered logjams can be incorporated seamlessly into the environmental history of place.

Ultimately, our ability to read the landscape of Dyea through advanced cartography and expanded interpretation speaks to our own contemporary perspectives and biases in constructing histories of place. The beauty of cultural landscape methodology is that it allows for a continual accretion of meaning, as the stratigraphy of physical and symbolic landscapes grows with each new layer of documentation, analysis, evaluation, and design. It poses some very intriguing questions that can be explored in equally intriguing and innovative ways. Building the spatial vocabulary—the infrastructure—through the ongoing mapping project at Dyea historic townsite has, in many ways, only just begun. But, as with any story, the deeper the excavation, the more enlightening, the more profound the tale becomes. And isn't this the real reason we cherish the national parks?

Endnotes

1. Henry Glassie, *Passing the Time in Ballymenone: Culture and History of an Ulster Community* (Philadelphia: University of Pennsylvania Press, 1982), 201.
2. I propose the term "sustainable history" as an alternative to the typological, thematic histories that are written to conform to the standards of the National Register of Historic Places. The fit between histories of landscape and those of archeological and architectural focus is uneasy, especially when considering the issues of natural site evolution, and range of environmental dynamics at play. With the principles of sustainable design adopted by the National Park Service, as articulated by architect William McDonough's Hannover Principles, a "sense of place" linked integrally with the "resources of the site" is the second determinant of sustainability, the first being the survival of the natural world (see National Park Service, *The Sustainable Grand Canyon* {1996}, in which McDonough's principles are articulated). It stands to reason, then, that constructing a history that reflects the full panorama of the landscape of place through a synthetic interpretation of its integrated environmental context, rather than concentrating on physical cultural resources and their integrity within "periods of significance," would more fully

reflect ideas of sustainability.

The Vanishing Treasures Program of the Tres Piedras Group

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Ruins Preservation Challenges in Western National Parks

The prehistoric and historic architectural remains of our shared heritage (Figure 1) face more threats today than any other time since the enactment of the Antiquities Act of 1906. In America's national parks, increased visitation, looting, vandalism, extensive soil erosion, years of insufficient funding, and many other threats pose serious risks to long-term preservation of these irreplaceable structures. Examples of the enormous variety of preservation challenges we face today in our national parks and other public lands include:

- Stabilization and routine maintenance for frontcountry structures;
- Statutory requirements of inventory, documentation, and evaluation of all historic properties on all land managed by the National Park Service (NPS);
- Condition assessments and treatment evaluations for thousands of backcountry sites;
- Monitoring and increased law enforcement patrols for resource protection;
- Data management and reporting; and
- Education and interpretation to ensure that the public and agencies are aware of the significance and relevance of cultural resources.

These challenges are great, and will be impossible to meet unless unique, flexible, and innovative strategies are developed soon.

Figure 1. The Upper Ruin at Tonto National Monument, Arizona, typifies the kind of prehistoric architectural remains found in many western national parks.

Three NPS units in New Mexico and Arizona are developing one such innovative strategy through cooperation and collaboration, and by participation in the Vanishing Treasures program. These three parks, known as the Tres Piedras Group, include Petrified Forest National Park in east-central Arizona, and El Malpais and El Morro national monuments in west-central New Mexico. Vanishing Treasures is a preservation program tightly focused on preserving archeological resources containing exposed architecture. Now in its sixth year of funding, Vanishing Treasures is one of the most successful cultural resource initiatives in the history of NPS. This paper introduces the Vanishing Treasures program, describes the cooperative effort of the Tres Piedras Group, and discusses the variety of preservation projects being conducted. We conclude by examining the key aspects of this program that make it a success.

The NPS Vanishing Treasures Program

What is Vanishing Treasures? Vanishing Treasures is a ruins preservation program that began in 1993 when cultural resource specialists and managers in the parks realized a crisis was looming regarding the preservation of countless prehistoric and historic structures (Metzger and Kendrick, in press). Decades of inadequate funding for the preservation of these irreplaceable archeological resources, some of which are World Heritage sites, had taken their toll and were now threatening their very integrity. Adding to this crisis was an aging preservation workforce nearing retirement. Few mechanisms existed to develop and train the younger workforce that would soon be needed by NPS.

The Vanishing Treasures program is currently active in 44 units of the National Park System in eight states of the arid West (Arizona, California, Colorado, Nevada, New Mexico, Texas, Utah, and Wyoming). The program operates in national parks, monuments, historic sites, memorials, and recreation areas. The program has hired conservators, archeologists, masonry workers, exhibit specialists, and a structural engineer in its efforts to build a long-term preservation workforce.

What are the goals of the Vanishing Treasures program? The goals of Vanishing Treasures are clear and simple. The first goal is to stop the current loss of unique and irreplaceable prehistoric and historic structures by securing funding and personnel to conduct emergency and high-priority preservation projects. The second goal is to renew the preservation workforce in the parks. Finally, the third goal is to develop into a proactive, rather than reactive, ruins preservation program.

What are Vanishing Treasures resources? One reason for the success of the program is that it has a specific focus on what we call "Vanishing Treasures resources," which are prehistoric (pre-European contact) or historic structures that meet the following criteria:

- Are in a partially collapsed or "ruined" state;
- Contain architectural fabric (such as wood, stone, earthen materials, and such) that is exposed;
- Are not being used for their original purpose;
- Are characterized by interrupted or discontinued occupation and use for an extended period;
- Are located in the arid West;
- Are the resources or part of the resources for which the park was created, or are national historic landmarks, or are listed on or are eligible for listing on the National Register of Historic Places.

Examples of Vanishing Treasures resources include ancient pueblos, cliff dwellings, historic forts, homesteads, and missions. Examples of resources that do not qualify as Vanishing Treasures include:

- Archeological sites with no exposed architecture;
- Civilian Conservation Corps and Civil Works Administration (CWA) buildings and features;
- NPS facilities;

- Historic structures that are regularly maintained;
- Petroglyphs or pictographs; and
- Reconstructed buildings (such as the reconstructed great kiva at Aztec Ruins National Monument).

How does Vanishing Treasures work? The Vanishing Treasures program is often considered a "grassroots" initiative. This is because Vanishing Treasures is a self-directed and self-managed program, one with a clear focus on accomplishments and accountability. The program is also directed and managed at the park level by a leadership committee comprising four to five park superintendents and a full-time program coordinator. The program is also guided by advisory, career development, database, funding, and guidelines workgroups (primarily containing cultural resource specialists within the Vanishing Treasures program).

Importantly, though, the Vanishing Treasures program is accountable for its funding. At the end of the fiscal year, each park contributes a fiscal accounting of their activities, projects, and accomplishments. The Vanishing Treasures program coordinator then compiles these into a fiscal report that is presented to Congress every year. Individuals hired through the Vanishing Treasures program are expected to work primarily (at least 80% of their annual work) on Vanishing Treasures resources, projects, and issues.

Vanishing Treasures accomplishments to date. In the brief time since funding began, the Vanishing Treasures program has made significant contributions to the preservation of cultural resources. These accomplishments include:

- $8.7 million since 1998 (fiscal years 1998 through 2003) to meet the goals of the program;
- $5 million for 78 emergency and high-priority project in 30 parks;
- $3.4 million to hire 56 preservation specialists in 22 parks (these specialists include archeologists, masonry workers, conservators, a structural engineer, and exhibit specialists); and
- $300,000 to meet the management needs of the program.

Vanishing Treasures Program of the Tres Piedras Group

A collaborative ruins preservation program between three NPS units. Spanning more than 200,000 acres across the southern Colorado Plateau, the Tres Piedras Group of parks—so named after the distinctive basalt of El Malpais National Monument, the prominent sandstone Inscription Rock of El Morro National Monument, and the well-known petrified wood of Petrified Forest National Park—contains thousands of archeological sites. Vanishing Treasures resources abound in the three parks. At El Malpais, prominent Vanishing Treasures resources include a Chaco-style great house and great kiva, and extensive prehistoric trail systems containing formal basalt ramps and bridges spanning lava crevasses. Other fascinating sites include prehistoric subterranean architecture with ancient pottery sherds frozen in the depths of ice caves. El Malpais Vanishing Treasures resources also include the ruins of Dust Bowl-era homesteads.

At El Morro, Vanishing Treasures resources range from small 13th-century households to the enormous 700-year-old Atsinna Pueblo, which has 800–900 rooms (by comparison, Pueblo Bonito in Chaco Canyon contains about 650 rooms). Across the box canyon from Atsinna is North Ruin, another massive multi-room site contemporaneous with its cross-canyon neighbor.

Petrified Forest National Park may contain the oldest Vanishing Treasures resources in the entire 44-unit program. House structures dating to the earliest centuries of the first millennium AD are found there. These sites also contain some of the oldest pottery in the northern Southwest. Not to be forgotten at Petrified Forest, of course, is the Chaco Era (AD 1050–1150) McCreery Pueblo with its great kiva and the late prehistoric Puerco Ruin. Puerco Ruin is one of the few major ruins of the Pueblo IV period (AD 1300 to about 1450) managed by NPS. It contains about 125 rooms and is the most visible and visited Vanishing Treasures resource at Petrified Forest.

Though the management and preservation challenges are great, the Vanishing Treasures program provides several mechanisms by which to meet them. These include a renewed preservation workforce, project funding, and a network of cultural resource and historic preservation specialists to provide advice and assistance when needed.

Examples of current projects. Because of the variety of site types across the three parks, the Vanishing Treasures program has initiated a number of different preservation projects since fiscal year 2000. Below, we provide summaries of our multi-year projects.

Atsinna Pueblo preservation project, El Morro National Monument. Site type: Pueblo (800 to 900 rooms). Period of occupation: AD 1200s to middle 1300s (final occupation). Accomplishments to date:

- Drainage system beneath the structure (built in 1950s and 1960s) renovated;
- Preservation history being finalized;
- Condition assessments completed for over 70 wall surfaces;
- Elevation drawings of wall surfaces initiated; and
- Previous preservation treatments harmful to the original fabric removed and replaced in-kind with unamended mortar in three walls (Figure 2).

Garrett Homestead preservation project, El Malpais National Monument. Site type: Single-room, sandstone masonry structure, and main residence for a homestead. Period of occupation: AD 1937 to ? (possibly the 1960s). Accomplishments to date:

- Elevation drawings and condition assessments for entire structure completed;
- Repointing of each wall completed in 2002; and
- Interpretation begun, through use of rack cards.

Puerco Pueblo preservation project,

Figure 2. Vanishing Treasures masonry worker treating a void in a 700-year-old wall at Atsinna Pueblo, El Morro National Monument, New Mexico.

Petrified Forest National Monument. Site type: Pueblo (approximately 100 rooms). Period of occupation: middle AD 1200s to late 1300s (final occupation). Accomplishments to date:

- As-built maps completed;
- Previous research and preservation history initiated; and
- Condition assessments for each of wall surface of 25 exposed rooms initiated.

Erosion control at three archeological sites in El Malpais National Monument. Site types: Pueblos, both large (approximately 60 rooms, a tower kiva, a prehistoric road, and a great kiva) and small (containing 10 or fewer rooms). Period of occupation: all three sites date between AD 1050 and 1150 (the Chaco Era). Accomplishments to date:

- All three sites thoroughly documented;
- Pre-project condition documented; and
- Excelsior sediment logs made of photo-degradable netting and chipped aspen installed at arroyo head-cuts and within active arroyo channels in two sites.

Core functions of the Tres Piedras Group Vanishing Treasures program. The core functions of the program tie statutory mandates and NPS policy with the overall Vanishing Treasures initiative. Primary among these core functions is preservation of the architectural remains (or ruins) of prehistoric and historic structures throughout the three parks (but not those structures that are NPS facilities or are currently still in use, as discussed above). Documentation of known Vanishing Treasures resources and inventory to locate the remaining structures is also a core function of the program. For example, over 90% of El Malpais has not received a systematic, professional inventory for cultural resources. Therefore, inventory and documentation are vital activities of the program. Program development is also a core function. This function focuses on securing project funding and ensuring sustainability in the program. Another core function is education and research through a heritage preservation perspective. Education and research flourish hand-in-hand. We will continue to ask questions about the resources and preservation techniques, contribute to a better understanding of the past, and relay that new information and its relevancy to the public and our fellow staff of NPS. Finally, all of these core functions will require constant management of data.

Keys to a successful multi-park program. Though we are just beginning to develop the tri-park program, we have observed several important points that make the collaboration successful. Primary among these is agreement on priorities. Each year the superintendents of the parks and the Vanishing Treasures personnel in those parks meet in order to assess the progress of the program and discuss immediate and long-term needs of Vanishing Treasures resources. This ensures projects and other activities focus on the highest priorities each year. Valuing professional diversity is another important part of the program's success. Each park benefits from the professional diversity the tri-park arrangement offers. Alone, each park might have one or two specialists who work solely in their particular park. Together, the three parks draw on each other's expertise and experience. The larger Vanishing Treasures initiative also allows access to other preservation specialists, such as structural engineers and conservators.

Although our tri-park program has just begun to pursue partnerships, we realize that long-term success will not be possible without them. We are currently developing working relationships with the following groups:

- University of New Mexico, which will hold its 2003 archeological field school at El Malpais (focusing primarily on inventory, documentation, and condition assessments).
- Arizona State University, which will begin extensive research into the prehistory of the El Morro valley in 2003. This will provide a tremendous opportunity for new interpretations of Atsinna and the ancient context in which it developed.
- Petrified Forest Museum Association, which annually fund an archeology internship at Petrified Forest.
- Pueblo of Acoma, which has expressed an

interest in working together on a number of preservation projects at El Malpais and at Acoma. Discussions have also focused on training and educational opportunities (for both Acoma and NPS), and an in-kind service agreement.

Finally, the most important keys to success are maintaining fiscal accountability and continuing to accomplish high-priority preservation projects. Ultimately, future generations will judge us successful or not by whether we have upheld the mission of the National Park Service by preserving and protecting resources of our shared heritage. By design, the Vanishing Treasures program focuses on one particular type of those resources—prehistoric and historic structures containing exposed architecture. This focus has allowed it to become a model program not just for accountability but also for significant accomplishments.

Reference

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Using Historic Structures to Serve Park Needs: The McGraw Ranch, Rocky Mountain National Park

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The short press release had a disturbingly familiar ring to it: "After careful consideration of all alternatives, Rocky Mountain National Park has decided that removal of the historic McGraw Ranch is the only feasible and cost effective course of action to pursue." Removal was justified, continued the release, due to "the high cost of rehabilitating the buildings … and the basic lack of need for the structures." To those of us in the Mountains/Plains Office of the National Trust for Historic Preservation (NTHP), these statements sounded very similar to what we had been hearing from Grand Teton National Park in Wyoming. In that park, numerous rustic barns and classic dude ranches that predated the establishment of the park had been systematically demolished over the years and others were still threatened. Similar losses had also occurred in Glacier National Park in Montana, where more than half of the park's original inventory of historic buildings was gone, including several classic guest lodges built by the Great Northern Railroad. There was even talk of removing another rustic lodge, the Many Glacier Hotel.

Why were so many historic buildings in national parks throughout the Rockies threatened with demolition? Maintenance costs and lack of use were certainly major factors. But it seemed that the underlying cause was a belief, held by generations of park managers and some environmental advocates, that historic buildings didn't really belong in the great, scenic parks of the West. Unless they were national historic landmarks like the Old Faithful Inn, most historic structures in these parks were seen as impediments to the goals of preserving scenery and natural resources.

When the plan to demolish the McGraw Ranch was announced, we at NTHP decided it was finally time to challenge this thinking. We wanted to see if we could come up with an alternative approach that would not only save this historic site in Rocky Mountain National Park, but perhaps influence decisions in other parks as well. Little did we know that we were embarking on a nine-year journey!

Located at the head of a popular hiking trail in the Northeast corner of Rocky Mountain National Park, the McGraw Ranch is not the kind of historic site that immediately impresses visitors with its ornate architecture or grand scale. It is a collection of 15 modest, vernacular-style structures that fit comfortably into the mountain landscape. The property was homesteaded in 1884 and shortly thereafter a ranch house, barn, bunkhouse, springhouse, and rustic-style outhouse were constructed, using locally harvested logs and stone. During the Depression, the owners of the ranch decided to make the transition from raising cattle to hosting guests, or "dudes." A group of small cabins was built to accommodate visitors who would pay to stay at the ranch, ride horses, fish, and explore the mountain scenery. The first guests at the McGraw Ranch were Kansas governor and 1936 Republican presidential candidate Alf Landon and his family. "I want to lead a flannel shirt life," said Landon, who made McGraw his summer campaign headquarters. Generations of visitors followed, and the McGraw Ranch gained a reputation as one of Colorado's finest guest ranches.

After five decades of operation, the McGraw family retired from the ranch and in 1988 the property was acquired by the park. For several years, the ranch buildings sat empty and deteriorating, until finally the park announced its plan to demolish all 15 structures and return the site to its "natural" condition. To the park's surprise, preservationists and local residents quickly voiced strong opposition to the plan and a major public controversy erupted.

The struggle between historic preservationists and the park over the fate of the

McGraw Ranch might have continued for years had not a new park superintendent, A. Durand "Randy" Jones, arrived and called for a cease-fire. He defused tension by setting up a committee to evaluate the condition and re-use potential of all historic structures throughout Rocky Mountain National Park, not just at McGraw Ranch. At the same time, an informal group of park staff and representatives from outside groups began collecting ideas for how various vacant park buildings might be used, based on park needs. A variety of adaptive-use options were discussed, including park employee housing, artist-in-residence programs, public education programs, Elderhostels, and retreat centers. This approach to the problem of vacant park buildings was similar in many ways to what Main Street groups have been doing for years to revitalize downtowns—matching up available building inventory with unmet market demand.

As it turned out, the key unmet market demand in Rocky Mountain National Park was housing for visiting scientists and researchers. Parks in general have been criticized by groups such as the National Academy of Science for not having sufficient scientific data on which to base important management decisions. Gathering better data is a particularly high priority in Rocky Mountain National Park, where independent consultants have identified a backlog of more than $12 million in unmet natural and cultural research needs, including the investigation of issues such as the impact of acid rain on the park ecosystem, how to manage the growing elk population, and what to do about invasive weeds in the park. With park budgets stretched thin to meet growing demands for visitor services, it was impossible to hire staff to address these research needs. For years parks have relied heavily on outside institutions, particularly universities and their graduate students, to carry out a range of scientific research. The problem for Rocky Mountain National Park, and for many other parks in the system, was a lack of in-park housing for these researchers.

One solution that was considered in the past was to build a new dormitory for researchers somewhere in the park, but Jones saw the potential for something more creative—a chance to address two park needs with one project. His "win–win" proposal was to establish a complete in-park research center by re-using the vacant buildings at the McGraw Ranch. It was a good fit. Without any new construction, the ranch could be rehabilitated to accommodate up to 20 researchers in private quarters, with room left over for an office, library, laboratory, seminar and meeting rooms, kitchen and dining facilities, and living areas for informal socializing.

With this concept for re-use in hand, potential university partners were asked if the proposed research facility would be attractive to their faculty and students. Colorado State University, an institution with long-standing connections to the Park Service, was seen as the key "launch client." After they agreed that their College of Natural Resources would partner in the development of an expanded research program for the park, similar departments from the University of Colorado and University of Northern Colorado came on board.

Paying for the rehabilitation was the next challenge. In part because we had started the whole debate about the McGraw Ranch, but mostly because we believed in the importance of the project's success, the Mountains/Plains Office of NTHP decided to become the lead private fundraising partner. Our commitment was to raise $800,000 toward the $2 million total project cost. The balance of the funding was provided by the park, primarily for budget items that are hard to raise money for, such as utilities and infrastructure improvements.

Because the project had so many dimensions—historic preservation, scientific research, university involvement, partnerships—we found that a range of outside funders were interested in supporting the rehabilitation of the McGraw Ranch. Our first major grants came from the largest source of historic preservation funding in the state, the Colorado Historical Society's State Historical Fund. With this key state support and a matching commitment from the park in hand, we were able to obtain additional support from private donors as well as several Colorado foundations. The Rocky Mountain National Park Association, a strong park friends group with a proven track record of raising funds for other historic sites in the park, joined as a funding partner as well.

Volunteers have played a major role throughout the rehabilitation of the McGraw Ranch—logging more than 5,000 hours to date. Nearly one hundred NTHP members from along the Colorado Front Range as well as groups from the Rotary Club, local churches, the Navy Seabees and Habitat for Humanity have contributed their time and skills. Volunteers were attracted by the beautiful park setting, the opportunity to learn new skills, such as repairing historic windows or re-chinking logs, and the chance to be part of a highly visible public project.

Carrying out a major rehabilitation in a highly visible public setting such as Rocky Mountain National Park has also presented excellent opportunities for historic preservation education and outreach. The rehabilitation site has become an outdoor classroom. For instance, when we were deciding what to do with the barn at McGraw Ranch, we invited a barn rehabilitation specialist to conduct a public workshop for barn owners from the surrounding area, using the McGraw barn as an example. Another workshop, organized by the Architectural Preservation Institute at Colorado State University, focused on the restoration of historic log structures at the ranch. As part of the Preservation and Skills Training (PAST) program developed by the National Park Service (NPS), a group of maintenance personnel from national parks around the country spent more than a week at McGraw, learning skills from experienced mentors while accomplishing considerable rehabilitation work on the property.

The final piece of the McGraw Ranch project came when Rocky Mountain National Park was selected to be a park *learning center*. Funded in part through an NPS initiative called the Natural Resource Challenge, these learning centers are intended to expand park research capacity, encourage collaboration with partner organizations, and engage the public more fully in park resource and management issues. Designation as a learning center also provides Rocky Mountain National Park with additional long-term funding for research staff and maintenance dollars for the McGraw Ranch research facility.

The newly named Continental Divide Research and Learning Center in Rocky Mountain National Park is among the first five such centers that have been established around the country. The others are located at Point Reyes National Seashore in California, Cape Cod National Seashore in Massachusetts, Great Smoky Mountains National Park in Tennessee, and Kenai Fjords National Park in Alaska. Another eight park learning centers are currently being developed, with the ultimate goal of establishing a total of 32 learning centers in parks across the nation by 2005.

Preservation advocates should be pleased that the criteria for selecting locations for learning centers includes a preference for adapting historic structures. For example, at Point Reyes, the historic Hagmaier Ranch was rehabilitated for use as the Pacific Coast Learning Center, while at Cape Cod a former Air Force facility is being re-used as part of the Atlantic Learning Center. In addition, the list of research underway at these centers includes cultural as well as natural resource projects. Cultural landscape investigations, historic structures assessments, ethnographic studies, and the development of a historic archives database are examples of projects already underway. As research efforts expand and more learning centers come on line, there is great potential for parks to build stronger connections between cultural and natural resource preservation and to engage park visitors in these efforts.

We hope that the preservation of the McGraw Ranch, which will have required nearly a decade of effort by the time it opens for researchers in the summer of 2003, has contributed to an evolution in attitudes about historic structures in national parks. When the battle over the McGraw Ranch began, the property was viewed by the park as a site of minor local interest, a drain on precious maintenance funds, and an impediment to natural resource management goals. Today, the McGraw Ranch is a model for the adaptive use of historic structures, a catalyst for increased park funding, and will soon become the centerpiece of the park's expanded research program.

"Americans have a deeply ingrained habit of seeing nature and culture as irreconcilably opposed; we automatically assume that whenever one gains, the other must lose," writes Michael Pollan in his book *Second Nature*. Maybe it is time we got over this idea, especially in our national parks.

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When Disaster Strikes at Your Historic Site During Construction

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Cultural resources are unique, non-renewable, and irreplaceable. Once a resource is gone, it is gone forever. Our cultural resources are most vulnerable during construction for a variety of reasons.

Most of what I have to say applies both to an in-house job where you use your own employees, and to a job where a contractor accomplishes the work.

Natural disaster can strike at almost any time. Check the weather forecast daily. In the Midwest there are weather alert radios that switch on to broadcast when there is a weather change. What is the nature of the risk? Think about it. Develop an emergency preparedness or disaster plan. If it is a contract job, involve the contractor in developing and implementing the plan.

This is not something that we must think about once and then forget. What is the risk today of a storm: ponding on the roof because of a clogged drain, lightning, a flood, mudslide, snow overload or avalanche, frozen pipes, a forest fire, an earthquake, etc.? Is there a special hazard adjacent to your site: a dam, a highway, a railroad, a factory?

Human error is always possible. Remember Murphy's Law: If it can possibly happen, sooner or later it will happen and usually at the worst possible time. What are the chances of an oil spill or a toxic hazard? These, of course, have adverse effects on cultural, natural, and human resources.

Human attitude: you value your cultural resources and are passionate about their preservation but the construction worker you hire or the contractor you retain and his or her employees may or may not care about the site. Some may be very professional and be very proud of working on a historic site. To others it may be just a job in a dirty old building. Attitude can make a big difference.

Human attack: theft, vandalism, graffiti, arson, terrorism, etc. We must provide security to prevent these.

Combination of circumstances: There are risks during construction of which we must be constantly mindful. Electricity may be turned off to do electrical work; therefore, any smoke or fire detection system and alarms may not be operable. Water may be turned off to do plumbing work, so you may not have water when you need it most. Phone lines may not be operable. How do you call 911 if you do not have an operable phone? If there are cell phones on the job, where are they? Can you pinpoint your location to the 911 operator? The 911 operator cannot pinpoint the location from a cell phone number. If in an urban or a remote location, can you give good directions to the fire department? More than one fire truck has gotten lost trying to find the fire. If you are in a remote location, there may not be a fire department. You may have to provide your own fire protection.

We need to think both about what we want to accomplish, but also what we want to prevent.

Be concerned for both the safety of the workers and the safety of the historic building. Look for slip or fall hazards. Railings may be removed for repairs. Use barricades where needed. Injury or death on the job site cannot just ruin your day; it can end your career and maybe your life. Safety is everyone's business.

Think about how to minimize risks. If at all possible, prohibit any open flames on the job.

Communication is very important: Does everyone know what to do if a disaster strikes? Has there been a pre-construction meeting on safety? Are there weekly meetings and reminders? Are signs posted? One of my favorites is: "SAFETY IS NO ACCIDENT! SAFETY IS GOOD PLANNING AND TRAINING." Safety does not just happen. Be redundant. Post several signs where they cannot be missed.

Selection of a contractor is very important. What is the contractor's safety and loss record? Contractors are required to have construction insurance. Make sure it covers disasters. What is the contractor's track record? Check with the insurance company on the contractor's past history of claims.

How should we communicate to the workers or contractor? Use meetings with contractors and workers. Holding a pre-construction meeting is very important. Workers, whether they are employed by a contractor or by the National Park Service, must have a fire safety orientation. Monitor changes in personnel. Contractors often send their best staff to the pre-construction meeting. Sometimes you may not see them again. If there is a change in personnel, each new person must go through a safety orientation. If it is a long job, have regular safety meetings and refresher safety briefings especially on the days of hot work. Hot work includes, but is not limited to, welding, soldering, brazing, hot roofing, removal of paint by heat gun (never remove paint by using a torch). Don't forget about sparks from cutting or grinding. My Uncle Edward was killed in 1929 by an aluminum dust explosion caused by a spark.

Make sure to stress to the contractor and/or employees why the historic building is significant and that it is an irreplaceable cultural resource. Once destroyed, no replica can ever replace it and be as significant.

The purpose of construction specifications is to communicate. Specifications are usually dull but they are a legal document and take precedent over plans because a lawyer can read specs and tear them apart; lawyers usually do not know how to read plans. Contractors do not always read or re-read the specs after making their bid.

For two years I worked for an architect in private practice. He hid things in his specifications to determine if the contractor read the specification. One contractor actually found the requirement of delivering a free case of gin to the architect's office every Friday at noon. Many contractors did not read the specifications thoroughly. I began to look forward to noon on Friday because the architect frequently handed out bonuses on Friday—a bottle of gin (or rum, or vodka) to everyone on the staff. We cannot use this clause in government contracts, but we could test the contractor in other ways. Maybe this is how we can get someone to dress up in a bunny costume and hand out Easter eggs at the NPS Employees Association spring party.

Also, put important notes on the construction drawings because workers and contractors usually refer to the plans more often than they re-read the specs.

Mark the fire lane on drawings. Designate areas on the drawings for dumpster and storage of materials so that they do not block the fire lane.

Put safety reminders in pay envelopes to workers or payments to the contractor.

If workers cannot read or speak English, be sure that there is always a translator on site. You may need to post signs in more than one language.

Have you invited the park safety officer to inspect the site on a regular basis? Include fire marshals—they are good at spotting hazards, better than you or me.

Have you invited the contractor's insurance carrier to the site for inspections?

Identify hazards: combustible materials, systems, chemicals, finishes, and fabrics.

Inspect storage areas: Are the roofs and/or floors overloaded because of the arrival and storage of construction materials? Is 100% of the new roofing stacked on 10% of the roof?

Are there any old gas fixtures or pipes that still have gas in them? Better to find out before someone cuts the pipe.

What are the risks and hazards in specified materials and treatments? Are there welding gas tanks stored at the site? Steel wool is flammable. Beware of using steel wool around outlets.

Seasonal risks: What are the risks at certain times of the year? Are portable heaters being used in the winter? Could combustible materials (e.g., empty paper cement sacks) be blown into a space heater when the door opens and there is a draft? Are fans being used?

Demolition is risky! What can go wrong? Everything from stepping on a rusty nail to unknown hazards (such as pigeon droppings in the attic) to unexpected collapses because of improper sequencing of demolition.

How many electrical panel boxes are there? If there are more than one, do not assume that all of the electricity is off just because some of it is off. You could have a rude surprise that could ruin or end your day—or even worse, your life.

Obstruction of the fire lane: Is the dumpster or the construction shed blocking the fire lane? Is the dumpster emptied on a regular basis? One night I was bicycling home from work. When I passed the State Building, I saw a dumpster on fire in the alley behind it. Flames were leaping 30–40 feet in the air. The dumpster was within five feet of the building and almost set it on fire before the Fire Department arrived.

Very few construction sheds are totally fireproof. If a portable heater accidentally sets the construction shed on fire, could the fire spread to your historic building? The construction office trailer should be at least 30 feet from your historic building, if possible.

Means of egress: construction materials, especially paint cans, should not be stored on or under stairs or in exit corridors. These must always remain clear. Incomplete systems (open floor joists and wall studs) allow fires to spread more rapidly. The sprinkler system may be installed but not yet operable.

Hot work: We cannot avoid all hot work. If there is to be hot work, we must plan for safety during and after hot work. There must be a hot work permitting process. The safety officer must be involved. Who is authorized to issue a permit? Who is responsible? Who inspects? These decisions need to be worked out in advance. There must be a hot work permit every day hot work is done—no blanket permit for a long period of time. Do not allow any hot work where there is dust, sawdust, oil, flammable chemicals, animal droppings, etc. Do not allow any hot work where flammable construction materials are stored. Do as much hot work outside the building as possible. If hot work must be done in or on the building, create a safety zone. Know what's going on each day and where the risks are.

Cover flammable materials that cannot be moved with a fireproof cover. If possible, you may want to wet down surrounding materials. Wet surfaces are less likely to burn. Evaporating moisture cools the surface.

Who supervises hot work and the use of tools? Maintain fire equipment. Always have fire extinguishers on site, especially at the site of hot work. All construction workers should be trained on the use of fire extinguishers. Have the fire extinguishers been inspected? Have they been recharged? Stop all hot work three hours before workers leave. There may need to be a 24-hour guard. The guard needs to know if there has been any hot work that day. Inspect areas where hot work has been done. Don't just look, also feel the surface for any heat. Dust in wall or floor cavities can smolder for hours before breaking into flames.

Use common sense. No smoking should be allowed on the job site, but smokers will smoke. Maintenance workers smoking once set the Main Interior Building in Washington, D.C., on fire. Provide a safe smoking area outside of the historic building and away from all hazards. Enforce the rules. If you are lax on enforcement, workers are more likely to cheat. Do daily checks. Inspect the smoking area. Some people think they can cheat without getting caught.

Keep the site clean. Construction debris, especially an accumulation of sawdust, can be a preventable hazard.

Arson—don't provide an opportunity. Provide site security.

Ever forget to purchase something at the grocery store? Usually you forget less often if you have a list. There are a lot of things that can go wrong and a lot to remember. The larger the job the more than can go wrong. Develop checklists for your construction site and use them. This documents your safety program. If the worst happens, it is good to have a safety paper trail. Store your safety records off-site or they may go up in flames with your historic site.

I must re-emphasize communication—what do you want and why is it important? Also, emphasize what you do not want. Assign responsibility for safety. Develop a plan and use it. Drill, drill, drill. You never know when disaster will strike. Inspect sites often. Speak to individuals. Discipline violators.

I can only hit a few highlights in this paper. For more in-depth coverage, get a copy of the publication *National Fire Protection Association 241: Safeguarding Construction Sites*, read it, and use it.

Expanding the Meaning of Heritage: The New Mexico Heritage Preservation Alliance

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I am glad the director of the National Park Service (NPS) advocates having the units of the National Park System work with partners who participate in the larger set of common interests that revolve around, and in many cases have grown out of, the NPS mission. Obviously there are many difficulties in reaching out beyond park boundaries, as it makes others feel entitled to reach in from outside. There is an understandable temptation to adopt a defensive way of thinking, but the trouble with this is that points are not scored—progress is not made and ultimately the parks will not be preserved—by defensive action alone.

There is more than one way to preserve a park. I want to focus on the abilities partners may have to do something the managers of protected areas need done in ways that may not be available to public employees. In an effort to make NPS the historic preservation leader the National Historic Preservation Act says it should be, I spent much of my career trying to enable new ideas about cultural resources to make sense in the context of the National Register of Historic Places. This was natural. The National Register was founded on a new idea—that the American people needed more in the way of historic preservation than could be accomplished by setting aside a handful of nationally significant places as museums, monuments, and memorials. In general, national park units and nationally protected areas are the cultural resource equivalent of the "charismatic megafauna." They may look great alone, but they have vital interrelationships with other less spectacular resources. It is necessary to preserve the totality of the larger environment.

I grew up in the tutelage of Ernest Connally, Robert Utley, William Murtagh, and Robert Garvey, and absorbed their vision of the National Register, section 106, and the network of federal, state, local, and tribal preservation officers functioning as one great comprehensive program to identify and preserve the national heritage. I am proud of having worked to make the National Register one great tent capable of sheltering all types of cultural resources, and of having helped to keep the National Register at the center of official historic preservation programs throughout the United States.

But "official" approaches are only one way—not always the best way—of making preservation happen. I want to focus now upon unofficial forces, such as public opinion, and some of the ways that non-governmental organizations such as statewide citizen non-profit heritage organizations can help to shape the forces. I have the honor of being president of one such organization—the New Mexico Heritage Preservation Alliance.

All fifty states have organizations like the alliance. They are loosely affiliated as partners of the National Trust for Historic Preservation and of one another. New Mexico was one of the very last states to organize one of these things, with our corporate charter approved in 1995 and our work only really becoming a meaningful force three or four years later. This has both good and bad aspects to it. One of the bad aspects is that, unlike statewide organizations that have had 20 or more years to build endowments and other financial arrangements, we live pretty much hand-to-mouth, able to pay only one poor overworked staff member and required to raise 100% of our annual budget *de novo* each year. One of the good aspects is that, unlike some statewide organizations that have had many years in which to become stodgy, we have internalized no limits upon our own creativity. The world expects us, as adolescents, to act up a bit; and we, as adolescents, act up in order to get the attention that can make us effective.

By acting up, I really mean the subject of this paper—expanding the public's understanding of what historical heritage can mean. Statewide organizations do many things, but virtually all of them release a list each year of what they have dubbed their state's most endangered historic places. Older and more settled statewides are apt to list a dozen or so buildings or districts—the daring ones throwing in maybe a bridge or an archeological site or a place significant to a minority. These lists are the organization's one great chance each year to call attention to their work and their values; the one great chance to have their work and values noticed by a news reporter or remembered by a governor or a legislator or a potential benefactor.

The upstart New Mexico Heritage Preservation Alliance, however, has developed a marvelous track record of attracting the attention of people who ordinarily might skip over a historically-based article in their newspaper. The reaction we strive for among people who read about us is not so much "aha" as "I never thought of that!"

It started in our very first year of releasing a most endangered list, when in 1999 we declared among our state's most endangered places a waterworks, a residential district, a ghost town, a bridge, an industrial site, and the New Mexico night sky. *"The New Mexico night sky!"* people said, *"I never thought of that!"* Most people in the United States who can still see the brilliance of stars and the moon at night are vaguely aware that they like seeing them. They may even be regretfully aware that this blessing is gradually being taken from them by light pollution and reduced air quality, but they are probably resigned to its loss as part of the price of "progress." And the few who actually want to do something about it are apt to think in terms of preserving what we in the National Park Service would probably categorize as a "natural" resource. But an endangered *historic place? Holy cow! I never thought of that!* And the justification was not really very hard. All it took was to apply traditional cultural property concepts to the heavens. But the boldness of the concept worked exactly as we had hoped. It received extraordinary and positive attention. The attention energized a coalition of people who had been working for night sky protection from an astronomer's perspective and, with a lot of behind-the-scenes guidance from NPS employee Joe Sovick, 90 days later the state had a new law regulating light pollution.

This succeeded so spectacularly that the alliance has since then made it a deliberate practice to introduce at least one innovative concept each year. We have designated, along with the normal array of buildings, structures, and sites, a mountain (now saved), a railroad (now saved), a cultural tradition (now on its way to being saved through enactment of a National Heritage Area), and a river valley (probably not going to be saved). But in 2003 we went further than ever before, designating two vast topographical land forms: the greater Otero Mesa, a scenic, natural, and archeological area in southeast New Mexico; and the La Bajada Escarpment, a long and magnificent bluff that served as the boundary marker between two Spanish administrative jurisdictions during colonial times. But the real blockbuster this year was "The waters of New Mexico." This was timely because the state has been in extreme drought. I want to read to you selections from the nominating documents by which cultural values were identified in such resources as the night sky and the waters of New Mexico. The point of reading this is to reveal the logic that enabled such unorthodox designations. It is not as "far out" as one might presume.

The Night Sky

"From the pleistocene to the present the night sky has been an important element in cultural heritage. The combination of what appeared to be eternal order in certain night sky patterns with such changeable things as lunar phases, planetary movements, seasonal angles of declination, and annual meteor showers was one of the early great stimuli to curiosity. The discovery of predictable order among the inconstants was important in the development of belief systems and their attendant cultural values—influencing even the idea of what it means to be human. It remains so today."

"Mammoth hunters at Clovis and Folsom, ancestral Puebloans at Chaco and Pecos, Vasquez de Coronado in his explorations, Onate and de Vargas in their conquests, cowboys on nightherd duty, and office workers resting from their daily toils all have lived under, admired, and wondered about the same night sky—virtually unchanged in human history."

"A pristine night sky almost universally stimulates thought. Some are humbled in their insignificance before the visible universe, and some are exhilarated by a sense of identification therewith. Some measure and test the movement of our earthly platform within the solar system, the solar system within the galaxy, and the galaxy within the universe until human understanding is exhausted and calculation at its limit. Some speculate about life elsewhere, and some contemplate that the flesh, blood, and bones of our very bodies—even the energy powering our thoughts—are of the light and substance we see coming down from the spangles above."

"Without conscious action it will be much more difficult for future generations to have the same experiences, or even to imagine them. As urban areas expand and as change without consideration of the night sky continues, places where it can be experienced grow fewer and more difficult to reach. We risk losing a beauty that has been the backdrop to and motivator of human actions since time immemorial."[1]

The Waters of New Mexico

From the first human's entry into present New Mexico until now and into the infinite future, water has been and will be the primary determinant of where, how, and whether people will live. The earliest known structure in this state is a well made perhaps 10,000 years ago at Blackwater Draw, and is evidence of the profound human drive to take action with regard to water in order to live here. Human recognition of water as giver of life made it a cultural, as well as a natural, resource. Blue Lake, Zuni Salt Lake, and other waters are held sacred by indigenous cultures. Water sources are focal points that both enable and limit human activity. Acequias—more than mere distribution systems, became human associations, cultural traditions, and the foundations of legal systems. The significance of water is evident in the locations and distribution of ancient habitation sites; road and trail routes; farms and field patterns; greenlines and tree rows; windmills and the cattle they support; and the locations of villages, towns, and cities. Water has become so completely a "cultural" resource that many people now consider its natural sources mere utilities, forgetting their greater roles in shaping human activity and supporting the interlocking systems upon which all life depends.

The famous spring that gave Portales its name has been dried by wells into a crusty rock shelf. The "Hope" that named an Eddy County town is poignantly memorialized in dry ditches and dead orchards. The mighty Rio Grande, fourth longest river in North America, is sometimes dry less than halfway to the sea. Institutions and legal systems that governed water use in earlier times have ceased to be effective, ignoring links between surface sources and aquifers and allowing water rights to exceed actual water. Public officials and private enterprise, focusing on short-term gain rather than sustainable possibilities, have not confronted the facts. Growing profligate uses threaten acequias, small farms, and other uses deeply rooted in heritage. As New Mexico prepares to address these problems, there is danger that a crassly utilitarian approach may reduce her waters to a simple element of economic production or a component of infrastructure. The true value of New Mexico's waters can only be understood, and humane solutions found, within the context of her history and cultures.

I have not said very much in this paper about reaching out beyond park boundaries and interacting with the vast federal, state, tribal, local, and private-sector historic preservation network that is actually led by the National Park Service because I have made that speech since 1981 and because many park managers have learned its truth—although a few Neanderthals still cower behind park boundaries. I have suggested that public opinion may be a more effective preserver than legal protections, and that innovative and imaginative concepts can be effective shapers of public opinion. Although I have focused mostly on two very innovative cultural resource concepts, let me say that the mountain we declared endangered (Buffalo Mountain, near Cerrillos) has been saved by recognition that it is important to the county park that has been created near it. The railroad (the Cumbres & Toltec steam railroad) functions essentially as an interstate park run by both Colorado and New Mexico. The cultural tradition (Hispanic heritage of northern New Mexico) leads logically to development of a heritage area that will be led by the National Park Service. The river valley (the Hondo Valley, east of Ruidoso) will probably not be saved because it is essentially an old-fashioned historic preservation controversy involving widening of a highway, but our State Historic Preservation Office has become more cognizant of cultural landscapes as a consequence of the designation. The 1999 designation of the New Mexico night sky enables us in 2003 to help Chaco Culture National Historical Park, a World Heritage site, defend itself against a coal-fired generating plant whose emissions would diminish Chaco's wonderful archeo-astronomical values. And working to preserve the waters of New Mexico will set conceptual precedents important to parks all over the world—as one not too distant example, the ecosystem in Big Bend National Park that depends upon the water and the aquatic life of the Rio Grande, not to mention the importance of New Mexican waters to Chamizal National Memorial, Amistad National Recreation Area, and Palo Alto Battlefield National Historic Site.

So if you still think the State Historic Preservation Officer, section 106, and the National Register are burdens to be endured or obstacles to be evaded; and if you think your statewide heritage preservation organization is some sort of remote ally of questionable value—wake up and get involved. It ain't so.

Endnote

1. Jerry L. Rogers, and Joseph E. Sovick, "The Ultimate Cultural Resource?" *The George Wright Society Forum* (Vol. 18, No. 4, 2001), 25–28.

California's Cultural Heritage Resources Summit: A Call for Action

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Californians today are vitally interested in their cultural heritage and in those cultural heritage resources that give them identity, visibility, and a sense of belonging. These cultural heritage resources are our historic sites, structures, and monuments; our art, artifacts, and museum collections; our libraries and archives; our cultural landscapes and archeological preserves; our folklore and folk life traditions; and our literature and oral traditions. For the purposes of this paper these treasured cultural heritage resources collectively form a unique legacy of who we were, and are, as Californians.

There is little argument among professionals that cultural heritage resources bind our peoples together. In their very existence is a spirit of renewal. In their preservation, there is hope. In the advocacy for their preservation are bonds among a diverse group of organizations to protect a valuable past and evolving present because of the cultural value placed on these resources. In fact, we contemporary Californians will perhaps be judged as a people who cared and endured, or a people who squandered their heritage by letting their cultural heritage resources lie unprotected or under-interpreted. However, cooperation and coordination for the statewide management of cultural heritage resources is admittedly difficult and complex. Those resources, often fragile, difficult to protect, and costly to restore and maintain, are not renewable and their very diversity and breadth increase the complexity of the management challenge. "Our cooperation with one another is really difficult because our media are so different," states Professor I. Michael Heyman.[1]

Visiting museums and historic sites is also increasingly popular as a family recreation activity, as evidenced in the 1997 study "Public Opinions and Attitudes on Outdoor Recreation in California.[2] The survey showed that nearly 75% of all Californians participated in visiting museums or historic sites during the year. Respondents visiting museums and historic sites averaged 10 activity-days, for an estimated 61.8 million household-participation-days per year. Also gleaned from the survey was that there is a high, unmet demand for cultural resource-related activities, as well as a willingness to pay for such services. These facts allude to the tremendous opportunities that exist for education, public outreach, and economic development in the management, interpretation, and effective use of California's cultural heritage resources.

It was with this background that the California Cultural Heritage Resources Summit, a forum for discussion of the issues surrounding cultural heritage resources, was organized. The summit was a colloquium planned and organized by the California Department of Parks and Recreation (also known as California State Parks) and the California Office of Historic Preservation. The purpose and goal of the summit was to begin the development of a statewide common agenda among the diverse groups who have some responsibility for California's cultural heritage resources. The term "common agenda," as used for the purposes of the summit, was defined as a collaborative effort between those present that results in unity of purpose to protect and preserve California's cultural heritage resources while educating and enlightening our citizenry about the wonders of the state's cultural landscape. Museums, historic parks, buildings and monuments, the arts, academia, historical societies, cultural awareness advocates, archival resources, and historic preservation groups were all part of that agenda.

The California Cultural Heritage Resources Summit was an unprecedented gathering in that it brought together individuals who normally do not come together. These individuals, while considered leaders in their fields or within their representative organizations, usually associated only with peers at professional gatherings or within their own professional organizations. These organizations and individuals had not had the opportunity to communicate at a cross-professional colloquium with a single focus on cultural heritage resources. The invitation-only event included stewards, spokespersons, and scholars for significant portions of this larger cultural legacy.

The summit was held in November 2002 at the J. Paul Getty Museum in Los Angeles. The gathering had support from the Friends of Hearst Castle, the Hearst Castle Preservation Foundation and the J. Paul Getty Trust, and co-sponsorship from the following groups: California Association of Museums, California Council for the Promotion of History, California Historical Society, California Preservation Foundation, California State Archives, California State Library, Los Angeles Conservancy, National Park Service, National Trust for Historic Preservation, and Society for California Archaeology.

The summit was originally conceived of in 2000. Concern over the management and organization of cultural heritage resources—specifically those in the care of California State Parks—was expressed by professionals and the public at a series of public workshops that were held to gain input for State Parks strategic plan development. California State Parks holds in public trust cultural heritage resources of astonishing breadth and diversity. Within California State Parks are approximately 13,000 historic and archaeological sites including 47 state historic parks, and 3,000 historic structures containing 4.5 million artifacts. Internally, California Parks' cultural resource management staff echoed the need for increased visibility of these resources, the organizational focus of which should equal the intensity and commitment made to our natural heritage treasures. State Parks executive staff agreed.

To begin that commitment, a cultural heritage division was formed that unified and heightened the internal awareness of State Parks holdings and responsibility, and promoted a stronger working relationship with the Office of Historic Preservation, administratively already an office within the California Department of Parks and Recreation but whose mission differs from that of State Parks. Concurrently, plans for a cultural heritage summit were developed whereby ideas from the diverse array of cultural heritage stakeholders could be both shared and gleaned for the benefit of not only State Parks, but those stakeholders as well. No one agency—public or private—in California could, or should, take on the daunting quest of ensuring that all Californians see themselves represented in culturally sensitive ways in the state's cultural heritage resources. But a collective summit goal was to ensure that Californians saw themselves *somewhere* in those resources when they were taken collectively. How that very significant goal would be met, however, was a pressing question that needed exploration through dialogue with a broad array of individuals, agencies and organizations, both public and private.

The assistance of Tom Frye, chief curator emeritus of history for the Oakland Museum, was enlisted as cultural resources advisor to the director. Frye developed several departmental strategies in the cultural resource management arena and played a key role in the planning of the summit, which began in earnest in early 2001 with the appointment of a steering team[3] to work on summit details. The J. Paul Getty Trust and Museum was approached by Frye, and key State Parks executive staff, to assess its receptivity of hosting and co-sponsoring the event. The knowledge, experience, and reputation of the Getty Museum within the cultural heritage field, as well as its spectacular setting and location within Los Angeles, made it an ideal partner for this premier gathering. The staff of the Getty Trust agreed to host and provide significant support for the event, but wished to remain in a secondary role to State Parks in the planning and implementation of the summit. State Parks solicited and received co-sponsorship and support from other organizations considered critical to the success of the summit. By early 2002 the summit steering team had secured full grant funding for the event, enabling the 90 invited participants to attend at no cost, which assisted in ensuring their attendance.

Concurrently with summit planning, two other events occurred that added an additional degree of complexity to that effort. While California's quality of life can be significantly enhanced by its cultural heritage resources, state and municipal funding and financial incentives for historic preservation had been minimal during the past several decades. However, beginning in 2000 Californians passed Proposition 12, the largest park bond act in the nation's history, which contained a modest amount of seed money, $12 million, for historic preservation grants to local agencies and $10 million for state park cultural resource projects. Two years later another bond act, Proposition 40, also passed. This bond contained $230 million for cultural resource projects—more than had ever been appropriated for such efforts. While the summit planning team purposely kept the focus of the proposed meeting on its original goal, there was no question that suddenly the California Cultural Heritage Resources Summit would take on an added dimension as a multitude of diverse heritage groups vied for a share of these dollars.

When finalized, the summit's outcomes and issues revolved around three basic questions, the answers to which would serve as a basis and framework for the goal of a collective common agenda. Those questions were: "What is the state of California's cultural heritage resources today with regard to the issues of preservation, stewardship, audience, relevancy and diversity, education and interpretation, and funding?"; "Where do we want to be with California's cultural heritage resources in five to ten years and what outcomes do we want to achieve?"; and "What do we do to get there?" In addition, the organizers and sponsors hoped that the summit would inaugurate a continuing dialogue among the diverse perspectives represented at the event.

In order to provide a focus for the discussion that would ensue, several additional objectives were presented, including:

- Exploring and identifying of what is missing from California's cultural heritage resources tableaux, and how filling those gaps might be addressed;
- Exploring and identifying of the nature of the partnerships and collaborations needed in the cultural heritage resources field;
- Determining whether the creation of a high-profile roster of California's Most Endangered Cultural Heritage Resources might contribute to efforts and means to preserve them;
- Forging a vision of promise and possibilities for California's cultural heritage resources, mindful of the challenging realities faced by many organizations, such as the economy, budget deficits, staffing issues, competing priorities, and national and regional crises; and
- Exploring and determining ways by which the visibility and importance of our collective cultural heritage resources may be extended to the broadest range of Californians.

The summit was divided into three sessions, each exploring one of the questions considered fundamental to the development of a common agenda. Each session was preceded by a notable speaker who set the stage for what followed. A panel of representative stakeholders then presented a point of view on the subject, after which audience participants asked questions or presented their own point or counterpoint. Breaks between sessions allowed for interpersonal discussion or debate. Special keynote presentations were made by Professor I. Michael Heyman, Congressman George Radanovich, and John Nau, III, chair of the National Advisory Council on Historic Preservation.

So what is the state of the state with regards to its cultural heritage resources here at the early beginnings of the 21st century? First, California has massive holdings with regard to these resources. However, there is little coordination between and among the various agencies and organizations that possess them. In addition:

- There is no direct nexus between university studies and historic preservation. There are no generally accepted curricula in historic preservation that lead to special studies and research.
- Preservation and stewardship issues revolve around the availability of financial resources. Some museums are well endowed; others, not. For governmental agencies, regardless of jurisdiction, deferred maintenance is a constant issue due to the expense of rehabilitating and maintaining historic structures and other cultural heritage resources such as artifacts and art works.
- California faces a daunting task with regard to relevancy, in the context of the broader view of cultural heritage resources, because of the fact that its citizens form one of the world's most diverse populations. Dozens and dozens of cultural groups look to make the California experience their experience. More than a hundred different languages are spoken in the Los Angeles School District alone.
- There is no current "California History Plan"—the last one was done in 1973—which could address acquisition, development, a statewide sites inventory, and the thematic deficiencies that need representation.

However, the state of this state's heritage resources also possesses positive footnotes. California's broad cultural heritage resources community is poised and committed to work together to meet the demands of relevancy and audience, stewardship and preservation, education and interpretation. The summit proved this. The diversity of California's population is not a weakness, but a strength. By addressing the issues and difficult challenges surrounding relevancy, tremendous opportunities exist for cross-cultural communication. A California history plan based on a new, modern, thematic framework, rather than a chronological one, is in the testing stages. The success of ballot Propositions 12 and 40 demonstrates that tremendous public and political support exists for efforts that promote California's cultural heritage resources. Grassroots historic preservation efforts are taking place throughout the state. All of this is occurring during a period of economic crisis. However, I am certainly not alone in recognizing that there is little innovation in government unless there is a crisis. Little dramatic change takes place without one.

The California Cultural Heritage Resources Summit generally exceeded the expectations of planners, sponsors, and participants alike. The first steps toward the goal of a common agenda were made with the fostering of a more complete understanding of the mission of represented organizations and agencies, and their connection to heritage resources. Perhaps the major revelation, by no means an assumed one, was that the myriad of organizations, organizational representatives, and spokespersons for those resources had much more in common with each other and collectively than they had differences separating them. Other outcomes from the conference included:

- Overwhelming support for continuing the dialogue begun at the summit.
- Support for future formal meetings, including the potential for another summit with a structured format.
- Agreement that a collective advocacy had the potential to achieve results within the competitive funding environment that exists within California today. Within the current budgetary crisis, this advocacy at a minimum could achieve acknowledgment that California's cultural heritage resources are a critical element in defining who we were and are as Californians and as such are non-renewable treasures.
- Agreement that accessibility and inclusion was critically important to creating a vibrant collective cultural heritage resources program to which all Californians could relate.
- Agreement that more ties were needed with the academic community specifically and in general among the interests vested in some portion of California's cultural

heritage.

- And for California State Parks, a heightened awareness of the context of its cultural heritage resource holdings within the broader heritage resources community.

Post-summit communication and evaluation echoed the success of the conference as a defining event within California. Many of the organizations not individually represented at the gathering expressed their interest in future dialogue as a common agenda is beginning to be shaped and structured.

My opinion of what must occur next if this agenda is to be successful can be summarized with four thoughts. First, the momentum of the summit must be used to gain further understanding of each other's media as they contribute to the greater collective whole of California's cultural heritage resources. Second, as stakeholders continue to meet, a collective advocacy must be designed, publicly and politically, for the preservation, interpretation, development, and acquisition of those resources as a part of the agenda. Similar to the environmental movement of the late 1960s and the 1970s, we must use the strength of what these groups have in common and not what divides them. A common agenda certainly need not be a passive one! Third, a California history plan, to include an inventory of the state's cultural resources with thematic deficiencies identified, must be completed. And finally, a strategic plan with goals, time frames, and performance measures for achieving a common agenda should be developed. This would detail the strategy, and the devil is in these details. Without facing that devil, only rhetoric will continue.[4]

Endnotes

1. Quote from Heyman's keynote address, November 17, 2002. Heyman is secretary emeritus of the Smithsonian Institution and chancellor emeritus of the University of California, Berkeley.
2. "Public Opinions and Attitudes" was prepared by CIC Research, Inc., of San Diego for California State Parks.
3. The steering team consisted of the following State Parks staff: Steade Craigo, FAIA, chief, Cultural Resources Division; Hoyt Fields, chief curator, Hearst San Simeon State Historical Monument; L. Thomas Frye, cultural resources advisor to the director and chief curator emeritus of history, the Oakland Museum of California; Knox Mellon, state historic preservation officer; Steve Mikesell, deputy state historic preservation officer; Erin Saberi, assistant director, California State Parks; Catherine Taylor, museum director, California State Railroad Museum; and Denzil Verardo (summit chair), chief deputy director for administration, California State Parks.
4. A full summit *Proceedings* is available by contacting California State Parks.

Fort Stephen A. Douglas: Adaptive Re-use for a Community of Scholars

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Introduction

This paper explores the stewardship aspects of rehabilitating the built environment. The University of Utah's award-winning re-use project at Fort Stephen A. Douglas in Salt Lake City will be used to illustrate good practices in stewardship of the built environment. It also demonstrates how historic buildings can be revitalized to promote a positive perception of urban renewal in the built environment.

The fort is on the east bench in the foothills immediately adjacent to the University of Utah at the eastern periphery of Salt Lake City. Fort Stephen A. Douglas was originally established in 1862 as Camp Stephen A. Douglas to protect the Overland Mail Route from attack by hostile Indians. The original commander, Colonel Patrick E. Connor, also felt a duty to "keep an eye on the Mormons" whose loyalty to the Union at the time was considered suspect (Peterson 2002). Consolidation of military activities led to the designation of the camp as Fort Stephen A. Douglas in 1878. The fort continued to grow throughout the 19th century and reached its zenith during World War II. The post-war period saw a long slow decline in the fort and eventually it was reduced to a reserve center headquarters (Stock 1996). The historic core of the fort was designated as a national historic landmark in 1970. Most of its original 10,525 acres have already been ceded to the University of Utah for academic, administrative, and residential facilities built in the latter part of the 20th century. Significant other portions have been transferred to the National Guard, Veterans Administration, and the U.S. Forest Service. Approximately 58 acres remain in use by the military (University of Utah Department of Facilities Planning 2000). With the designation of Salt Lake City as host of the 2002 Winter Olympic Games, the university had an opportunity to host the Olympic Athletes' Village while resolving a shortfall in its student residential accommodations. Thus began the stewardship process described herein.

Defining Stewardship of the Built Environment

The short-term gains of expanding the built environment have long been viewed as financially attractive despite the resultant and unfortunate long-term degradation of the natural environment that has been taken for granted. The resultant landscape of both environments reveals that the overwhelming majority favors an extraction and depletion philosophy. Although this degradation has been mostly ignored in the last five centuries, the past century or so has seen a growing number of individuals and groups who have been outspoken in defending the natural environment. What affects the built environment affects the natural environment. Conversely, what affects the natural environment affects the sustainability of the built environment. By understanding the closed system of forces that affect both landscapes it is possible to adopt a stewardship approach wherein the effects of change are taken in the context of the whole rather than individually. As this concept has become widely recognized, stewardship of the built environment has increasingly become a goal of many.

An increasing amount of the built environment lays underused throughout the country. Stewardship explores how changes in the natural and built environments interact with one another. Therefore, by extension, the intrinsic philosophy of the stewardship approach to growth is to reverse the current outward flow of development back towards the central cities and to reconsolidate existing built environments that have declined due social and political trends.

Stewardship Transforms Urban Renewal into Urban Revitalization

"Urban renewal" evokes many images. For those who experienced it in the early second half of the 20th century, it meant razing older buildings and replacing them. However, when conservation and stewardship of the environment are added, "urban renewal" is transformed into "urban revitalization." Instead of losing the historical continuity and community that older neighborhoods and built landscapes can provide, the more appropriate concept of urban revitalization adapts existing buildings to accept the modern amenities and building code interventions necessary for their continued operation and use in the 21st century. Urban revitalization is the culmination of responses to how American politics have addressed the built environment. Prior to the 1949 creation of the National Trust for Historic Preservation, preservation was largely seen as the work undertaken by a few "wealthy" or "devoted" individuals to save only the finest examples of historic buildings. However, prosperity after World War II led to a burgeoning suburban housing market surrounding many urban centers and thus started an exodus to the suburbs that subsequently led to the deterioration of many inner-city neighborhoods and the creation of urban renewal programs across the country. Those unable to leave had little political wherewithal and the resultant renewal programs designed to remove "urban blight" across America left their mark on the built landscape. These programs were also fueled by the National Highway Transportation Act of 1956 that at the initial stages of the Cold War responded to the perceived need for emergency evacuation routes during a nuclear attack. While those attacks have not materialized, the "evacuation" did occur, albeit at a multi-decade pace. Fostered by the newly opened access to hitherto remote environments, suburban sprawl evolved and formed an even greater demand for movement of vehicles to and from the suburbs. The optimism of the era led to the "Great Society" programs of the 1960s, including the National Historic Preservation Act of 1966 that made the federal government responsible for mitigating the loss of historically significant properties through the section 106 review process.

The economic upheavals of the 1970s, including a recession and two energy crises, temporarily tempered expansion into the suburbs as soaring fuel costs provided a wake-up call for a re-evaluation of transportation systems and the economics of expanded suburban markets. While not a complete reversal, by the 1980s socioeconomic awareness fomented a new concept of "urban revitalization" in lieu of the earlier urban renewal. This period started the initial developments in both the inner city and suburban markets of what has become known as "New Urbanism." While the concepts forming these philosophical approaches borrow directly from buildings of earlier eras, their manifestation has largely been in the suburbs where land prices and a perceived high level of consumer demand provide more favorable market conditions. While expansion into the suburbs resumed in this period, preservation tax credits demonstrated that revitalization could be done at a large scale. Widespread investment propelled a previously small market segment into prominence, and this period saw the re-invigoration and expansion of the need for skills and products that became commonplace in the historic preservation and conservation sector. Unfortunately, the Tax Act of 1986 cut investment interest in many of these programs short.

Thus, the echoes of political climate of the 1950s reverberated throughout the societal climate of the 1960s and were tempered by the economic crises of the 1970s. These then were fueled by the proven merits for revitalization in the 1980s and 1990s that still hold resonance. The combination of the market development from the 1980s and the growing recognition of the value of the older or historic built environment has enabled large property owners to enhance livability and hence the revitalization of communities.

An Opportunity for Large-Scale Stewardship of the Built Environment

In recent decades, numerous buildings have been left vacant, underused, or simply abandoned. The cause can largely be accounted for within the economic framework of the sociopolitical system. Recently many domestic industries have been down-sized due to offshore competition, leaving numerous buildings—and, by extension, the residential and commercial districts supporting them—vulnerable to accelerated decline. However this tends to occur in a more discrete and segmented fashion over an extended time frame. Up until the recent war on terrorism, one recurring opportunity in the post-Cold War era has been the consolidation of military operations that has provided a multitude of simultaneous adaptive re-use opportunities for many older and historic buildings at a single location and at one time. The Base Realignment and Closure Commission (BRACC) was formed so that decommissioned military facilities could be transferred to the public sector and re-used. Two notable examples are the Presidio in San Francisco, California, which has become a major incubator for small business and non-profit institutions, and Fort Ord near Monterey, California, which has been converted into the Monterey Bay Community College. Both underwent significant planning periods to enable potential users to fully comprehend the demands that such a conversion requires.

In Salt Lake City, a similar transformation has occurred at Fort Stephen A. Douglas. The University of Utah has envisioned re-using the fort buildings for its Fort Douglas Heritage Commons program in which existing residential and administrative aspects of the fort would be converted to student housing and small classroom spaces. The project encompasses more than 40 buildings and is expected to cost $44 million (Wolf 1998:16–22). Prior work had included converting several small housing units on "Officer's Circle" into housing for students in a scholarship program. However, the university had a larger goal to use the entire fort as a residential/scholastic environment that moves students and the academic environment closer together. In preparation for the 2002 Winter Olympic games, Fort Douglas was selected as the site for the athletic village housing. The university used this opportunity to expand its deficient housing while meeting the need for accommodations for 2,500 athletes.

As a national historic landmark, Fort Douglas is protected by the strictest preservation regulations. This factor led the university to undertake a planning study to ensure that infill buildings would not adversely affect the composition and form of the fort and its environment. Overall, and in the larger context, this housing master plan process was conducted as part of developing and refining a long-range development plan (LRDP) for the entire university. In this light, a planning consultant was hired and spent two years convening numerous meetings to coordinate the needs of the university with the demands of the Salt Lake Olympic Committee (SLOC) and the requirements of the Secretary of Interior's Standards as overseen by the Utah state historic preservation officer. Anne Racer, the university's director of facilities planning, specifically describes the philosophy of collaborative participation as "unique" and further states that "we approached the project with the idea that people who are actively involved in developing a plan are more likely to accept it, adopt it, and use it" (Racer 2002:4). Similarly, the university had to reach a decision regarding the continued use of its existing residential facilities, which had become seriously outdated (University of Utah Alumni Association 2001). The process was composed of these phases:

1. *Programming and need assessment.* The planning consultant interviewed and coordinated the information flow between all concerned parties. Preliminary visual studies were made to educate these parties as to the potential impacts of their needs, and housing and operational support requirements were identified.
2. *Identification and physical exploration of*

existing facilities. A local architectural firm was hired to investigate the physical condition of the buildings affected by the proposed project. The historic aspects of the buildings (in part and as a whole) were identified to establish a baseline for the historic rehabilitation work. A cost estimate for rehabilitation was prepared for each building, infrastructure modification and extension costs were calculated, and an overall cost estimate was prepared.

3. *Schematic design development.* Significant buildings and those spaces where infill buildings could be built were identified. Several schematic designs were developed using a materials palette based on existing elements at the fort. Resource allocations were coordinated with a budget developed concurrently with this process.
4. *Schematic design review/modification.* The alternatives were reviewed by the interested parties and a final design was selected based on modifications to get the project within the $120 million budgetary constraints established by the state legislature.
5. *Construction document development.* The project plans were developed into construction documents.
6. *Bid submission and contractor selections.* The project was sent out to bids and the contractors were selected.
7. *Construction.* The construction period took approximately two years.
8. *Occupation.* The SLOC required that the buildings be in operation for at least twelve months prior to the 2002 games so that operational problems could be detected and remedied. As part of a commissioning process, this phase enabled plant operations to engage in the use and maintenance of the buildings prior to the Olympics.

During this process, several notable activities on site occurred. First, buildings not considered historically contributing were removed to allow new buildings to be built without destroying the view corridors defined by the protective covenants. Second, one contributing structure was physically moved to allow for the construction of a commons building. The adverse effect of the move was mitigated by the structure's careful relocation within the immediate vicinity. Third, proposed materials were reviewed to complement the existing material palette of the fort. Fourth, significant buildings not used as dormitory spaces were restored for ancillary uses. These included the chapel, theater, officer's club, and base commandant's quarters. Finally, other buildings not re-used for the Olympics were mothballed and await programming for later re-use.

As a result, the project was recognized in 1999 as an official Save America's Treasures project. Subsequent honors and awards continued to arrive. In 2001 this designation was followed by an honor award from the Society of College and University Planners Association and the American Institute of Architects, and culminated with a preservation award in October 2001 from the National Trust for Historic Preservation (NTHP). In presenting the award, Richard Moe, president of the NTHP, stated that the student housing project was "one of the most significant restoration projects in America" (Racer 2002:9–10). Most recently, the restorations of the post chapel, post theater, commander's house, and the officer's club were each individually recognized in 2002 with preservation awards by the Utah Heritage Foundation, the statewide preservation advocacy organization.

Conclusion

The positive effects and outcomes from this process have been multifaceted. The athletes of the Olympics were housed in first-class facilities, and the university now has a revitalized residential community upon which to build its "Community of Scholars" programs. This project demonstrates that careful stewardship can result in the large-scale re-use of an underused set of buildings rather than their wholesale demolition. At the broad scale of the Fort Stephen A. Douglas revitalization, stewardship of the built environment is working—a prime example of urban revitalization. The ability of institutions and individuals to complete this project is a testament to the ready opportunity to do so. Although complexities vary, the outcome is still the same: the re-use of the built environment that extends the sustainability and, perhaps most importantly, the vitality of the overall system of the total environment itself.

Acknowledgment

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Preserving the Painted Desert Inn in Petrified Forest National Park

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Painted Desert Inn (Figure 1) is the architectural centerpiece of Petrified Forest National Park. Its history and architectural significance is integral to the cultural interpretation of the park and greatly enhances the visitor's experience. Nevertheless, Painted Desert Inn suffers from structural deterioration caused by bentonite clay, which produces severe expansion and contraction, resulting in numerous physical challenges. This essay shall summarize the history and development of Painted Desert Inn and how its architectural design enhances interpretation and the visitor experience. The threats and challenges facing Painted Desert Inn will then be elaborated upon, followed by a brief discussion of current treatments.

Figure 1. Painted Desert Inn, Petrified Forest National Park, Arizona.

Petrified Forest, located in northeastern Arizona, was initially established as a national monument in 1906 under the Antiquities Act to protect and preserve petrified wood deposits in what is now the south end of the park. The monument was greatly expanded in the 1930s, and then re-established as a national park in 1962.

The story of Painted Desert Inn begins in 1924 when Herbert Lore constructed what he called the "Stone Tree House." It was called this because he constructed it of petrified wood. Lore provided food, lodging, and curio sales for visitors to the Painted Desert region, many of whom he personally transported from the nearby railroad stop in Adamana.

Additional visitors reached Painted Desert Inn from Route 66, which passed just to the south. In 1931, Lore constructed another road from the Rio Puerco Bridge near Adamana to the Painted Desert Inn, offering an additional way for visitors to reach his property.

As early as 1931, the National Park Service (NPS) considered expanding what was then Petrified Forest National Monument to encompass the Painted Desert area and thereby acquire the Stone Tree House. In 1932, NPS purchased 53,300 acres of the Painted Desert, which did not include Lore's property. Then in 1936, NPS purchased an additional 2,500 acres from Lore, including the Stone Tree House and related improvements. At that time, the Painted Desert Inn was closed and Lore departed (Livingston 1994:7–8).

As part of its planning effort for the Painted Desert region, NPS solicited Civilian Conservation Corps (CCC) labor to expand and improve the Stone Tree House. This project began in 1937 and lasted until 1940, greatly expanding the building's size and incorporating various details, including carved corbels, carved wooden furniture, and stamped tinware fixtures. With completion of all these improvements in 1940, the building was reopened as the Painted Desert Inn.

In 1940, Standard Concessions, Inc., entered into a three-year contract with NPS for concession services at the newly completed Painted Desert Inn. Standard Concessions, under the direction of Edward McGrath, continued to operate the Painted Desert Inn until 1947, except for a brief hiatus during World War II.

As early as May 1947, the Fred Harvey Company expressed interest in taking over the Painted Desert Inn concession contract, which they successfully negotiated in July 1947. In October of that same year, the Fred Harvey Company announced that their designer/architect, Mary Jane Colter, would renovate the interior of the Painted Desert Inn. It was closed between November and January for this purpose, and further improvements were conducted during the summer of 1948. Colter's redesign plan included new paint and plaster, an improved lunch counter, and additional architectural details.

Colter's design for Painted Desert Inn also included interior murals, for which she hired Fred Kabotie, a Hopi Indian artist she had previously worked with for her design of the Watchtower at Grand Canyon. Colter hired Kabotie to paint two murals in the Painted Desert Inn's lunch room and three in the dining room. The largest mural depicts Kabotie's interpretation of the Hopi legend regarding ceremonial salt gathering.

The Fred Harvey Company continued to operate the Painted Desert Inn until 1963, when the company moved its operation to the new Painted Desert Community Complex, which is located three-miles to the south of the inn. As a result, the inn was closed and remained so for ten years.

By the early 1970s, the building had been abandoned for so long that it was thought of as an eyesore. As a result, the Painted Desert Inn was slated for demolition in 1975. Thankfully, public outcry and administrative actions prevented this outcome, and the building was listed on the National Register of Historic Places in August 1975. Later, the building was included in the *Architecture in the Parks Theme Study* and thereby listed as a national historic landmark in 1987.

Since the building was listed on the National Register and NPS was now "obligated" to keep and maintain the building, the park made some cosmetic improvements and reopened the building as their Bicentennial Travel Center in 1975–1976. The building continued to serve as a seasonal operation from 1976 until 1991, and with a few further improvements and the cooperative interest of the Petrified Forest Museum Association, the building was opened to the public year-round in 1992, and it remains so today.

Historically, the building served as a visitor contact station; concession sales, food, and lodging facility; and as a museum. During the Fred Harvey era, the building was essentially divided, with the company operating one side as a food, sales, and lodging facility, while NPS managed an information desk and museum on the other. In fact, there were two separate entrances for these different uses, although each could be accessed from the interior. Unfortunately, staffing limitations prevented NPS from maintaining a presence in the so-called "Ranger Room" year-round.

As a result of varying needs and functions, some of the historic uses have changed. Today, the building serves as a visitor contact, museum, and sales area. Interpretive tours are held daily, museum objects and exhibits are displayed throughout the building, and the cooperating association, the Petrified Forest Museum Association, maintains a book and small souvenir sales area.

Museum objects contained within Painted Desert Inn include historic furnishings constructed by the CCC, Kabotie murals, glass ceiling tiles with Indian motifs, and stamped tinware fixtures and features designed by the CCC. When dealing with museum collections in historic buildings, such as Painted Desert Inn, three important elements must be addressed: interpretation, security, and outreach education.

In the comprehensive interpretive plan for Petrified Forest, Painted Desert Inn is defined as a "cultural interpretation location" where the cultural and social history of the park and the inn are interpreted and discussed. Exhibits and interpretive programs at the inn focus on the cultural history of Petrified Forest National Park, especially that of the inn. In addition, there are several display cases that feature archeological and historic objects, including some specific to the inn and others related to the CCC. Thus, Painted Desert Inn contributes to the overall interpretive mission of the park.

Because of these museum objects, Painted Desert Inn's lack of security is a cause for concern. In preparation for the bicentennial and related displays in 1976, iron security bars were installed on all of the windows and doors, and this is still the only significant security measure in place. However, all display cabinets are locked and historic furnishings are corded off.

Outreach is chiefly accomplished through publications, and in the primary literature for Petrified Forest, titled *Story Behind the Scenery,* Painted Desert Inn and its museum elements are highlighted. Petrified Forest Museum Association also plans to publish a book specifically on the inn, while additional publications have featured the Kabotie murals. In fact, some visitors come to Painted Desert Inn specifically to see these murals, and the Museum of Northern Arizona is currently considering the Kabotie murals for inclusion in a traveling exhibit they are developing on the southwestern mural tradition.

The very nature of Painted Desert Inn influences the interpretation and use of this structure. It is a unique building with attractive features that visitors are drawn to when traveling through Petrified Forest National Park. The inn's architectural design enhances interpretation in three ways:

The *visitor experience* is deeply influenced by the Spanish Revival style of the building, which draws people to the structure because it is unique and aesthetically appealing. Similarly, visitors are attracted to the building because of its location. It rests on the edge of the Painted Desert with 180 degrees of breathtaking vistas. Once attracted to the building, the architectural design carries visitors in a dynamic circulation pattern that allows them to move in and out of the structure and its interior spaces, each of which presents new views and new experiences. For example, when the Fred Harvey Company occupied the building, guests would move in and out of the structure to gain different services. The architectural features of this building also influence the visitor experience. The carvel corbels, glass ceiling tiles, stamped tinware, viewing terraces, open vistas, and outer courtyards all lend themselves to a pleasurable and unique visitor experience.

Painted Desert Inn serves as a *visitor contact* area, where many questions are asked, not the least of which are those regarding the building and its present condition. It is not unusual for visitors to ask if the building is really "safe" for occupancy, and they accusingly ask why NPS has not taken better care of the property. Other questions pertain to the use of the building. Visitors ask if lodge rooms are still available, if the building will ever be returned to an inn, and if food service is still available. None of these things are available.

Interpretive tours of Painted Desert Inn are held daily. Tours typically focus on the human and social history of the building and the region, but naturally such discussions must also include comments regarding the building's architectural history. Interpreters will often take this opportunity to discuss the Recreation Fee Demo program and how it will contribute to the restoration of the inn. Tours have also focused on the Kabotie murals and related tourism and travel themes. Once a year, a special Harvey Girl interpretive program is hosted by the "Winslow Harvey Girls" who dress up in Harvey uniforms and greet visitors. Various other special events have occurred at the Painted Desert Inn over the years, including events during Founders Day, National Park Service Week, and National Archeology Month. Historically, traveling exhibits were also featured at Painted Desert Inn, and special events for park personnel are periodically held there. Since the 1940s, the local constituency has lovingly referred to the inn as the "pink palace," where they used to hold social events and similar community gatherings.

Painted Desert Inn presents many challenges for park managers. As is quite common for the area, the building was constructed on a vein of bentonite clay, which has a very high expansion and contraction rate, and due to this subsurface movement, the building also moves and flexes, causing impressive and somewhat disconcerting expansion cracks. Since the building serves as a museum space, there are also environmental concerns because historic furnishings and artifacts are subject to extreme changes in temperature and humidity. Whenever it rains, the roof leaks, causing severe water damage to the interior plaster and finishes. Rodent infestation is also of concern. A few rodents may carry hantavirus, a serious medical threat to those who encounter rodent feces in enclosed spaces, although there has never been a reported case of hantavirus contamination within Petrified Forest National Park. Accessibility presents another challenge. As designed, there is no way to enter the building without navigating stairs, which presents a significant obstacle for visitors who are physically challenged. The proper use of the inn's interior spaces is currently being debated. Since it was originally designed to provide food and lodging, it is difficult to determine the proper use for this structure without providing or at least acknowledging the concessionaire history, but we must also consider the impact a food service operation may have on museum objects and architectural features that are openly displayed. With all of these physical conditions, it becomes a challenge to provide an enjoyable visitor experience.

In an effort to rectify or at least treat some of these challenges and conditions, several measures have been taken. Cracks are monitored on a monthly basis, and this information is stored in a database that records lateral movement. The temperature and humidity of the interior is also measured and recorded by a datalogger every two hours. This information is stored in a similar database. Because of the hantavirus threat, rodents are monitored and trapped. Many of the trapped rodents are then given to a wildlife biologist at the U.S. Geological Survey (USGS). When it rains, buckets are placed throughout the building to catch leaks, but unfortunately, the worst leaks are at the perimeter or even inside the walls, making leak capture very difficult. Beginning in the spring of 2003, the roof will finally be replaced, which should fix many of our water infiltration problems. In an attempt to stem the tide of deterioration, the murals were restored in 1977 after cracks and time had damaged many of them. Sometime within the next few years, we will once again embark on a mural restoration campaign to repair some of the damage that has occurred since 1977. We are also slated for a substantial line-item construction project to completely restore Painted Desert Inn, but it was dropped from the 2002 and 2003 budgets. We are hopeful Congress will make the money available to us in 2004.

The challenges at Painted Desert Inn are great, and, as is the case in most parks, our resources are few. Since the park first acquired the property in 1936, the concessionaires and

NPS have spent a lot of time and money on the building's upkeep and maintenance. Unfortunately, because it was constructed on bentonite clay the building moves and will continue to move for the rest of its maintainable life. Extensive reports and investigations of the structure and its subsurface conditions have been conducted, but there is very little that can be done to rectify this innate condition. In fact, several other buildings in the park suffer this same fate.

Though the challenges are great, the private and public support of Painted Desert Inn has been a saving grace. If it were not for private interests, the inn would have been demolished in the 1970s. It is a wonderful addition to Petrified Forest National Park and a great resource for the American public. It tells the story of exploration and early tourism development; it relates to Route 66, the "mother road"; and it was one of the last projects Mary Colter ever did for the Fred Harvey Company. Its rich history and unique architectural treatment, as well as its problems, lend a great deal to the history of the park. We have made a lot of effort to turn the building's challenges into an asset for resource management and interpretation. We can learn from these experiences and pass this information on to other parks and to the public at large.

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California's New Marine Managed Areas System

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Introduction

Point Lobos State Reserve became the first permanent marine protected area in the nation on July 1, 1960. Seven hundred and fifty acres of submerged lands were annexed to the terrestrial portion of the reserve. Buck Island Reef National Monument, in the U.S. Virgin Islands, was established in 1961, followed in 1963 by John Pennekamp Coral Reef State Park in the Florida Keys.

In 1968, Director William Penn Mott established the California Department of Parks and Recreation Underwater Parks Program, appointing a scientific- and industry-represented panel: the California Advisory Board for Underwater Parks and Reserves. Its mission was to identify outstanding and representative examples of marine and inland underwater ecosystems, and to recommend management methods for both preservation and recreational use.

The board investigated numerous sites and made recommendations for inclusion into the State Parks System. Quarterly site investigations and public meetings were held from 1968 to the early 1980s, when budget restraints precluded further investigations. The State Parks System includes over 500 units, of which 273 have been classified. Currently, 28 of the 273 classified units include contiguous underwater portions, totaling around 59,600 acres. Of these units, 16 are in marine environments, 13 are estuarine, 2 are freshwater, and 1 is saline. Most are managed by California State Parks under 49- or 10-year leases from the California State Lands Commission.

The California Ecological Reserve Act of 1968 authorized the Department of Fish and Game to create ecological reserves (California Fish and Game Code Sections 1580–1585, 1907). There are 28 ecological reserves within marine and estuarine waters of the state. Regulations vary from protection of one taxon (e.g., California hydrocoral at Farnsworth Bank Ecological Reserve) to total protection (e.g., Heisler Park Ecological Reserve). The Department of Fish and Game also manages several variations of refuges (20) and reserves (9).

In the 1970s, the California State Water Resources Control Board established 34 "areas of biological significance" in coastal waters. These were designated to protect marine biota from point-source and thermal pollution.

The California Marine Resources Protection Act of 1990 was a referendum that required the California Fish and Game Commission to establish four fully protected ecological reserves. These were brought into the new classification system on January 1, 2003. They are King Range (Punta Gorda), Big Creek, Vandenberg, and Big Sycamore Canyon state marine reserves.

Following the "California and the World Oceans Conference '97", the California Resources Agency released an analysis which indicated that the state's array of ocean and coastal managed area designations (such as reserves, state reserves, refuges, state parks, and natural preserves) that has evolved over the last 50 years is complex and often confusing.

The analysis recommended development of a more effective and less complicated statewide system of ocean and coastal managed areas. It further recommended developing a comprehensive program, with clear criteria for creating, administering, and enforcing management measures in these areas. To address this issue, the Resources Agency convened the State Interagency Marine Managed Areas Workgroup to better define and evaluate state marine managed area classifications. The workgroup's January 2000 report, "Improving California's System of Marine Managed Areas," made recommendations for improving the organizational system and management of the array of state marine managed areas in California, and was the result of a collaborative effort spanning an 18-month period.

The California Marine Managed Areas Improvement Act of 2000 provided a uniform classification system and defined the terms "marine managed areas" and "marine protected areas." It also gave priority to establishing marine protected areas adjacent to protected terrestrial lands. The workgroup conducted its deliberations, where possible, in cooperation with other marine managed area efforts that were underway in California. One such effort was the passage of Assembly Bill 933 (Shelley 1999), the Marine Life Protection Act, requiring the California Fish and Game Commission to adopt a master plan for guiding the adoption and implementation of a marine life protection program by the Department of Fish and Game, focusing on the protection of living marine resources and their habitats through marine protected areas, where the extraction of such resources is prohibited or restricted in some fashion. A draft report to the Fish and Game Commission was to be submitted by January 2002 and the final master plan by April 2002. These deadlines have been extended three years by the legislature at the request of the Department of Fish and Game.

The requirements of the Marine Life Protection Act are consistent with, and complementary to, the recommendations made in the marine managed areas report. The comprehensive set of findings and recommendations address such issues as designing a more manageable classification system, the site proposal and designation process, management and enforcement within designated areas, and improving public education, research, monitoring, and evaluation activities.

In 1998, the Channel Islands Marine Resources Restoration Committee, a group of concerned citizens, requested the Fish and Game Commission to establish a network of marine protected areas around the northern Channel Islands. This request preceded the Marine Life Protection Act by nearly one year. As a result of the request, the Fish and Game Commission directed the Department of Fish and Game and Channel Islands National Marine Sanctuary to jointly support a process to discuss marine protected areas in the Channel Islands area. In October 2002, the Fish and Game Commission adopted 12 new marine protected areas around the Channel Islands as a result of this process.

California Marine Managed Areas System

The 1991 amendments to the California Ocean Resources Management Act transferred all responsibility for marine and coastal resource management programs to the secretary for resources. The Resources Agency drafted the following vision and mission statements:

Vision. "Provide statewide leadership to ensure that California's marine managed area needs are met fully and efficiently for future generations. These needs include, but are not limited to heritage preservation, adequate marine life refugia to perpetuate commercial and sport fisheries, non-consumptive scientific and recreational uses and public education."

Mission. "To provide an efficient, integrated system of marine managed areas that is representative of all marine ecosystems found within State waters and tidelands. To access, conserve, and/or restore marine ecosystems. To manage California's ocean resources on a long-term, sustainable basis. To maintain biological diversity and productivity and to protect marine archeological resources."

"Marine managed areas" in California are defined as named, discrete geographic marine or estuarine areas along the California coast designated by law or administrative action, and which are intended to protect, conserve or otherwise manage a variety of resources and their uses. The resources and uses may include, but are not limited to, living marine resources and their habitats, scenic views, water quality, recreational values, and cultural or geological resources (California Public Resources Code, Section 36602(d)).

"Marine protected areas" in California are defined as marine or estuarine areas seaward of the mean high tide line or the mouth of a coastal river, including any area of intertidal or subtidal terrain, together with its overlying water and associated flora and fauna, that have been designated by law or administrative action to protect or conserve marine life and habitat (California Public Resources Code, Section 36602(e)).

The six classifications of marine managed areas (including estuarine) that have been established for the state of California are:

- **State marine reserve**. Protected areas where all features and marine life are protected.
- **State marine park**. Protected areas that are designated to protect marine life but allows some recreational take of resources.
- **State marine conservation area**. Protected areas that are designated to protect marine life but allow some commercial and recreational take of resources.
- **State marine cultural preservation area**. Protected areas that are designated to preserve cultural objects or sites of historical, archeological, or scientific interest in marine areas.
- **State marine recreational management area.** Protected areas that are designated to provide, limit, or restrict recreational opportunities while preserving the basic resource values for present and future generations.
- **State marine water quality protection area**. Protected areas that are designated to protect marine species or biological communities from an undesirable alteration in natural water quality (formerly called "areas of special biological significance").

Planning by Ecological Regions and Subregions

California's coastal configuration and oceanic environments are extremely varied. The San Andreas Fault determines the configuration of the continental shelf north of San Francisco as well as the undersea mountain range—the Mendocino Escarpment. The continental shelf is narrow here, unlike southern California, where the same tectonic forces have created a broader shelf (continental borderlands) with islands and submarine mountain ranges separated by basins. North of Point Conception, submarine canyons and deep sea fans caused by violent turbidity currents punctuate the shelf. Southward, sea mounts (submerged mountains) are numerous. Four marine ecological regions identified by Barry and Foster (1998) are illustrated in Figures 1–4. These ecological regions are divided into 12 subregions. Subregions were determined by environmental factors such as water temperature, geologic features, and biota.

Figures 1–4. California's four marine ecological regions, from north (Figure 1) to south (Figure 4).

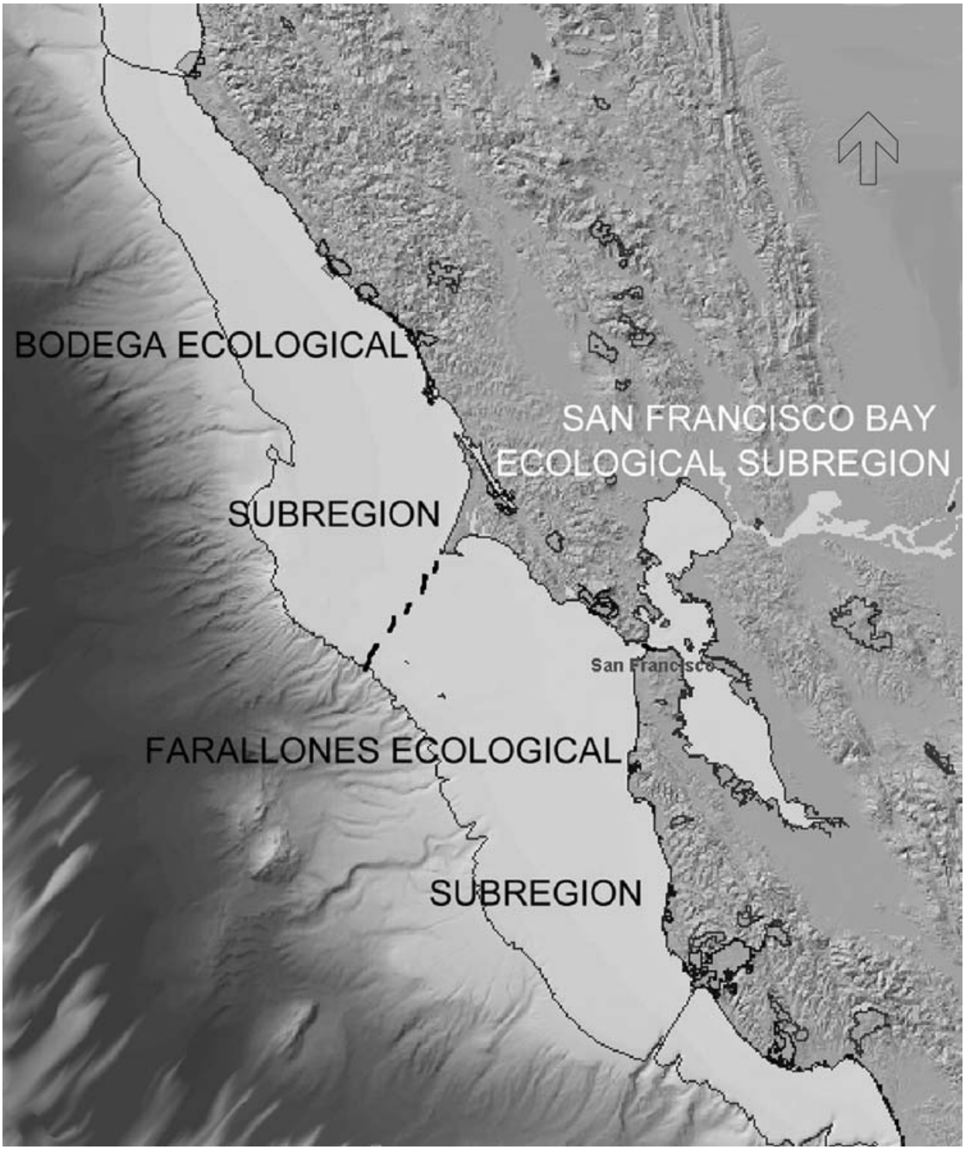

Figure 2.

The new marine managed area system includes the following components, some of which also have been reclassified (as state marine water quality protection areas) under the new system. Areas thus classified are marked with an asterisk.

Oregonian Marine Ecological Region

Gorda Marine Ecological Subregion

- Tolowa Dunes State Park
- Redwoods National & State Parks
- Redwoods National Park*
- Kelp Beds at Trinidad Head*

Figure 3.

Mendocino Marine Ecological Subregion

- King Range Marine Ecological Reserve
- MacKerricher State Park
- Point Cabrillo State Marine Reserve
- Russian Gulch State Park
- Van Damme State Park
- Manchester State Park
- Arena Rock Marine Natural Preserve
- Kings Range National Conservation Area*
- Pygmy Forest*

Northern Californian Marine Ecological Region

Bodega Marine Ecological Subregion

- Kelp Beds at Saunders Reef
- Del Mar Landing Ecological Reserve
- Salt Point State Park
- Gerstle Cove Reserve
- Fort Ross State Historic Park
- Sonoma Coast State Beaches
- Bodega Marine Life Refuge
- Tomales Bay Ecological Reserve
- Del Mar Landing*
- Gerstle Cove*
- Bodega Marine Life Refuge*
- Bird Rock*

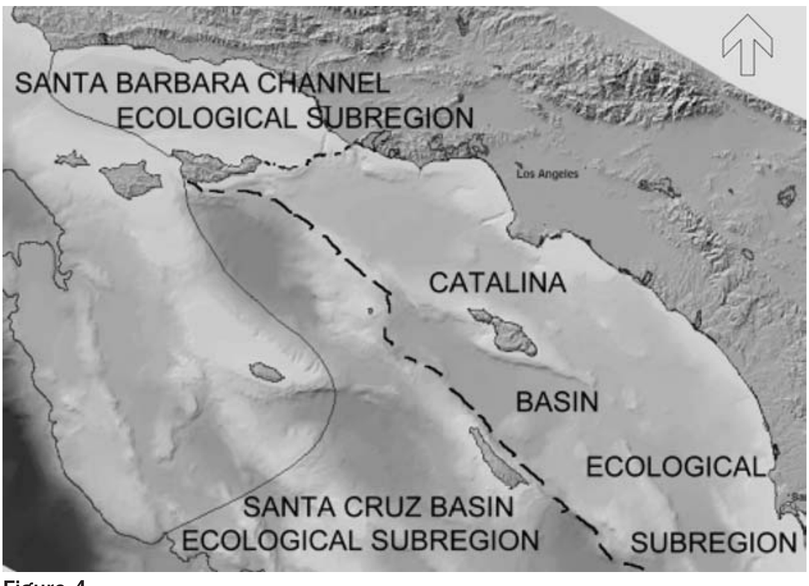

Figure 4.

Farallones Ecological Subregion
- Point Reyes Headlands Reserve
- Estero de Limantour Reserve
- Point Reyes National Seashore
- Duxbury Reef Reserve
- James V. Fitzgerald Marine Life Refuge
- Point Reyes Headland and Extension*
- Double Point*
- Duxbury Reef Reserve and Extension*
- Farallon Island*
- James V. Fitzgerald Marine Reserve*

San Francisco Bay Ecological Subregion
- Angel Island State Park
- China Camp State Park
- Benicia State Recreation Area, Southampton Bay Natural Preserve
- Brannan Island State Recreation Area
- Franks Tract State Recreation Area
- EastShore State Park
- Albany State Marine Reserve
- Emeryville Crescent State Marine Reserve
- Fagan Marsh Ecological Reserve
- Peytonia Slough Ecological Reserve
- Corte Madera Ecological Reserve
- Marin Islands Ecological Reserve
- Robert W. Crown Reserve
- Redwood Shores Ecological Reserve
- Bair Island Ecological Reserve

Central Californian Marine Ecological Region

Monterey Bay Marine Ecological Subregion
- Elkhorn Slough Ecological Reserve
- Salinas River State Beach, Salinas River Mouth Natural Preserve
- Hopkins Marine Life Refuge
- Pacific Grove Marine Gardens Fish Refuge
- Carmel River State Beach, Carmel River Lagoon and Wetland Natural Preserve
- Carmel Bay Ecological Reserve
- Point Lobos State Marine Reserve
- Azo Nuevo Point and Island*
- Hopkins Marine Life Refuge*
- Pacific Grove Gardens Fish Refuge*
- Carmel Bay*
- Point Lobos Ecological Reserve*

Big Sur Marine Ecological Subregion
- Julia Pfeiffer Burns State Park
- Big Creek State Marine Reserve
- Julia Pfeiffer Burns Underwater Park*
- Ocean Area Surrounding Salmon Creek*

Santa Lucia Bank Marine Ecological Subregion
- Atascadero Beach Pismo Clam Refuge
- Morro Beach Pismo Clam Preserve
- Pismo Invertebrate Reserve
- Pismo Clam Preserve

Conception Marine Ecological Subregion
- Vandenberg State Marine Reserve
- Harris Point State Marine Reserve, San Miguel Island
- Judith Rock State Marine Reserve, San Miguel Island
- Richardson Rock State Marine Reserve, San Miguel Island
- Carrington Point State Marine Reserve, Santa Rosa Island
- Skunk Point State Marine Reserve, Santa Rosa Island
- South Point State Marine Reserve
- San Miguel*
- Santa Rosa*
- Begg Rock*
- San Nicolas Island*

Southern–Baja Californian Marine Ecological Region

Santa Barbara Channel Marine Ecological Subregion
- Refugio State Beach
- Santa Cruz Islands
- Painted Cave State Marine Conservation Area, Santa Cruz Island
- Scorpion State Marine Reserve, Santa Cruz Island
- Anacapa Island State Marine Reserve
- Anacapa Island State Marine Conservation Area
- Mugu Lagoon–Latigo Point*
- Anacapa Island*

Santa Catalina Marine Ecological Subregion
- Abalone Cove Ecological Reserve
- Point Fermin Marine Life Refuge

- Bolsa Chica Ecological Reserve
- Upper Newport Bay Ecological Reserve
- Newport Beach Marine Life Refuge
- Crystal Cove State Park
- Irvine Coast Marine Life Refuge
- Heisler Park Ecological Reserve
- Laguna Beach Marine Life Refuge
- Niguel Marine Life Refuge
- Dana Point Marine Life Refuge
- Doheny State Beach
- Doheny Marine Life Refuge
- Buena Vista Lagoon Ecological Reserve
- Batiquitos Lagoon Ecological Reserve
- City of Encinitas Marine Life Refuge
- San Elijo State Beach
- Cardiff State Beach
- San Dieguito Lagoon Ecological Reserve.
- Torrey Pines State Reserve, Los Penasquitos Natural Preserve
- San Diego Marine Life Refuge
- San Diego–La Jolla Marine Life Refuge
- Silver Strand State Beach
- Farnsworth Bank Ecological Reserve
- Newport Beach Marine Life Refuge*
- Irvine Coast Marine Life Refuge*
- Heisler Park Ecological Reserve*
- San Diego Marine Life Refuge*
- San Diego–La Jolla Marine Life Refuge*
- Isthmus Cove to Catalina Head Santa*
- North End of Little Harbor to Ben Weston Point*
- Farnsworth Bank Ecological Reserve*
- Binnacle Rock to Jewfish Point*

Santa Cruz Basin Ecological Subregion
- Gull Island State Marine Reserve, Santa Cruz Island
- Santa Barbara Island State Marine Reserve
- San Clemente Island*
- Santa Barbara Island*

Proposed New Additions

New additions identified include 25 proposed state marine reserves, 51 state marine parks, 3 state marine conservation areas, 4 state marine conservation areas, 5 state marine cultural management areas, and 5 state marine recreational management areas.

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Building a Coral Nursery at Biscayne National Park

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Introduction

Biscayne National Park is one of nine coral reef parks in the National Park System. Five are in the western Atlantic (Virgin Islands National Park, Buck Island Reef National Monument, Biscayne National Park, Dry Tortugas National Park, and Salt River Bay National Historical Park and Ecological Reserve). Coral reefs provide relief, habitat, and substrate to a diverse community of organisms that rivals the diversity of a tropical rain forest. The western Atlantic coral reef parks are very near commercial shipping lanes and popular recreational locations, and are heavily used by commercial and recreational fishers. The coral reefs in each of these parks have a high potential for being damaged by boat and ship groundings, anchors, gear placement (including recovery and loss), and breakage from direct human contact.

Background

Coral reefs are home to a complex and diverse biological community. The scleractinian corals, in particular, are capable of building massive limestone reefs through the accumulation and coalescence of dead coral skeletons loosely cemented together by coralline algae. Coral reefs range in depth from 0.5 m to more than 30 m. The coastal location of coral reefs make them very susceptible to both natural and anthropogenic disturbances, yet they support a variety of potentially damaging activities because of their physical beauty and species abundance and diversity. Tropical tourism depends heavily on the attraction of coral reefs, and many fisheries depend on the large biomass of fish populations. Coral reefs are not readily visible to the average boater and reefs are rarely marked, increasing their vulnerability to boat damage. Groundings, coupled with the added pressure of over-harvesting and other anthropogenic and natural stressors on limited resources, make coral reefs one of the most endangered ecosystems on the planet.

The structure of coral reefs can be undermined by both natural and anthropogenic events. Destruction of the reef framework by tropical storms and hurricanes can be considerable, yet these types of events are analogous to fires in forests, critical to the health and rejuvenation of the ecosystem. In general, both coral reefs and forests have two basic ecological processes occurring simultaneously: (1) accretion, the growth of the forest or coral reef, such as the accumulation of substrate; and (2) degradation, the erosion of living tissue and of the substrate, which is essential for nutrient recycling and for opening niches for recruitment. The balance between the processes of calcification and reef growth and mechanical destruction and bioerosion is important for the persistence and recovery of disturbed coral reefs.

Our understanding of forest ecosystems is broad enough to allow the reconstruction of devastated sites to conditions that are almost identical to pre-event conditions. Further, we know enough to manipulate their community structure and function to achieve a particular aesthetic or functional value. In both forests and coral reefs, system recovery is slow, often requiring decades to centuries for full recovery. In forests there is a latent source of seeds, and volunteers, available in the understory and soil to initiate the recovery process, rapidly stabilizing damaged areas. There is no analogous process for coral reefs. Forests are more robust, capable of withstanding air and soil pollution levels several orders of magnitude above that tolerated by most marine organisms. Biologists are just beginning to understand coral reefs and how biological, chemical, physical and geological processes interact in reef systems. Coral reef reconstruction with a goal of "restoration to pre-event conditions" is a daunting task, well beyond our limited understanding of reef processes and the currently available technology.

Catastrophic grounding events occur within National Park Service (NPS) areas once or twice a decade. Smaller groundings or reef-damaging events occur more often, with a frequency somewhat inversely proportional to vessel size. At Biscayne National Park there have been five major groundings in 25 years, and there are more than 20 documented (vessels stuck on the reef long enough to be observed, or requiring commercial assistance) groundings every year. Undocumented groundings probably double if not triple that number. Small-vessel groundings damage approximately 5 to 30 m^2 per event, and most require some sort of rehabilitative action to stabilize the broken coral colonies, salvage coral fragments, and minimize further damage from wave surge.

Coral reefs worldwide are declining rapidly, mostly from consumptive activities. Other symptoms of stress, diseases and bleaching events, are increasing in frequency, duration, and degree. New coral diseases are being described almost quarterly, and summer temperatures are increasing steadily. Two of the five major coral species in the Atlantic, *Acropora palmata* and *A. cervicornis*, are currently being considered for listing as endangered species under the Endangered Species Act. Compounding these impacts, exotic species are being found in ever-increasing numbers along the Atlantic coast.

Rehabilitation

Coral reef rehabilitation projects have largely focused on areas mechanically damaged during vessel groundings, and rarely involve more than the stabilization of the remaining reef framework and transplanting a large number of hard-coral colonies into the area, letting nature do the rest. Some restoration efforts have been more creative, reconstructing the topography in an effort to restore habitat complexity. A few projects have transplanted other coral reef organisms from the area being rehabilitated. Transplanted corals used for rehabilitation typically come from one of two sources: the damaged area itself through the recovery of larger colony fragments and dislodged soft corals, or by harvesting material from the surrounding intact reefs. Transplanting hard- and soft-coral colonies generally works; however, harvesting coral colonies from surrounding reefs for the purpose of rehabilitation is both environmentally and legally questionable. Harvesting coral colonies—in effect, damaging coral reefs already under stress to rehabilitate another reef—is a questionable practice, and the collection of coral is illegal in Florida and in most protected areas under U.S. jurisdiction. Unfortunately, there is no other source of coral available to managers or contractors for restoration or habitat enhancement.

The Original Concept

Biscayne National Park established three prototype coral nurseries in 1993, using Americorps volunteers and year-end funding. It has been shown that corals transplanted for rehabilitation will grow at a new site and there is an expanding literature reporting the growth of coral under laboratory conditions. The operational plans for the coral nurseries in the park are based on those concepts.

The initial design question was where to locate the nurseries to achieve maximum growth rates. Three sites were selected for the pilot project. One was located on the seaward edge of the coral reef platform, an area strongly influenced by the Florida Current. Another was located near the longitudinal center of the reef platform (mid-platform), an area of active patch reef development. The last site was in a tidal creek connecting estuarine Biscayne Bay to the seaward reef platform. Here the water is turbid, with strong tidal currents and wide seasonal fluctuations in temperature. In 1993, colony fragments approximately 5–10 cm in size were transferred to structures at each site from an "orphan" grounding site and a seawall damaged during Hurricane Andrew. The coral fragments were attached to nursery structures using a two-part underwater epoxy (Z-Spar).

We hypothesized that maximum coral growth would occur on the mid-platform nursery structures and minimal growth would occur on the tidal creek structures. The structures placed off-shore were quickly destroyed during early winter storms. The mid-platform structures withstood winter storms and grew well. The structures also recruited a spectrum of other reef organisms such as sponges, tunicates, and soft corals. The corals placed on the tidal creek structures grew even better. However, at this site, only turf algae grew between the attached coral fragments.

Our nursery goal is to have enough hard coral colonies in culture to supply the needs of rehabilitation projects in the Florida Keys. We chose to use tidal creeks for nursery purposes because they supported coral growth, are easily accessible during any weather, contain islands that provide a suitable area to stage maintenance and monitoring activities, do not require SCUBA diving skills to conduct our research activities, are accessible by boat or land, and provide a strong potential for the non-diving public to learn about coral reefs and even participate in the maintenance and monitoring of the nursery stock. Another advantage of the tidal creeks is that they are not a visual intrusion on the park's visitor experience. The disadvantage to locating nurseries in tidal creeks is that temperature of the water leaving Biscayne Bay can fluctuate dramatically, from very cold during periodic winter cold fronts to warm in the summer. Exposure to temperature extremes can result in high coral mortality.

The Current Nursery Concept

The operational premise of the park's coral nursery is very similar to the field aspect of terrestrial nurseries that are used to stock trees for forest restoration. Like terrestrial nurseries, the coral nursery in Biscayne National Park requires a source of corals. Terrestrial nurseries do this by purchasing seeds, collecting seeds from the wild or their own stocks, or using cuttings from existing stock. The coral nursery can do the same thing: sourcing material from grounding sites (the wild), from the nursery stock itself (cuttings), and from the culture of settled coral gametes captured during spawning (seed acquisition). None of these stock sources violates the National Park Service mandate "to preserve and protect for future generations" (as stated in the 1916 National Park Service Act and Biscayne's enabling legislation, P.L. 96-287).

Wild Stock

On average, each boat grounding damages between 1 to 10 coral heads. Much of this material can be salvaged by re-attachment at the grounding site, but many fragments are far too small to survive even if re-attached. These are recovered for stocking the nursery. Collected fragments range in size from several cm^2 to about 700 cm^2. Larger fragments are cut into 2-cm^2 squares using a standard 10-inch lapidary saw and seawater coolant. Much of the coral rock is removed, leaving the healthy coral over a skeleton about 1.5 cm thick. The corals are then epoxied to PVC (polyvinyl chloride) stakes, our equivalent of the flowerpot. Passive integrated transponders (PIT tags) are placed between the PVC rod and coral fragment to give each fragment a unique 12-digit identification number that can be electronically read both in and out of the water (see Figure 1). This allows us to follow the history of the coral fragment throughout its life in the nursery. At the present time we have over 250 coral colonies in culture.

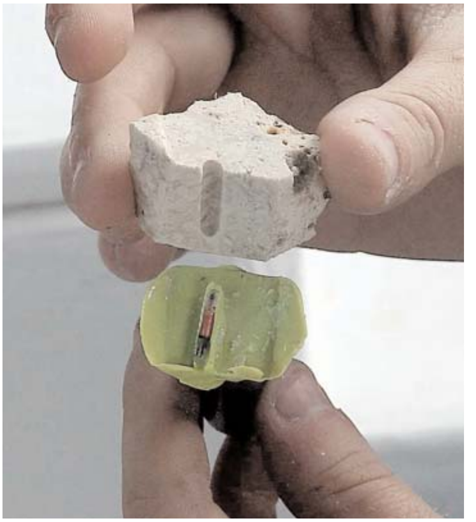

Figure 1. PIT tag inserted in epoxy with coral fragment removed.

The research question is, "How small can we cut the pieces to get a reasonable number of colonies within the next ten years, assuming that we will have a catastrophic grounding within that time frame?" Initial work under laboratory conditions indicates that coral fragments having at least five polyps will survive and grow, but we have no idea if that is true in our field-level nurseries, nor how large the polyps must get before we can place them in the field nursery.

Cuttings

As the coral colonies grow, they will eventually take on a spherical shape, and some of the corals that were placed in the nursery one year ago are already starting to round out nicely. Coral colonies will be kept in the nursery until they reach sexual maturity. Some researchers speculate that, for the non-branching corals, this will occur when they are about 15 cm in diameter (10–15 years in the nursery). When they reach this size, the lower hemisphere (the side with the PVC post) will be cut away and cut into several sections to increase the nursery population. The upper hemisphere will be transplanted to a suitable rehabilitation site.

Seed Collection

The final way to increase the number of coral colonies in the nursery is to collect coral gametes during the annual coral spawning and culture them to the settlement stage. Settled coral larvae will be kept in a laboratory environment until they grow large enough (3 cm^2 diameter) to survive the rigors of life in the natural environment in the field nursery. We have attempted this over the last three years for the annual spawn of the *Montastraea* corals. Our collections, and those of our collaborators, have been alive only for approximately the length of time required for fertilized gametes to reach the settlement phase.

The Greenhouse

Our original grow-out structures used in the field nurseries were three-sided concrete pyramids. The problem with them was that as the corals grew, they expanded onto the concrete substrate, making it difficult to recover an undamaged coral colony, collect growth data, and find an easy way of identifying which colonies came from where, other than mapping their location on the structure.

We have revised the structure design to accommodate these problems, ending up with a coral rock quadri-pod with centered holes drilled on all sides (see Figure 2) to accommodate rods of coral mounts as described earlier. The PIT tag reader may also be used underwater, allowing accurate positioning of the corals fragments on the nursery structures as needed for various experiments.

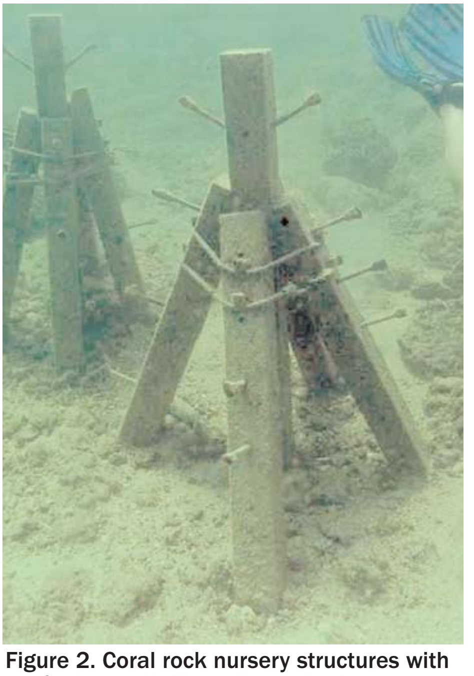

Figure 2. Coral rock nursery structures with fragment "lollipops" attached.

Gardening

We are just starting to study how to maintain the nursery for optimal growth. After only a short time in the field, the PVC rod and the block of epoxy become encrusted with algae and other fouling organisms. We can only speculate about whether the encrusting organisms along the coral margin are impeding growth. We assume for now that they do, so we remove them (weeding). To obtain quantitative growth information, we need to remove the encrustation from the PVC rod and the epoxy. Since the corals are not permanently attached to the structure (the PVC rods are inserted into holes in the structures), we can easily remove them, scrape off any encrusting organisms, measure weight and volume, and count the number of polyps.

The hermatypic corals have a mutualistic symbiosis with a photosynthetic dinoflagellate (zooxanthellae). Some researchers think that the corals do not need to feed on plankton to survive, getting the nutrition they need from the zooxanthellae. Recent laboratory research (Capo and Carter 2002) has shown that periodically feeding the corals brine shrimp increases growth rates (fertilizing), as does lengthening the photoperiod and elevating water the temperature. The research challenge here is to determine an effective method for manipulating these conditions in a field-level nursery.

Early Results

It wasn't until late 2001 that we started a quantitative approach to the growing of coral for coral reef rehabilitation, and the data collected so far are insufficient to report any significant findings. However, we have observed that corals to which the epoxy was applied only to the lower surface of the fragment appear to show a rapid growth of tissue over the exposed skeletal surface, whereas growth appeared to be inhibited in those in which the cut surfaces were covered with epoxy. Our preliminary data also show that there is an initial period of almost no growth upon transfer to the nursery structure, followed by a steady increase in growth and colony weight.

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Monitoring Visitor Impacts in Coastal National Parks: A Review of Techniques

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Introduction

Coastal areas, particularly sandy coasts and barrier islands, are prime destinations for outdoor recreation activities, yet the same zones possess diverse, dynamic, and, often, sensitive ecosystems (Beatley et al. 2002). There are 295 barrier islands, totaling 2,700 miles of barrier length in the 18 eastern U.S. states alone (Leatherman 1988). Visitor use and impacts are an important and growing concern in national parks located in these sensitive zones. Activities such as the use of off-road vehicles (ORVs), walking on the beach or dunes, and feeding wildlife can trample vegetation, accelerate soil erosion, reduce sand dune height, and change wildlife behavior.

The utility of visitor impact monitoring as an effective tool for managing visitation in coastal parks has been recognized (Marion et al. 2001). As part of the National Park Service (NPS) Vital Signs Program, we initiated a research project to develop visitor impact indicators and monitoring protocols for seven park units within the NPS Northeast and Barrier Network. One of the project objectives was to conduct a thorough review of the scientific literature, with the scope set to sandy coasts and barrier islands. This paper highlights results of this literature review. We identified relevant publications in our personal databases and also conducted thorough searches in reference databases through the university libraries. A substantial number of references were identified, but only a small portion is applicable to sandy coasts and barrier islands. Several studies were conducted in the park units included in this project (such as Patterson et al. 1991; Steiner and Leatherman 1981).

Research on Coastal Visitor Impacts

Earlier studies of visitor impacts to coastal areas have been reviewed by Leatherman (1988) and Vaske et al. (1992). Leatherman and Steiner (1987) compiled an annotated bibliography with 110 entries on the impacts of ORVs and walking traffic on coastal ecosystems. This bibliography included both social and environmental impacts, and most of the entries are rather dated (1970s or earlier).

ORV use was an early but consistent visitor impact concern in coastal parks, particularly on barrier islands and near sand dunes (Rickard et al. 1994). At Cape Cod National Seashore, Godfrey and Godfrey (1980) conducted a comprehensive study on the effects of ORV use on different ecological components such as birds, sand dunes, and salt marshes. Management implications of their findings were provided (Godfrey et al. 1980). In the same region, Carlson and Godfrey (1989) applied vegetation survey and mapping techniques to evaluate the effectiveness of a visitor management plan developed for R.T. Crane, Jr., Memorial Reservation in Massachusetts. McAtee and Drawe (1981) studied recreational impacts on the beach and foredune microclimate in Texas. The primary effect was reduced vegetation cover and lower species diversity. They also found that as recreational activities increased, the dune height decreased. In North Carolina, Hosier and Eaton (1980) studied ORV impacts to dunes and found that vegetation cover and the number of species were lower in areas with ORV use. The potential impacts of ORVs on macroinvertebrates have also been investigated (Wolcott and Wolcott 1984).

Much of the literature focused on the effects of visitor impacts on the ecological communities. Steiner and Leatherman (1981) studied the distribution of ghost crabs at Assateague Island National Seashore in relation to ORV and pedestrian usage. Pedestrians were found to have no harmful effects on ghost crabs. In fact, the density was higher in these areas, possibly due to the abundance of food scraps. The ORV sites contained significantly fewer ghost crabs than the pedestrian sites. The difference between areas of high and low ORV use was not significant. Barros (2001) found the number of ghost crab burrows in non-urban beaches to be higher than in urban beaches.

Thomas et al. (2003) studied the effects of visitor activities on the foraging behavior of sanderlings. They found through field observation that the number and proximity of people, their activity, and the presence of free-running dogs significantly reduced the amount of time sanderlings spent foraging. Through a controlled experiment, they found group size to be significant in reducing foraging time. In both measurements, they found that sanderlings respond (by either running or flying) when humans approach within 30 m. Burger (1986) found that only 30% of birds were unaffected by human activity, and that most birds flew away in response. Burger was unable to determine if these activities were harmful to the overall health of the birds, but indicated that disturbance during prime foraging times would have an adverse affect on health. Patterson and others (1991) found no evidence to suggest that recreational activities had a detrimental effect on the productivity of piping plovers. Low productivity was attributed to predation.

Visitor Impact Monitoring: Methodologies and Techniques

A thorough review of relevant scientific literature suggests that there are two dominant methodological approaches to visitor impact monitoring in coastal areas (Figure 1). The

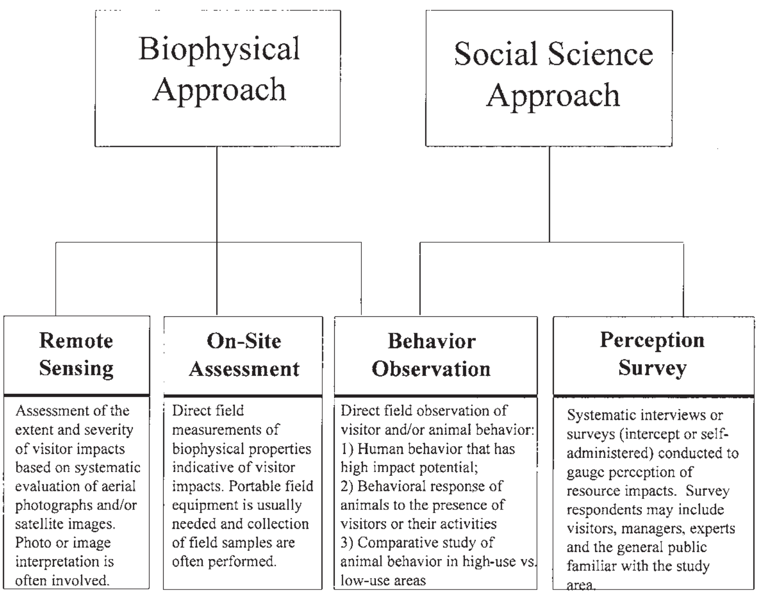

Figure 1. A classification of visitor impact monitoring techniques developed for coastal parks and protected areas.

biophysical approach includes studies that evaluate the extent and intensity of visitor impacts based on remotely sensed data or direct measurements of recreation sites, coastal habitats, and wildlife behavior. Within this first approach, remote sensing, on-site assessments, and observation of animal behavior are the three major groups of techniques. On the other hand, studies that employ the *social science* approach evaluate the extent and intensity of visitor impacts based on (1) perception of park visitors, managers, local experts, and/or general public; or (2) direct observation of visitor behavior that has high impact potential. The following is a concise description of each group of techniques with examples from past studies.

Remote sensing. Remote sensing refers to the detection and recording of values of emitted or reflected electromagnetic radiation with sensors onboard aircraft or satellites. This group of techniques is particularly useful for monitoring easily detectable visitor impacts that occur in a large expanse of coastal areas. Butler and Wright (1983) discuss the potential of remote sensing in recreation research, including the measurement of user density and intensity and comparison of changes over time. Welch et al. (1999) created databases of digital maps detailing vegetation and ORV trails in the Everglades for use in management and modeling. Hockings and Twyford (1997) used aerial photography to identify beach camping impacts. They used the extent of clearing and vehicle tracks as indicators. They compared their findings with ground surveys and found aerial photography to be a valid and reliable measure. Aerial photography was also used in the study to examine spatial and temporal changes within the campsites.

On-site assessment. On-site biophysical assessment refers to direct measurements or assessments on the ground, usually with portable field equipment. This research approach may also involve collection of field samples for laboratory analysis. Several campsite impact studies recently have been conducted in North America (Monz 1998; Gajda et al. 2000). These studies extended field procedures from earlier studies conducted in inland forests and parks (Leung and Marion 2000). In North Carolina, Buerger et al. (2000) assessed impacts of recreation on a barrier island. Researchers identified impact areas as sites (resulting from camping, picnicking, and boat landings) and trails. Physical impacts such as compacted sand, loss of vegetation, and trash were recorded. These impacts were compared over time to determine if mitigation of recreation impacts occurred naturally. They found the degree of mitigation depended largely on the location of the impact on the island. Sites closer to the water had a higher level of mitigation. Chandrasekara and Frid (1996) used on-site measurements to determine the effects of trampling on tidal flat infauna. Faunal and sediment samples were taken from the site and brought to the lab for further analysis. Sediment pH was measured on site. The authors found trampling caused a change in the composition of benthic fauna.

Behavior observation. Behavior observation is a group of techniques that may fall within either the biophysical or social science methodological approach, depending on the actual subject of observation. In visitor observation, human behaviors that cause impacts are systematically observed. In wildlife observation, immediate behavioral response of wildlife to the presence of visitors or visitor activities is observed. These techniques can be used together (Burger 1986; Thomas et al. 2003) or separately (Patterson et al. 1991; Loegering and Fraser 1995). Burger (1986) found walking (40%) and fishing (10–20%) to be responsible for the majority of disturbances to shore birds. Dogs accounted for less than 10% of the disturbances. Shorebird responses were recorded as one of three behaviors: remained at the site, flew away but returned, and flew away and did not return. While there were some differences between sites, the percentage of birds that flew away and did not return was inversely related to the number of disturbances. Burger also found evidence to suggest that birds in small flocks were more likely to fly away and not return than birds in large flocks. Thomas et al. (2003) found that group size, activity type, and free-running dogs tend to have a significant effect on the foraging time of sanderlings. Observation of behavior has also been used to determine if human disturbance had an effect on animal survival (Patterson et al. 1991; Loegering and Fraser 1995).

Perception survey. The extent and severity of visitor impacts may be evaluated based on human perceptions of such problems. This social science approach can be implemented in forms of systematic interviews and/or surveys (intercept or self-administered). Survey respondents typically include visitors and managers of the study area. However, the general public and professionals who are familiar with the study area may also be surveyed. Vaske et al. (1992) used written self-administered surveys to understand visitor perceptions of conflict and of the natural environment. Responses were separated by user group (pedestrian, boater, ORV user) and by use area. They found that boaters were less educated about the ecology of the area, regulations, and human impacts. Survey responses also revealed that visitors felt the beach area was becoming crowded. The responses from the surveys were combined with ecological data to create new management techniques. Becker et al. (1986) assessed the threats of human impacts to coastal areas based on a survey of visitors and public, though managers and experts were also involved. Similar to surveys of visitors and the public, surveys or interviews of managers may also be used to gauge the extent and intensity of visitor impacts, based on managers' or experts' perceptions. In the Becker et al. (1986) study, coastal park managers and experts were also involved in the survey. No other park manager/expert surveys focusing on perceived visitor impacts on coastal areas have been identified.

Discussion and Conclusions

The scientific assessment and monitoring of visitor impacts on sandy coasts and barrier islands emerged about 30 to 40 years ago, though our knowledge of direct impacts of visitors on coastal resources is still limited. A variety of monitoring techniques have been developed or adapted for a wide array of impact indicators, although on-site assessment and behavior observation appear to be the most popular methodological approaches. On-site biophysical assessment has been applied to various countries, while remote sensing and behavior observation techniques were largely developed in North America.

Several current trends in methodologies for coastal visitor impact monitoring were identified:

1. Expanding geographic scale of monitoring studies from primarily North America to different world regions in recent years, partly as a result of rapid growth in coastal ecotourism;
2. Increased number of integrated studies that include both biophysical and social research components; and
3. Increased application of technologies in visitor impact monitoring studies. These technologies, such as global positioning systems (GPS), geographic information systems (GIS), and remote sensing, enhance the overall quality and especially the spatial accuracy of monitoring data.

The process of literature review benefits the next steps of this project. For example, some of the indicators reviewed, such as the use of remotely sensed data, site assessments, shorebird responses, the presence of ghost crabs, and visitor behavior observation, are being adapted to the project. Informed by the state-of-knowledge in visitor impact monitoring, our next critical step is to adapt or develop network-wide and park-specific impact indicators and monitoring protocols for the seven park units and integrate these procedures into the broader Vital Signs Program, which strives to protect the park resources for future generations.

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Restoration of Coral Reef Habitats within the National Park System

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Introduction

The National Park Service (NPS) has long been involved in resource restoration activities designed to enhance the recovery rate of injured terrestrial resources. When injury to natural resources occurs, rapid restoration and recovery is important, both to other resources dependent on the injured resource and to the public who utilize the resource. Restoration actions may reduce cumulative impacts to these stressed systems, speed the recovery of ecosystem function, and minimize loss of dependent organisms.

Coral reefs are often vulnerable to human-caused injury. Coral reefs occur in relatively shallow water, are utilized by the boating public, and are often located near navigation and shipping channels. Injuries from wayward shipping vessels, recreational boat groundings, anchors, sport divers, and fishing gear often compound the effect of other reef stresses and create a need for resource managers to restore the injured resource. Biscayne National Park, Dry Tortugas National Park, Virgin Islands National Park and other coral reef parks in the Pacific have all suffered reef injury incidents caused by grounded vessels. Many vessel groundings result in massive injuries to the reef ecosystem; this then requires mitigative actions to facilitate ecological recovery.

NPS Interdisciplinary Team

To help address the issue of coral reef ecosystem restoration at Biscayne and other national parks, the NPS Natural Resource Program Center, in conjunction with Biscayne National Park and Marine Resources, Inc., have formed a Coral Reef Ecosystem Interdisciplinary Restoration Team. This team is reviewing past coral reef and seagrass restoration actions, compiling available scientific literature on restoration techniques, and developing a guidance document that can be used to address coral reef ecosystem injuries and restoration within the park.

Challenges of Coral Reef Restoration

Ocean environments, particularly coral reef ecosystems, present special challenges to those wanting to mitigate human-caused injuries to natural resources and undertake restoration actions. The primary challenges of coral reef restoration include:

- *Coral reefs support a dense and diverse biological community and are ecologically complex.* Macro-organisms injured or disturbed by even a minor incident of small spatial extent can number as many as several thousands (Glynn 1976; Connell 1978; Gulko 1998). Replacements for macro-organisms impacted during an injury event are extremely difficult to obtain, and natural recruitment and regrowth can require decades or longer to occur (Salvat 1987). In the highly competitive and ecologically complex reef ecosystem, the natural balance of organisms present is also often important (Connell 1976; Glynn 1976). Organisms selected for transplanting or repair, if not placed carefully and with natural processes in mind, can gain an unnatural advantage, prevent recruitment of other organisms, and eventually result in permanently altered communities.

- *Coral reefs occur in high-energy environments*. Ocean surge, wave action, and currents are continuous and often relentless in their effects on restoration attempts. This necessitates utilization of creative technical approaches.
- *Coral reefs have many fragile and/or site-specific microhabitat species.* Coral reefs are highly competitive environments, and many reef organisms have evolved into highly specialized niches (Connell 1976). Loss of habitat or three-dimensional structure due to vessel groundings severely impedes or precludes re-establishment of the pre-injury reef community without recreating the original topographic structure and habitat complexity (Pearson 1981; Miller et al. 1993; Jaap 2000; Hudson and Goodwin 2001).
- *There is a lack of experience and knowledge in successful restoration techniques.* Restoration techniques for coral reef ecosystems are still being developed and evaluated. To deal with high-energy forces within this environment, artificial materials and adhesives have often been used to stabilize reef substrate and to recreate the habitat complexity necessary to re-establish pre-injury species diversity (Miller et al. 1993; Hudson and Goodwin 2001). Some managers feel that the techniques and materials used at some coral reef restoration sites are inappropriate for use in national parks.
- *There is greater difficulty in defining goals*. Injured sites may not be completely restored to their pre-injury condition through mitigative actions. Goals may need to be based on the ability of restoration actions to accelerate habitat recovery following injury incidents. Different agencies and organizations have varying opinions as to what are acceptable mitigative actions and site-specific goals associated with these actions.
- *A long time is needed to evaluate results.* Because of the slow growth and low recruitment potential of coral and many other reef organisms, a long time is needed to fully evaluate results of restoration efforts and the usefulness of the utilized techniques.

The primary challenges facing the team are making the determination as to what restoration actions and techniques are appropriate for national parks and establishing goals and success criteria.

Restoration Goals

One of the most widely accepted definitions of ecosystem restoration in terrestrial environments is: "actions taken to return an impacted site or ecosystem to a close approximation of its condition prior to disturbance" (Cairns 1995). A return to a close approximation of its prior condition is often the goal of terrestrial natural resource restoration efforts in national parks (NPS 1991).

Coral reef ecosystem restoration is more difficult to define. Studies have shown that since coral reefs are such highly complex and ecologically diverse systems, once an injury occurs, the reef cannot be readily "restored" to any close approximation of their pre-impact condition through artificial manipulations (Jaap 2000; Precht et al. 2001; Pinit et al., in press). Most marine biologists acknowledge that natural recovery processes, often in conjunction with artificial manipulation, are necessary to fully restore the ecological condition of an injured site. The rate of recovery to a pre-injury condition can be accelerated through mitigative actions and management intervention by providing physical habitat requirements conducive for natural recovery processes. Therefore, coral reef ecosystem restoration must meet structural and functional goals.

Structural and Functional Goals of Coral Reef Restoration

Injured coral reef ecosystems cannot be entirely reconstructed to a pre-impact condition. Thus, the goal of coral reef restoration activities becomes one of attempting to restore structural and functional components of the site to accelerate natural recovery processes. It is important to achieve the following elements in this process:

- Resiliency to further erosion and loss;
- Self-sustainability in terms of natural processes of repair and recolonization;
- Similarity in appearance to natural reef substrate; and
- Substrate conditions such that, over time, the site will produce a quantity and diversity of organisms similar to surrounding unimpacted areas.

The following goals for coral reef restoration actions have been adopted by others:

- "Actions taken to re-establish a self-sustaining coral reef habitat that, in time, can come close to resembling a natural condition in terms of structure and function." (Key Largo Coral Reef Marine Sanctuary)
- "A proactive program designed to speed recovery of a damaged reef to an endpoint that has aesthetic value and is functional as a coral reef ecosystem." (National Oceanic and Atmospheric Administration Office of Habitat Conservation)

All of these goals have a common element of "taking actions that will enhance natural recovery processes." The amount of management intervention and the type of actions necessary to achieve this type of goal statement vary with the nature and extent of injury sustained, rate of recovery desired, and the degree to which introduction of artificial materials is acceptable.

The NPS Coral Reef Ecosystem Interdisciplinary Restoration Team is working to develop a goal statement that will accommodate a variety of coral reef injuries and provide the latitude to encompass a number of alternative restoration actions.

Injury Categories

To properly analyze and understand the nature of injuries that can occur to a coral reef, it is first necessary to understand the geologic structure and reef growth processes that occur within a coral reef ecosystem. Reef substrate is composed primarily of limestone and is characterized by a reef platform matrix of encrusted and lithified hard-coral skeletons and calcium carbonate rubble. The reef formation is geologically dynamic due to the relative balance of depositional and erosional processes occurring on the structure. Hard corals, calcareous algae, hydrocorals (e.g., fire coral), and bryoans all accrete calcium carbonate onto the reef, building and maintaining the complex structure. Natural erosional processes working to break down the reef matrix include both physical factors, such as currents and storm damage, and biological factors, such as effects of boring sponges, mollusks, polychaetes, and echinoderms. This dynamic balance of on-going, diametrically opposed processes provide structural topographic features of the reef and the highly variable microhabitats within the reef structure. Habitat creation within the reef structure facilitates species diversity due to niche partitioning and biotal zonation. Loss of structural reef components is detrimental to the maintenance of the complex web, which it ultimately supports. Any anthropogenic impact that eliminates reef structure also accelerates habitat degradation and can change the constructional balance of the reef.

Although diving, snorkeling, and other recreational uses of the coral reef ecosystem result in some injury to corals and other reef organisms, the extent and nature of these impacts seldom reach a level that requires mitigation for recovery to occur. Injuries caused by inadvertent contact by divers' fins or standing on corals usually does not impact the reef's geologic structure, and injury to biological organisms usually is isolated and not fatal. This type of injury is considered to be a limited "surficial biological injury." However, when a vessel grounding occurs, impacts to the reef are usually more substantial and may require mitigative actions to decrease recovery time. Vessel grounding impacts can be divided into two categories, surficial and topographic/structural injury, as described below.

Surficial injury. Surficial injury includes that to the biological organisms living on or near the outer surface of the reef and the scraping, grinding, or minor gouging of the reef surface. This category of injury may range from only minor injury of surface biota to much more damaging injuries involving broken coral heads, crushed organisms, and scraping of the reef surface over large geographic areas. The reef's geologic structure remains intact and natural topographic relief (rugosity) at the site remains unaltered. Surficial injuries include the displacement of organisms, overturning and breakage of individual living coral heads and other benthic organisms, and/or burial of living organisms from fragmented material.

Surficial injury impact assessments are two-dimensional (length x width of surface area impacted). Restoration may require removal of loose or grated material to ensure that organisms are not buried and adjacent areas are not impacted from loose material washed around by ocean currents and wave action. If impacts are significant, recovery time can often be greatly reduced through mitigative actions that restore living biological organisms to the site. Restoration actions enhance the recovery of ecosystem function, as well as improve the aesthetic appearance of the site.

Topographic/structural injury. Because coral reefs are geologically composed of a hard outer shell with an interior of unconsolidated sand, shell, and coral fragments, vessel groundings involving heavy ships can cause injury to the reef's geological structural integrity. In this category of injury, the reef matrix is cracked or penetrated and/or major portions of the reef's topographic relief have been altered.

This type of injury destabilizes the reef's surface and makes the reef vulnerable to the erosional processes of ocean currents. Studies have shown that once this occurs, recovery is not likely without mitigative actions to stabilize the site (Miller et al. 1993; Jaap 2000; Hudson and Goodwin 2001). Lack of management intervention following the incident will often result in a continued degradation and enlargement of the impacted site over time. Such impacts can be significant and continue for decades. Stabilization of the site is mandatory even if no other actions are taken. This category of injury usually occurs with vessels over 30 feet in length and usually involves widespread injury and destruction of surface biota in conjunction with loss of reef topographic complexity.

With topographic/structural injury, the impact assessment requires three-dimensional analyses (surface length x width x vertical relief). If topographic height or structural complexity has been lost due to the grounding incident, restoration of the original reef form and structural complexity through mitigative actions may be crucial to recovery. Many organisms within the coral reef community are highly sensitive to water depth, currents, and light levels. All of these factors are changed when topographic relief and structural complexity are altered. If not restored through mitigative actions, natural processes will likely change the site into a permanently altered coral community.

Measures of Restoration Success

As with any management action, it is important to thoroughly evaluate restoration goals and determine the relative success of restoration. Actions taken to enhance the recovery of injured coral reefs are primarily directed at regaining the structural and functional characteristics of the site. Evaluation of the relative success should focus on the structural and functional aspects of the restored site. Structural and functional parameters to be considered for monitoring include, but are not limited to, the following:

Structural:

- Morphological/topographic form of the site—does it resemble the pre-injury habitat or a reference site?

- Stability and structural integrity of restored topography.
- Similarity of abundance and diversity of flora and fauna to the natural unimpacted reef or reference site.

Functional:
- Ichthyofauna—does it resemble that of uninjured reef areas?
- Biological recruitment rates.
- Epibiotal colonization.
- Biological community structure (percent cover, density, and relative abundance).
- Stability, attachment status, and relative health of reattached organisms.

Monitoring a select list of parameters should provide the information necessary to evaluate the relative success of the restoration actions in promoting ecological recovery. Resource recovery will ultimately depend on successful biological recruitment, survival, and development to withstand natural perturbations and provide structural and biological three-dimensional relief that closely resembles that of the pre-injury habitat. Restoration is a process to correct an artificially altered resource and should be applied to prevent the loss and degradation of that resource.

Conclusions

1. Techniques and success of methods for coral reef ecosystem restoration are still being evaluated.
2. Goals of restoration actions need to be stated in terms of re-establishing structure and function to the damaged site.
3. Two factors should be of primary concern when evaluating coral reef damage from vessel groundings or anchoring: (a) extent of penetration and fracturing of the reef's hard outer surface, which may result in further erosion; and (b) loss of reef topographic relief and structural complexity that may have existed at the site before the injury occurred. These two factors will largely govern the extent of geologic stabilization and structural restoration that needs to be implemented to achieve ecological function and processes that will lead to pre-impact, near-natural conditions.
4. Management intervention involving site stabilization and reconstruction of geologic topographic structure is usually necessary whenever either of the two forms of impact mentioned above have occurred.
5. Restoration actions at sites not involving the above two factors may be limited to loose substrate removal and/or biological mitigation for recovery to occur within decadal time frames.
6. Transplanting of biological organisms to impacted sites can serve to greatly improve aesthetic appearances and help accelerate overall site recovery.

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Permanently Protected Parks for a Dynamic Society: An Examination of Race and Ethnicity in National Park Visitation and Participation

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The United States has the oldest and perhaps most well-respected National Park System in the world. It represents, in principle, the finest the country has to offer in scenery, history, and culture. Stewardship of the national parks is a tremendous responsibility entrusted to the National Park Service (NPS) and the American people, through the action of their elected representatives and civil society (including nongovernmental organizations [NGOs]). NPS and associated NGOs have observed that, as the American public has become more racially and ethnically diverse, the national parks' constituency has not followed the same pattern. Recent studies indicate that minorities are represented in national park visitation in percentages lower than their population percentages in all types of National Park System units all across the country (Machlis 1993; Machlis 1999; Floyd 1999; Wilkinson 2000). NPS and associated NGOs have become concerned and some individuals and groups have attempted to address this as a threat to the future of the National Park System.

Race, Ethnicity, and Minority Americans

This paper uses the terms "race," "ethnicity," and "minority" to describe components of the American population. "Race" refers to "a social group distinguished or set apart, by others or by itself, primarily on the basis of real or perceived physical characteristics" (Floyd 1999:23). For the purpose of this paper, "African American," "Asian American," "Native American," and "White" are used as racial categories. "Ethnicity" refers to "a social group set apart on the basis of cultural or nationality characteristics" (Floyd 1999:23). Members of an ethnic group may be of any race. For the purposes of this paper, "Hispanic" is used as an ethnic category. The term "minority" refers to a racial or ethnic group comprising a numerical minority of the total population; in the U.S. context, it usually refers to African Americans, Hispanic Americans, Native Americans, and Asian Americans (Floyd 1999).

The American public is now more racially and ethnically diverse than at any other time in the history of the country. The 1990 and 2000 censuses indicate the continuing trend towards diversity (Table 1).

National Park Visitation

Studies examining racial and ethnic demographics of national park visitation show that minorities visit national parks in percentages lower than their percentage contribution to the American public. NPS, in conjunction with the Cooperative Park Studies Unit at the University of Idaho, annually produces ten

Table 1. U.S. race and ethnicity data, 1990 and 2000

Race/Ethnicity	1990	2000
White	80.2%	77.1%
African American	12%	12.9%
Hispanic	9.0%	12.5%
Asian American	2.8%	4.2%

Source: U.S. Census Bureau 2001a (White), 2001b (African American), 2001c (Hispanic), 2001d (Asian American).

survey studies of visitors to individual parks. While the vast majority of these studies do not include information on ethnicity or race, the few that do can provide insight into minority-use patterns in specific national parks. The race and ethnicity data in these studies were not collected for individual visitors; rather, visitor groups were asked to indicate the races and ethnicities represented in their group (Floyd 1999). What has been learned about minority visitation through this research is indicated by the following examples (Table 2).

Other studies also indicate that minorities are under-represented in national park visitation when compared with nationwide population percentages. In 2000, Nina Roberts conducted a survey study at Rocky Mountain National Park. She found that visitation was as follows: 94.2% White, 2.2% Bi-racial/Multiracial, 1.4% Hispanic, 1.1% Pacific Islander, 0.7% African American, and 0.4% Native American (Erickson 2001).

A report commissioned by NPS, *The National Park Service Comprehensive Survey of the American Public* (NPS 2001), provides information on individual racial and ethnic groups' visitation rates. This study claims to have found that 35% of the White population, 32% of the American Indian / Alaska Native population, 27% of the Hispanic population, 18% of the Native Hawaiian / Pacific Islander, and 14% of the African American population visited a national park site in the two years prior to being interviewed (1998 and 1999). Although this study serves to give a relative idea of park visitation by segments of the American population, it was designed such that representative sample sizes were not obtained for all populations. The sample sizes were as follows: n=2631 for Whites; n=406 for African Americans; n=379 for Hispanics; n=90 for Asian Americans; n=34 for Native Hawaiians; n=28 for Native Americans. While the data provided may give an idea of visitation within those groups, many of the sample sizes are insufficient to allow extrapolation to the entire population of a racial or ethnic group. The study also produced unpublished data correlating ethnicity with sites visited (Brian Forist, NPS assistant social scientist, Washington Area Service Office, personal communication, 4 January 2002). This may be useful to park managers in further identifying which sites are used by particular groups.

These studies indicate that, on a national scale, members of minority groups have significantly lower visitation rates to areas of the National Park System than does the White majority. They also show that minorities are under-represented across the spectrum of NPS-run sites and in NPS visitation as a whole. Including race and ethnicity in such studies on a regular basis would allow NPS to understand, in depth, the use patterns by spe-

Table 2. Visitation by race and ethnicity at selected National Park System units, 1990s

Sources: Rock Creek (Machlis 1993); Santa Monica Mountains (Machlis 1993; Floyd 1999); Bent's Old Fort, Whitman Mission, Booker T. Washington, and Bandelier (Floyd 1999), Yellowstone (Wilkinson 2000).

	White	African American	Asian American	Hispanic American	Native American	Native Hawaiian/ Pacific Islander	Other
Rock Creek	74%	24%	3%	2%	1%	1%	—
Santa Monica Mountains	95%	4%	—	8%	—	—	10%
Bent's Old Fort	94%	—	—	5%	—	—	7%
Whitman Mission	93%	0%	—	1%	—	—	7%
Booker T. Washington	85%	17%	—	4%	—	—	4%
Bandelier	90%	1%	—	8%	2%	—	1%
Yellowstone	90%	1.5%	4.1%	1%	0.5%	—	—

cific park, by type of park unit, and by region. This would help NPS make informed management decisions on an individual site, regional, or site-type basis.

Defining the Problem

NPS and associated NGOs have both recognized low visitation rates by minority groups and they perceive it as a problem in two ways. First, it represents a failure of NPS to implement its mission, and second, it poses a political threat to the future integrity of the National Park System. These problems are, of course, intimately connected. It is the mission of NPS to provide for the enjoyment of the parks and to protect them for future generations. The future generations of the U.S. will be racially and ethnically diverse. Therefore, in order to protect the parks for those generations and to ensure that they enjoy the parks, NPS must develop a demographically representative political constituency, visitation, and participation base.

The lack of a diverse visitor group reflects an agency that is not serving a representative cross-section of the American population but rather only a segment thereof. It is the mandate of the federal government to serve the American public and each agency of the U.S. government must carry out its mission with that purpose in mind. The implication is that NPS is serving the White population at the expense of serving minority populations for reasons that are not inherent to park protection.

The NPS mission is defined in terms of acting on behalf of the future. "As a people, our quality of life—our very health and well-being—depends in the most basic way on the protection of nature, the accessibility of open spaces, and recreation opportunities, and the preservation of landmarks that illustrate our historic continuity.... The larger purpose of this mission is to build a citizenry that is committed to conserving its heritage and its home on earth [sic]" (National Park System Advisory Board 2001:13). In order to fulfill the further defined purpose of this mission, it will be vital that the entire cross-section of the American population participates. A citizenry comprises the entire population, and cannot be built through partial representation. For NPS, the design and management of the parks is only negotiable within certain limits. Essential park values and resources must be preserved. Those limits take the form of laws and rules that govern park use and ensure park protection. NPS and associated NGOs must convince a representative cross-section of the population that the natural, historical, and cultural values of the parks should be protected.

Both the NGOs and NPS have also defined the lack of diversity in NPS visitation and participation as a potential political problem. It is recognized that, "national parks exist because the people want them to exist. They were created by an act of Congress and they can be done away with by an act of Congress. The parks have to be relevant to the people.... If the parks aren't reality to a portion of the population, then they won't be something to vote for either" (Shelton Johnson, interpretive park ranger, Yosemite National Park, personal communication, 20 January 2002). The lack of diversity in national park visitation has been identified as a potential political problem for NPS if it persists in the face of an increasingly diverse and politically active American population.

In discussing the changing demographics of the American population in the *National Parks for the 21st Century: The Vail Agenda,* the National Parks Steering Committee states: "[O]urs is a nation and world that is rapidly changing, and any public service agency that is not adapting will eventually create its own crisis. Hence the National Park Service must act" (NPS Vail Steering Committee 1992:64). Furthermore, it states that "effective leadership requires an understanding of the changing political environment in which an agency operates. Policies and goals must fit into this dynamic context. In a democracy, an agency that ignores its political environment does so at its own peril" (NPS Vail Steering Committee 1992:104). NPS does not operate in a vacuum; it must operate within and conform to the larger political context of the nation.

NGOs also have determined that a broad-based and diverse constituency is imperative to the NPS' political viability. The National Parks Conservation Association (NPCA) states:

> If the Park Service continues its current trend, the agency runs the serious risk of becoming irrelevant to and out of touch with a large and increasing segment of the United States population.... If people of color remain strangers to the park system and the Park Service, it will be unfair and unrealistic to expect them to serve as advocates when the parks face future threats.... This pronounced gap between the national parks and communities of color will come right at the time when a large portion of the responsibility for protection of our natural and cultural resources will fall to Native, Asian, Latino, and African Americans. As taxpayers, voters, and citizens, it is both our right and our obligation to play a more prominent role in park advocacy. Enhancing cultural diversity throughout the National Park Service is a crucial first step towards making that happen (National Parks Conservation Association 2001:1).

NPCA and NPS are in agreement on the need to diversify the national park constituency in order to remain relevant to the diverse and changing American population and to maintain the political viability the agency has enjoyed in the past.

While both mission-oriented and political reasons for addressing diversity in the National Park System have been articulated separately, they have also been described as inextricably intertwined. Jonathan Jarvis, NPS Pacific West regional director, described his reasoning in this way:

> Our mission is to preserve and protect for the enjoyment of *future* generations. Those future generations are very diverse. The National Park System and all public lands in America are part of [future generations'] birthright or citizenship right. They are something they get by either having been born or becoming a citizen. It's one of the American values. They need to know what they have received and what responsibility it carries. [The national parks are] not just going to take care of themselves. They need a constituency. They need love and care. Therefore, if we, as the stewards of this land now, take our mission to heart, we need to be looking out there to those future generations and making a monetary and programmatic staffing commitment to teaching the next generation about that responsibility.... We have a responsibility to the future to make sure [these national parks] persist (personal communication, 24 January 2002).

Stated in this way, the assurance of a diverse constituency for the future is part of the mission of NPS. The development of that constituency is part of protecting the national parks for future generations.

Conclusion

It is generally agreed that diversifying the NPS visitation base and constituency is important in order to maintain the integrity and quality of the National Park System that we know today and to ensure that the enjoyment of that system is equitably distributed throughout the population. This will be important to the development and implementation of effective, system-wide national policies and programs to promote racial and ethnic diversity in our national parks.

NPS and associated NGOs concerned with protecting the national parks are at the beginning of what must become a widespread effort to reach each corner of America and every nook of NPS, to make fundamental changes in the way national parks are perceived, used, and managed. If NPS and associated NGOs hope to ensure the perpetual integrity of the national parks, they must become valuable to the broad-based American public for reasons specific to and consistent with their environmental and cultural integrity. We, as a society, must eliminate the socially constructed components of the national parks that are divisive to members of American society, at the same time that we promote the components that protect the ecological and cultural integrity of the parks and their associated ecosystems and historic sites. It is imperative that the divisive practices of NPS and those that associate themselves with national parks (and thus contribute to their image) end, in order to continue to protect the essential components of the parks and allow NPS to fulfill its mission in the service of the American public.

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Nervous Landscapes: The Heritage of Racial Segregation in New South Wales, Australia

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Introduction

The geographical focus of this paper is the Manning Valley on the lower North Coast of New South Wales (NSW), Australia.[1] I should mention that the National Parks and Wildlife Service (NPWS) in NSW is accountable for Aboriginal heritage across the whole state, not just on-park, and that explains my involvement in a project whose focus is mainly outside the park system.

My paper addresses itself to the segregation of Aboriginal and white populations that took place in the Manning Valley, in one form or another, between the 1820s and the 1970s.[2] At a global level, racial segregation has occurred in a surprisingly large number of countries at some point in their history. The history of segregation is perhaps best known, or best researched, in the United States and South Africa, in each of which, especially over the last couple of decades (less in the case of South Africa), it has been the subject of heritage discourse and the focus of various acts of commemoration.[3]

Racial segregation, by its very nature, is a spatial practice. It is about the separation of people in space and the rules and devices that are set up to achieve this. It has been the spatiality of segregation in Australia that has been the particular subject of my interest. As heritage practitioners we operate not just in the field of place, but also in the field of space.

The "Lightness" of the Aboriginal Presence

I would argue that segregation was not merely a historical reality in NSW but that, taken in its broadest sense, it is the key to deciphering and understanding the whole spatial pattern of Aboriginal life in the post-1788 NSW landscape (1788 marking the beginning of white settlement in Australia). The absence of any major infrastructure of segregation, apart from the Reserves system, accords with a general sparseness of obvious physical traces of the Aboriginal presence in the post-contact landscape overall. Like their ancestors, Aboriginal people in NSW after 1788 lived fairly lightly on the ground. Their dwellings were also liable to be demolished, burned, or removed by the authorities. Relatively speaking, where the white heritage of the post-contact period is fabric-heavy, Aboriginal heritage is fabric-light and the odds are stacked against it surviving into the archeological and architectural heritage record.

Another difficulty is posed by the increasing use by Aboriginal people through the post-contact period of a material culture borrowed from Europeans. Aboriginal people used teacups and spoons, hammers and nails, bicycles, and steel rabbit traps. While the objects themselves may not be distinctively Aboriginal, we can assume that the distributional pattern of the objects at any one site will reflect distinctive behavioral patterns. But how do we find these sites? My present project evolved out of a concern that Aboriginal post-contact heritage sites were radically under-recorded relative to non-indigenous heritage places for the same period. The project aims to develop principles for finding Aboriginal people in the historical (post-contact) landscape. It is looking for the logic that explains where Aboriginal people were in the colonial landscape, and that logic, I contend, is the (highly illogical) logic of segregation.

In-between Space

When we think of racial segregation in Australia we normally think of the institutionalized racism of the latter part of 19th century and the first half of the 20th century.[4] I suggest we need to look earlier than this. In my study area, the Manning Valley, the first land grants and sales were made to white farmers in the 1820s. What we see is the familiar rectangular grid of white land holdings spreading along the alluvial flats of the valley and then expanding into the grazing country back from the river. The fertile ground in the valley was all taken up by the 1880s. What had begun as a mosaic of rectangular farms became a continuous carpet of white-owned land along the bottom of the valley and over the foothills.

The concept of private land ownership was itself an instrument of segregation, a key separator of the two races. The exclusionary effect was not immediate, though. In the 1820s and 1830s, white settlers simply did not have the technology to clear more than a paddock or two around their homesteads. The forest and woodland covering the rest of their holdings remained more or less accessible to the Biripi people. Even though the white population of the valley grew from 400 in the early 1840s to about 3,000 by 1860, the valley remained substantially bush covered.[5] Ring-barking changed that. Widely practiced in the valley from the 1860s, ring-barking produced landscapes that look like scenes from an eco-disaster. Over large parts of the Manning Valley the native tree cover was wiped off the map, producing, in a sense, a clean slate for the lines that would be drawn by the wire fences, which were introduced from the 1870s. Wire fences made the cadastral grid a visible, tangible reality on the ground where, previously, it had for the most part been real only on paper.

These developments radically curtailed Aboriginal freedom of movement through the countryside. It is now appropriate to ask the question, "How, in a practical–spatial sense, do you live in a landscape that no longer belongs to you?" This is to say, how do you live inside a cadastral grid which you have no proprietary state in? As white settlement spread, from the 1820s, many or most of the customary Aboriginal camp sites, ceremony places, and food resource places became inaccessible and unusable. The rectangular farms increasingly cut across customary Aboriginal lines of movement. There were, however, gaps and opportunities in the grid which Aboriginal people could occupy and move through. These openings included water reserves, traveling stock reserves, and town commons. They included narrow strips of land reserved for roads that had not yet been built as well as terrain too steep or boggy or sandy to have ever been cleared for agriculture.[6] Aboriginal people often could and did camp in these gaps and negotiate their way through the colonized landscape by means of them. It is thus possible to think of the Aboriginal presence in the colonized landscape in terms of in-betweenness.[7]

Oral and documentary history sources provide fragmentary evidence of an Aboriginal life lived "in between." We have supplemented this by what you might call an audit of gaps and openings in the cadastré. For sample areas of the valley, we have reviewed the series of cadastral maps going back to the 1880s in order to identify road reserves. There were always far more of these than ever had roads constructed on them and in the days before cars replaced horses they provided networks for white as well as Aboriginal movement through the landscape. Narrow bands of reserved land along some of the waterways provided another opening. For Aboriginal people living on the Aboriginal Reserve gazetted at Purfleet in 1900, the water reserves in the nearby Glenthorne area allowed access for line fishing from the shore as well as the mooring of the fishing boats some Aboriginal families owned (and often built) and sites for drying fishing nets. These continue to be used into the present. Other water reserves along the river allowed the river itself and its wide estuary to become something of a zone of free movement for Aboriginal people who had access to boats. The cadastral grid stopped at the shoreline and, to an extent, the water was a neutral, unsegregated zone and, from an Aboriginal point of view, a gap in the cadastré.

Segregation and Tactics for Testing It

As the title of my paper suggests, I am

interested in the idea of racial segregation as a spatial regime that was always, to borrow Michael Taussig's term, a "nervous system."[8] The Manning Valley over the last 150 years or so can be seen as a cultural landscape that vibrated with the tensions set up not just by the strictures of racial segregation and their enforcement, but by the numerous ways that those strictures were tested and undermined by people on both sides of the highly unstable racial divide. So, while the ideal or objective of segregation was a neat—and one might say, clinical—separation of black and white lives for all but economic purposes, the social-historical reality of segregation was somewhat the opposite: the black and white populations existed in a state of mental and behavioral entanglement. My purpose in taking up racial segregation as a heritage theme or topic is partly to highlight this entanglement and, in doing so, lend support to those arguing that Aboriginal and non-indigenous historical heritage should not be kept in separate boxes.[9]

One of the main reasons segregation may speak more about racial entanglement than real racial separation is that people resisted it. I have pointed to the ways in which the cadastral system was replete with cracks and openings that enabled Aboriginal people to live inside it, in a state of in-betweenness. These gaps, in the form of various types of reserves, were a formal, proper part of the cadastral system and Aboriginal people were merely taking advantage of the opportunities they offered. In a different category are what might be called the anti-cadastral practices of Aboriginal people. I refer here to the jumping of fences, the raiding of orchards and corn fields, the short-cutting across a hostile farmer's lower paddock in order to get to the river, the sneaking onto a property by Aboriginal children in order to swim in a farmer's dam-pond. Historical records indicate that incursions such as these were common across the whole of NSW and were on on-going source of inter-racial tension. They are also a major theme in oral histories recorded from Aboriginal people. Listening to the way Aboriginal people in our own study area recall and narrate these acts of trespass, often carried out against the real threat of shotguns and dogs and the specter of the police, I'm inclined to think of them almost as a systematic refusal of the boundaries of cadastral system, a refusal to acknowledge its legitimacy, a constant prodding and testing of its resolve. These experiences and the relating of them are a significant part of Aboriginal folklore, as are the stories, particularly from the 1970s, of how individuals defied boundaries in segregated picture theaters and the previously racially bounded space of white bars and discos. All these experiences are spatial and therefore eminently mappable as heritage.

They are, in quite a real sense, already mapped by Aboriginal people. Something I noticed early in our fieldwork in the Manning Valley was the extent of Aboriginal knowledge of white land ownership. As we drove through the valley with local Aboriginal people they frequently noted, in passing, not just who a particular farm belonged to but often who had owned it previously, the names of the parents and grandparents of the current owner, etc. This knowledge was almost always backed by information about how friendly or otherwise these white people were to Aborigines. Narratives about fence-jumping and orchard raiding had their counterpart in narratives of farmers who had always let them cross their fields, or who had given them fruit, or even, in one case, a white family who planted extra vegetables specifically for them to come and pick. Or the shop in Taree in the 1950s where you could always get served and be spoken to decently, or the doctor who could be relied on to treat you well. All of this comprises a mental map of the valley that is an alternative to the official "white map." It is a map maintained and updated and passed on from generation to generation. So an answer to the question, "How do you live in a landscape that no longer belongs to you?" may be that you maintain your own map of that landscape. We've tried to record parts of this alternative map on paper (actually on GIS).

In this area of research I have found the work of the French historian, Michel de Certeau, to be particularly helpful and provocative.[10] Certeau drew a comparison between reading and walking. He observed that no matter how tightly written a particular text might be, you can't control people's reading of it. The agency of the reader lay in the unique interpretations he or she could bring to the text, but also in the way it could act as an unpredictable springboard to his or her own lines of thought—not as something external to the text but as taking place in the spaces between and around and even inside its words and lines. Similarly, no matter how densely built an urban environment might be, people walking through a city or neighborhood would devise their own personal patterns of movement.[11] People would find ways to inscribe their everyday lives, their whims and desires, in spaces whose design made no allowance for them.

Sites of Segregation

In a different category from those described so far in this paper are those places where Aboriginal people were subject to segregation inside the built space, and thus potentially inside the built heritage of white people. In the Manning Valley these include the old public swimming pool and the Boomerang picture theater, both in Taree. Aboriginal children were allowed into the public pool but were required to keep to their own end of it. In the case of the picture theater, they had to sit in a roped-off section up the front. When the Boomerang Theatre is mentioned to older Aboriginal people in the area today, the first thing that springs to their minds is the humiliation of having to sit in those front rows and of only being allowed in after the lights went down. For them this is what the Boomerang Theatre means, but that meaning has no direct physical expression in the fabric of the place and would only become visible through an assessment of the place's historical or social significance.[12]

The Boomerang Theatre is also significant as a site of desegregation. Aboriginal people in the early 1970s simply refused to sit in the roped-off section any more. They took their seats up the back, discovering that in the face of their defiance this part of the "color bar" collapsed. In other cases it did not depart so quietly.

In the Manning Valley these events are neither attested to nor commemorated by physical fabric. The heritage of segregation—like the rules governing its enforcement—remains mostly in the realm of the unspoken.

Segregation and Visibility

I turn now to the issue of visibility, always a critical factor in racial segregation. Aboriginal people, and others who have experienced racism, often describe how effectively the disapproval of white people—their sense of superiority and control over you—is conveyed in the way they look at you. They speak of the effect of living under this disapproving gaze on a daily basis and what that does to you. We saw, how from the 1860s, through the practice of ring-barking, great tracts of the Manning Valley lost their tree cover. The situation of the Aborigines was not just that they were dispossessed of their land—they also became visible in it in a new and presumably quite disturbing way. They were subject to white surveillance.[13]

No surprise, then, that Aborigines often sought to remove themselves from the white gaze. And here the term "bush cover" takes on new meaning. It is clear that several of the places and pathways we have mapped during oral history recording sessions were valued for the privacy that the bush cover afforded. It appears that many of the places that people walked, fished, swam, and picnicked were chosen either for this reason or because they were specifically not the places white people walked, fished, swam, and picnicked. An often-overlooked aspect of segregation is that by the time it became a feature of white public policy in the late 19th century, Aboriginal people were already to an extent, and where practicable, voluntarily withdrawing their presence.

Endnotes

1. Several of the themes in this paper have been developed in more detail in Denis Byrne, "Nervous landscapes: race and space in Australia," *Journal of Social Archaeology* 3:2 (forthcoming 2003).

2. This area has been the subject of a study of post-contact Aboriginal heritage by myself and others at the NSW National Parks and Wildlife Service. My co-researcher at NPWS has been Maria Nugent (now at the School of Historical Studies, Monash University). The study has been carried out in partnership with the Taree–Purfleet Local Aboriginal Land Council (represented by Vienna Maslin) and the Forster Local Aboriginal Land Council (represented by Robert Yettica).
3. For the U.S., see, for instance, Owen J. Dwyer, "Interpreting the Civil Rights movement: place, memory, and conflict," *Professional Geographer* 52:4 (2000), pp. 660–671; for South Africa, see, for example, the District Six Museum in Cape Town (www.districtsix.co.za) and The Apartheid Museum in Johannesburg (www.apartheidmuseum.org).
4. David Hollinsworth, *Race and Racism in Australia* (Katoomba, Australia: Social Science Press, 1998). Hollinsworth and others point to the period after the 1860s in southeastern Australia as one in which a decreased reliance on Aboriginal labor was accompanied by "the construction and naturalisation of hegemonic ideas of racial exclusivity and superiority" by white settlers (Hollinsworth 1998, p. 87).
5. For white population estimates, see W.K. Birrell, *The Manning Valley: Landscape and Settlement 1824–1900* (Sydney: Jacaranda Press, 1987), p. 118; John Ramsland, *The Struggle Against Isolation: A History of the Manning Valley* (Sydney: Library of Australian History, 1987), p. 29.
6. Much of this resonates with the marginal existence of the hill people of West Virginia as described by K. Stewart, *A Space on the Side of the Road* (Princeton: Princeton University Press, 1996).
7. See T. Minh-ha, "The undone interval" (in conversation with Annamaria Morelli), in I. Chambers and L. Curti (eds.), *The Post-colonial Question* (London and New York: Routledge, 1996), pp. 3–16.
8. Michael Taussig, *The Nervous System* (New York: Routledge, 1991).
9. Denis Byrne, "The ethos of return: erasure and reinstatement of Aboriginal visibility in the Australian historical landscape," *Historical Archaeology* 37:1 (2003), pp. 73–86.
10. Michel de Certeau, *The Practice of Everyday Life*, translated from the French by Steven F. Rendall (Berkeley: University of California Press, 1998).
11. Certeau used the term "tactics" to describe the means that the disempowered employ to create space for themselves. The tactic, as Certeau (1998, p. 36) says, "must vigilantly make use of the cracks that particular conjunctions open in the surveillance of the proprietary powers. It poaches in them. It creates surprises in them."
12. An interior photograph of the Boomerang Theatre (ca. 1923) appears on the cover a recent publication by NPWS promoting social significance assessment: Denis Byrne, Helen Brayshaw, and Tracy Ireland, *Social Significance: A Discussion Paper* (Sydney: NSW National Parks and Wildlife Service, 2001). In this photo Aboriginal people can be seen occupying the front rows of seats.
13. Michel Foucault showed us how important visual surveillance became in the 19th century as a way of the modern state controlling and modifying the behavior of people who are outside the definition of the "model citizen," e.g., in his *Discipline and Punish* (New York: Viking, 1979). The visual observation of the colonized (the need to "keep an eye on them") is part of the process of building up a body of knowledge about them which, as Nicholas Thomas points out in *Colonialism's Culture* (Melbourne: Melbourne University Press, 1994), "is intimately linked with a classification and diagnosis of the inferiority or inadequacy of the latter, that establishes the need for management" (p. 41).

Impact through Action, Influence and Involvement—Ethnic Minority Recreation: Where to from Here? (Session Summary)

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Introduction

This paper documents the outcome of a panel discussion session that addressed the theme reflected in the title. Five professionals and scholars were part of this panel, including a senior-level executive from the Student Conservation Association, research social scientist from the Forest Service, professor from Old Dominion University, interpretive ranger/outreach specialist from Golden Gate National Recreation Area, and education/outreach specialist from the National Park Service Washington Office.

The purpose of the presentation and discussion was to provide a format for dialogue among natural resource professionals and academicians on outreach strategies, programs, and research involving diverse communities. Within this format, questions were presented to initiate dialogue, and an extremely valuable interaction proceeded thereafter. This paper highlights some of the discussions. Although not all of the questions initially developed were addressed (due to the ensuing discussion), the presentation and subsequent discourse centered on the following questions:

- What paradigm changes are required to ensure that land management agencies are more inclusive regarding decisions impacting the lives of people of color? What do these changes demand from us personally?
- If we think we understand how natural resources and outdoor recreation are viewed through the filters of urban youth, how can we best connect with them in planning for the future?
- What do managers of our public lands need to consider when they want to engage diverse communities?
- What are the different roles of parks, protected areas, and cultural sites in promoting relevancy of these areas to diverse users?
- What are some of the best practices your agency uses in meeting the recreational needs, and program desires of people of ethnically diverse cultures?

Paradigm Changes

This discussion started by defining *paradigm* and *paradigm shift*. In general, a paradigm is a mental model that reflects commonly held beliefs among a group of people (e.g., park managers). A paradigm shift is a change in thinking that is driven by agents of change. Some of the changes that were discussed were personal, systemic, and institutional in nature. From a personal standpoint, we as resource management and related professionals have to take the extra steps necessary to "connect" with the diverse population we will undeniably encounter.

These extra steps should include a proactive stance (personal), continued research on diverse groups (personal and institutional), and guidance and support from management (institutional and systemic). We need to continually educate ourselves with respect to understanding and accommodating the needs and desires of our diverse constituent base. This means risk-taking. We must reach out to all our constituents, not just a select and privileged few.

A member of the audience brought up the point of challenging the level of "sincerity" on the part of the federal land agencies. He questioned whether or not the agencies are sincere in their efforts towards truly embracing diversity and conducting outreach. He suggested that perhaps decision-makers, especially those with funding allocations, need to include some form of "grading" or evaluation component for diversity outreach efforts (e.g., make it a fund-based initiative). Additionally, it was suggested that community outreach requirements be imposed on new initiatives.

Use of the "I Triad" (invite, include, and involve) was also recommended by one of the scholars on the panel. Park managers, for instance, should *invite* people of color to use their services, perhaps through brochures. People of color should also be *included* in meaningful ways. For example, they could be liaisons to community leaders (key informants), or help in the translation and administration of surveys. *Involvement* of people of color needs to be more prominent and deliberate. In addition to hiring people of color into front-line and management/decision-making positions, involve them as board members.

An example of a successful outreach project is the use of a "Forest Information Van." This program discovered the kind of information that Latinos were interested in; learned that Latinos do not use traditional communication outlets, such as visitor centers; and subsequently brought a van directly to the visitor at the outdoor recreation sites where they were gathered. Additionally, bilingual employees and volunteers handled the operations and functions of the van.

Connecting with Youth

Connecting with youth from multicultural backgrounds was brought up as another critical issue. Today's youth will be tomorrow's voters. It is important not only to educate these youths, but also to prepare them to be our supporters and promoters of conservation, balanced with recreational use, as they will be the future voters as well as leaders for the protection of park resources—yes, "for future generations."

One panelist noted that we need to create an element of partnership, and that this relationship needs to be an *equal* partnership. Too often we say, "Come join us, come play our game" and we explain rules as we go along versus creating the "game" together. Examples of programs that have served youth well and can serve as models, according to the audience and panelists, are FamCamp, the California Environmental Program, Hawkins Park, and ECO-Teams. The key to engaging youth is not only about experiential learning, but giving them the skills to protect resources, and helping them become informed advocates for the future.

Consideration of Diverse Communities

In general, when engaging diverse communities, managers of public lands need to consider "staying the course," understanding diversity within groups, embracing change, and valuing new opinions and multiple perspectives. An example of *staying the course* was provided by Hawkins Park in South Central Los Angeles (Compton). The park was named after a pioneering black educator and congressman, Augustus F. Hawkins. The Santa Monica Mountain Conservancy is the regional agency that built and operates the 8.5-acre park. Hawkins Park is a miniature Santa Monica Mountains replica. The conservancy has made a commitment to educate the young people from inner-city neighborhoods, and then take them to visit the actual park.

Understanding diversity within groups is another essential ingredient. As managers of public lands, we must understand that there are differences within the broad categories used as labels for these various ethnic/racial group members. This has both research and practical implications. From both a research and practical perspective, language varies in groups within these broad categories. For example, Salvadoran Spanish is different from Mexican Spanish, which is different from the Caribbean Spanish. This example is similar to the differences between English spoken in the United States and that spoken in Great

Britain. Even within the same ethnic group there are differences (e.g., Vietnamese from the north speak a different dialect than those from the south of the country, and the Chinese speak Mandarin or Cantonese, among other dialects). Differences in language usage are critical to know when asking survey questions, or for signage. From a practical perspective, use of the actual resource will vary among groups. As such, adaptive management will be needed for reconstructing areas for high-quality use depending on local recreational preferences and participation patterns.

The "face" of America is changing; this is no secret. Therefore, we must be much more pluralistic in our approach, and our management practices must change to reflect this change. Embracing change is important, and there should be action-oriented strategies from both within an organization (managers) and outside of the organization (policy leaders in the community) to hold park agencies accountable for the inclusion of diversity in their management plans.

As our country becomes more diversified, managers and interpretive specialists of public land agencies should value and incorporate opinions and histories of those who are coming to visit these special places. The audience at the session during this conference participated in much debate on this issue—especially as it relates to ethical issues of presenting a "balanced" approach to the reporting of history. The majority of the interpretation of history in our parks is from a white perspective, and does not represent the contributions of other ethnic groups which may have played a decisive role in the history of any given park (e.g., Civil War parks and national battlefields).

One audience member from Alaska also noted the lack of dialogue between national park managers and Alaska natives. She commented on the need for the Park Service to be more inclusive and shared the significance and benefits of having a more balanced representation of the Alaska native ethnic groups and their culture at the table. Related to this was the general distrust that still exists between Alaskan native peoples and whites. Native people of Alaska represent one segment of indigenous populations that continue to lack trust in land agencies, indicating a continued need for enhancing community relations.

In short, the consensus among the group at this session was that we must do a better job of incorporating stories other than those of the dominant society into our interpretation and education efforts; not doing so was viewed as "unethical." We often tell the story in the context of what we think is appropriate, but often find that there are stories that are not told because of "sensitivity" issues and fear of offending someone or some group of people. As such, we need to recognize the roles others play within a structure—if we miss that, we may be missing the real story.

Our Role in Promoting Relevancy to Diverse Users

A suggestion was made that our role in promoting relevancy of protected areas could be stated from a self-centered perspective. In other words, we need to include these groups in certain decision-making processes to survive! The following were stated as concerns that resource managers and educators need to consider:

- Strengthen the mentorship program;
- Address perceived discrimination;
- Address barriers that the public reports (time commitments, financial issues, built accommodations, information, etc.);
- Take an inclusive stance (managers and frontline);
- Market to differences;
- Make interpretation multi-faceted;
- Vary the message, and message delivery, by racial/ethnic group;
- Become more accountable for diversity; and
- Instill a sense of ownership (which is difficult, as there are few people of color employed in our ranks).

Best Practices

The discussion on best practices began by noting that diversity training does not go far enough, and the training may be inadequate without accountability and efficient follow-through. Besides making our employees more culturally sensitive, we need to make them more culturally *competent.* One of the panel members stated that it should start with the "understanding of the others." We must understand the values that other cultures place on cultural, natural, and human resources and landscapes, and acknowledge that these values may not necessarily conform to mainstream values. The key is to find a bridge between the multiple values. As was stated, "We cannot be everything to everyone, but we can strive to be most things to most everyone."

If our constituency base is changing, then perhaps land management and interpretive plans also need to change to reflect current and future needs of all citizens. The concept of *wording* was also seen as an issue. How we word our program descriptions has a cultural connotation that may be inappropriate, such as "hoods in the woods." The prescription: build cultural competency among our staff and cultivate diverse users into partnerships.

The following is a summary of suggestions for best practices:

- Willing to try adaptive management;
- Willing to have evaluation work completed;
- Willing to "stick" with programs, and see them through;
- Willing to ask questions and seek help;
- Use the data when developing management plans; and
- Allow for self-determination of the users.

Conclusion

The discussions and dialogue were very lively and informative. The format was very conducive to allowing professional, research, and academic input. As the title indicates: where to from here? The discussion that occurred in this forum is merely another step in the recipe for success. Resource managers and educators must continue discussing the impact and influence that ethnic minority populations will indisputably have on public lands, and progress from discussion to action and accountability. Multiple examples were given of success stories that abound within public land agencies. We must all learn from these pioneering efforts and continue to strive to invite, include, and involve current and potential users of what will be a more diverse tomorrow.

Teaching Cultural Heritage Preservation: Developing Curriculum Materials for Minority Colleges and Universities

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The "Teaching Cultural Heritage Preservation" project grew out of the need to attract young, diverse individuals to the cultural resources field. This cooperative project involved the National Park Service (NPS) and representatives of minority colleges and universities in the development of a basic course outline for teaching cultural heritage preservation. The project resulted in a printed and on-line course outline and provided a model by which established cultural resources organizations may work with minority organizations to achieve a mutually beneficial goal.

For decades, the professionals who work in the field as historians, archeologists, architects, landscape architects, and curators have not represented the multicultural nature of the country. There are various theories about why this field remained non-diverse, while other professions, such as law, medicine, accounting, and computer science, became diversified through the leadership of the professional schools and leading professionals. The major disciplines that feed professionals into the cultural resources field—history, architecture, archeology, landscape architecture, and others—are also very non-diverse.

Cultural Resources Diversity Program

Rather than accepting the status quo, in 1998, the National Park Service initiated the Cultural Resources Diversity Program (CRDP) in order to address the demographics of the field. The impetus for the CRDP came from Robert Stanton, then director of the National Park Service, who was concerned that NPS and its partners were increasingly addressing cultural resources associated with minority cultures and cooperating with diverse communities on resource management issues. He thought that NPS should take the lead in diversifying the professional ranks of those who worked on these resources and with these communities.

While the major purpose of the CRDP was to increase the number of individuals representing all the nation's cultural and ethnic groups in professional cultural resources jobs, the program expanded in scope to include increasing the number of historic and cultural resources associated with the nation's diverse cultural groups that are identified, documented, preserved, and interpreted. It also took on the goal of increasing the number of diverse organizations and communities that are involved in preserving the nation's heritage in cooperation with NPS and its partners.

There are several legislative bases for the CRDP. One of these is found in section 101(j)(I) of the National Historic Preservation Act (NHPA):

> The Secretary [of the Interior] shall … develop and implement a comprehensive preservation education and training program … [that shall include] technical or financial assistance, or both, to historically black colleges and universities, to tribal colleges, and to colleges with a high enrollment of Native Americans or Native Hawaiians, to establish preservation training and degree programs.

This paragraph was added to the NHPA through the 1990 amendments and provided a legislative justification for the CRDP programs directed at minority colleges and universities. These programs could include cooperative efforts in training, professional development, research, and community outreach.

One of the major programs to develop from the overall CRDP was the Cultural

Resources Diversity Internship Program. Since 1999, between 15 and 20 diverse undergraduate and graduate students per year work at NPS or with one of its partnership organizations on a 10-week internship. The diversity internship program is envisioned as providing career exploration opportunities for diverse undergraduate and graduate students. Because of the careful selection of internship projects, the program offers challenging work experiences that help interns build their résumés in this field. In cooperation with the Student Conservation Association, which is the administrative partner on the diversity internship program, NPS actively recruits students from minority colleges and universities.

Development of Teaching Cultural Heritage Preservation Course Outline

As successful as the Diversity Internship Program was in providing initial exposure to the field to dozens of undergraduate and graduate students, its reach does not extend beyond a relatively small number of beneficiaries per year. If minority colleges and universities offered at least one course in cultural heritage preservation, then potentially hundreds of students could be reached. Course offerings could provide students with exposure to the field and, if preservation professionals were invited to participate in the course, additional internship opportunities could be organized nearby the schools.

The National Park Service realized that it could not simply duplicate and distribute the teaching materials offered at any one of a number of graduate degree programs in historic preservation because few of them were sponsored by minority colleges and universities. NPS decided to develop new materials based on the active involvement of the constituents who would use the materials.

Organizing the Curriculum Forum

To develop the course materials, NPS initiated discussions with one of its educational partners—Goucher College in Baltimore, Maryland—regarding assembling a planning group. Goucher College contacted Coppin State University and Morgan State University, both of which are historically black colleges and universities (HBCUs) also located in Baltimore. The planning group also included NPS's Harpers Ferry Center, which was responsible for NPS training in cultural resources. Each of the planning group members recommended individuals from minority colleges and universities and diverse professionals who were interested in the purposes of the project and experienced with minority students.

The Curriculum Forum met for a day-and-a-half in Baltimore in April 2001, and moved its deliberations from Morgan State to Coppin State and finally to Goucher College. Its members included educators and cultural resources professionals representing 11 colleges and universities, the National Park Service, the Cincinnati Museum Complex, and the Smithsonian Institution. The professional disciplines represented included historic preservation, history, architecture, ethnic studies, anthropology, and ethnography.

Based on extensive meeting notes, drafts of the course outline were prepared and distributed to the Curriculum Forum members and others for review and comment. The final course outline was edited, printed, and distributed to hundreds of minority colleges and universities, as well as state historic preservation offices, federal preservation offices, and national organizations. An e-mail message from the U.S. Committee of the International Council on Monuments and Sites (US/ICOMOS) generated requests from other countries, such as Korea, Sweden, Australia, and Italy. The electronic version of the course outline was posted on the website of the NPS Cultural Resources Diversity Program (www.cr.nps.gov/crdi). The Archaeological Institute of America was impressed with the course outline and posted the electronic copy of on its own website.

Contents of the Course Outline

The "Teaching Cultural Heritage Preservation" course outline was organized into three units: (1) *Place and Culture*, (2) *Power and Politics*, and (3) *Process and*

Profession. For each unit, learning objectives, activities, and resources were developed. The course outline also included a general discussion of the challenge of diversifying the cultural resources field and the goal of the course outline of encouraging colleges and universities to create undergraduate courses in the preservation of minority cultural heritage.

The *Place and Culture* unit addresses what is encompassed within the term "cultural heritage." (It is interesting to note that the Curriculum Forum members preferred the term "cultural heritage preservation" to "historic preservation" or "cultural resource stewardship.") The unit encourages students to learn from communities what is important and worthy of preservation. The unit also encourages students to analyze the ways in which historic places and events are interpreted to the public. This unit suggests that communities also may value other expressions of cultural heritage, including intangible culture, such as songs and stories.

The *Power and Politics* unit directs students to examine the role of power and politics in decisions about the recognition, preservation, and interpretation of cultural heritage. Many of these decisions are made by government agencies and elected officials and reflected in the desires of property owners and community members. The end result of this unit is to encourage communities to involve themselves in the shaping of these decisions to ensure the preservation of cultural heritage that is important to them.

The third and final unit, *Process and Profession*, provides a compressed discussion of the official process of identifying, documenting, and preserving the historic places and cultural heritage. It suggests ways in which the process could be more inclusive of diverse points of views. Finally, this unit introduces students to the range of professions that play important roles in the preservation process. Ideally, students will become familiar with preservation organizations and agencies in their communities and learn how various professionals entered the field.

Reactions to the Teaching Cultural Heritage Preservation Course Outline

When the Teaching Cultural Heritage Preservation course outline was distributed, most of the responses came from established historic preservation organizations. A representative of the Division of Historical Resources of the state of Florida wrote, "I strongly believe that your book has provided the preservation field with another step forward in recognizing the intangible heritage of our many peoples." The Office of Parks, Recreation and Historic Preservation of the state of New York reported, "One of the goals of our State Historic Preservation Plan is to 'educate New Yorkers on the importance of preserving the state's rich heritage.'— your publication will definitely be a resource in helping us achieve this goal!" These responses, plus many other e-mail messages, underscored the importance of NPS endorsement of a broader "footprint" for the cultural resources field. The respondents also appreciated the connection between the wider scope of the field and educational objectives.

There were few unsolicited responses from professors at minority colleges and universities. When contacted by NPS, professors at these schools were pleased to receive the course outline and were considering ways in which to integrate parts of it into their course offerings. This points out the need for continued dialogue with these professors to ensure that the materials are relevant to their teaching needs.

The Next Steps

The next step in the implementation of the Teaching Cultural Heritage Preservation project is to find ways to assist minority colleges and universities with the development of new courses. An opportunity arose to address this topic during the April 2003 meeting of the Organization of American Historians (OAH) in Memphis, Tennessee. The OAH organized a number of sessions at the conference in order to address the special needs of historically black colleges and universities. One of these sessions was titled "Historically Black

Colleges and Universities and Historic Preservation."

Several professors reported that they had received the Teaching Cultural Heritage Preservation course outline and were reviewing ways in which they could integrate the contents into their courses. Others expressed an interest in using the course outline to build campus support for historic campus buildings, the historical archives of the institution, stronger connections between themselves and the surrounding communities, and other historical needs of the school. The HBCUs represented at the OAH session agreed to form an informal consortium and discuss an agenda and plan for future action. The National Park Service will continue to work with minority colleges, not just because it is the right thing to do, but because this commitment will contribute to the ability of NPS and its partners to address the cultural heritage needs of the multicultural United States of the 21st century.

Protecting a Diverse Heritage: Engaging Communities in Preserving and Interpreting That Which They Value

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In spite of our claim as preservers and interpreters of our nation's heritage that our parks, preserves, protected areas and cultural properties relay a comprehensive and accurate picture of our nation's diverse heritage, the fact remains that we do a very poor job in some respects. In some cases we have a very poor record in conducting accurate and thorough research of some of the periods of history in our country, or in some cases, of a history of a people within a specific geographical area. Although the National Park Service (NPS) is not directly responsible for the preservation and interpretation of all heritage sites throughout the country, it is this writer's opinion that we, too, fall short in relating some historical periods accurately. We, too, fall prey to these general misrepresentations.

During the period of 1996–1998 in New Mexico, Hispanic folks in the area were engaged in planning and undertaking activities through which they could commemorate the arrival of the Spanish in July 1598. These commemorative activities, referred to as the *Cuarto Centenario*, all but fizzled. Those commemorative activities that were held could best be compared with a laser-light exposition under a bushel basket. This writer attributes "fizzled commemoration" to the "Oñate Syndrome"—a general lambasting of all the Spanish settlers who established the first Spanish capital in what is now the United States. The lambasting came about because of the alleged atrocities that Don Juan de Oñate, the *adelantado y gobernador,* had committed against the Acoma Indians.

However, this is not the only period in these people's history about which inaccuracies and slanted interpretations have been presented by anthropologists, historians, or simply by folks who dabble in history and literature. This is best reflected by Charles F. Lummis in his book, *Land of Poco Tiempo,* in which he wrote in 1928:

> The first public penance in New Mexico (as it then was) was by Juan de Oñate and his men, in 1594 [sic]. By slow degrees the once godly order [referring to *Los Hermanos Penitentes* of Spain] shrank and grew deformed among the brave but isolated and ingrown people of that lonely land; until the monstrosity of the present fanaticism had developed.

Moreover, his biases and inaccuracies were not limited to the *penitentes*, as is reflected in his opening chapter:

> Then the ten thousand Navajo Indians—whose other ten thousand are in Arizona—sullen, nomad, horse-loving, horse-stealing, horse-living vagrants of the saddle; pagans first, last, and all the time.... Last of all, the Mexicans; in-bred and isolation-shrunken descendants of the Castilian world-finders; living almost as much against the house as in it; ignorant as slaves, and more courteous than kings; poor as Lazarus and more hospitable than Croesus [ancient king of Lydia]; Catholics from A to Izzard, except when they take occasion to be penitentes....

The slanted and biased perspectives of some authors are evident as recently as 1987, when Lorayne Ann Horka Follick, in her book, *Los Hermanos Penitentes,* states:

> These Spanish colonials became isolated in the mountains during the sixteenth and seventeenth centuries. Their only recollections of civilization were those brought with the *conquistadores*

> from Spain. Until modern man contacted them again in the nineteenth century and especially in the twentieth century, they lived a life of a sixteenth century Spanish peasant.... That the *Penitentes* present a bizarre note in the American landscape cannot be denied.... As this work is read, let the reader bear in mind that he is dealing with a sixteenth century people....

And she proceeds to state: "Therefore, judge these men and women within their own context, not yours, as they are not a part of it."

Amongst native New Mexicans, specifically Hispanics and American Indians, there has always existed a concern as to how the history of peoples from northern New Mexico had been presented and how this history had been perceived by those unacquainted with this rich heritage. More importantly, there was a deeper concern about how the history of this area was being understood by the peoples themselves, especially by younger folks. Some native New Mexico historians are trying to rectify the erosion and distortion of the region's history—their heritage, and the legacy left by their ancestors. One such author is Andy Lovato, an administrator at the College of Santa Fe. During an interview published March 31, 2003, for the *Journal North* of the *Albuquerque Journal*, Lovato stated:

> Most of what's been written about us has been by and for outsiders. But as a local Hispanic, I've always felt conflicted about other people appropriating our way of life for tourist use. Sure, it's helped us economically. But we always need to distinguish between what's authentic and what's manufactured. I'm very intrigued by the question of what happens when stereotypes become reality.

Lovato's concern has resulted in a book, *Santa Fe Hispanic Culture: Preserving Identity in a Tourist Town,* which will be published by the University of New Mexico Press later this year. During the interview, Lovato further stated, "To what extent are we defined by ourselves or by others?"

Unfortunately, most of the history books that have been utilized in our schools, and in units of the National Park System for that matter, are replete with inaccuracies—inaccuracies that keep being repeated over and over as new textbooks are printed. These same books of history and these same textbooks become the sources for the interpretive material used by our interpreters in the units of the National Park System to the point that erroneous information becomes fact.

During the past three decades, NPS employees in the Santa Fe office, including historians and archeologists, have been wrestling with the dilemma of how to pursue the preservation of northern New Mexico's rich history without compromising those very values that make this one of the richest places to our nation's heritage. In other words, how can an area's living heritage be interpreted and preserved through means that leave the ways of life intact, or even enhance and encourage the perpetuation of the same? In 1988, Congress requested that NPS undertake a feasibility study of how the state of New Mexico, and communities therein, could commemorate and interpret Spanish colonization sites throughout the state. The study concluded that this period of our nation's history deserved appropriate treatment and recognition. Seven alternatives, without an identified preferred one, were forwarded with the study. The alternatives ranged from having communities working with communities in the commemoration of these sites, to having a state agency work with communities towards the same end, and even having communities pursue the establishment of a national monument or a national historic site in some of the more important sites of Spanish colonization. Although some interest was raised as a result of the public meetings, discussions and consultation with many folks in the state, little action was taken with regard to any of the seven alternatives. The more traditional approach of creating a national monument or national historic site would not lead to the desired end, for the mere establishment of a national monument or historic site would result in acquisition of property and the "expulsion" of the very people whose lifeways were the focus of preservation and interpretation in these traditional communities.

The interest in, and concern for, the preservation and interpretation of this rich heritage continued among some of us in the NPS office in Santa Fe. In 1998, folks in NPS nominated the Hispanic culture—the tangible and the intangible, including the language spoken in northern New Mexico—to the New Mexico Heritage Preservation Alliance's list of endangered cultural resources. The nomination was accepted and the fragility of the area's Hispanic heritage was highlighted during the course of the year. But the struggle for a more sustained effort to preserve and interpret this geographic region's heritage continued.

In early 1999, NPS historians and management in Santa Fe started investigating the national heritage area program as a possible vehicle for such an undertaking. After preliminary research into the national heritage area concept, and through some deliberation, the decision was made to pursue the idea and to share it with key folks in northern New Mexico. However, the scope of the undertaking was modified to include the broader heritage of the area—that of the American Indian, whose presence is still vibrant in eight pueblos within the area of consideration. This area of consideration included the cities of Santa Fe, Española, and Taos, tens of traditional Hispanic communities, and the eight pueblos. The heritage of this area is multi-dimensional and intertwined with co-mingled traditions, customs, and values of American Indians and Hispanics due to four centuries of co-existence—peaceful and otherwise.

During the period of July through September 1999, contact was made with the mayors of Española and Taos as well as several key New Mexico state government officials in the departments of Economic Development, Tourism, Energy, Minerals, and Natural Resources; with the state historian; and with the Office of Cultural Affairs where the museums, monuments, and historic preservation divisions reside. Discussions were also held with Hispanic and American Indian historians and people of these cultural groups who are engaged in various walks of life. The response to the national heritage area concept as a means of preserving and interpreting the region's heritage was extremely positive. The principal reason for this response was due to the principle espoused by heritage areas: local control and local determination. This principle—coupled with that of communities working with communities, communities working with the various governmental entities, governmental entities working with other governmental entities, as well as non-governmental preservation groups working with all of the above—led to the pursuit of a national heritage area by these diverse groups. Thus, the folks in the NPS Santa Fe office began a systematic public information process regarding the national heritage area idea. Contact was then made with officials from other federal agencies, as well as with members and/or staff of the state's congressional delegation to discuss the national heritage area idea.

During the next eleven months, four NPS employees took to the roads of northern New Mexico—with support and assistance from key people from communities in the area under consideration—to visit informally with individuals in the communities within nine "districts" identified in the informal public information strategy. The reception to the idea of a national heritage area in the region was positive, although there was some trepidation, given the long-standing distrust of the federal government by these traditional communities. The strongest concern that was voiced came with regard to tourism and what that would mean to the privacy and ways of life of these peoples. However, there was a realization that tourism had existed in the region for almost a century and that the tourism infrastructure within the state—in the form of the Department of Tourism, tourism organizations, as well as chambers of commerce and convention and visitors bureaus—was seeking and employing means through which this industry could be expanded. There also came a realization that the principle of local control and management of a heritage area could lead to forms of tourism that take the people's interests into account.

After having completed an informal circuit-riding to introduce the concept of heritage areas, the mayor of the city of Española hosted a forum on the national heritage area idea in September 2000. Representatives from the nine "districts," including representatives from some of the pueblos, came to a consensus that there was sufficient interest in the idea of a national heritage area to proceed. Each "district" then selected a representative to serve on a steering committee to work with NPS to pursue the concept in earnest. The steering committee began its work on a dual track: becoming more deeply informed and educated on heritage areas, and pursuing support for the idea from local and county councils and commissions. At the same time, the steering committee began outreach efforts to their neighbors: the eight American Indian pueblos and their collaborative entity, the Eight Northern Indian Pueblo Council. Letters of support were solicited from individuals, non-profit organizations, and state government officials, as well as state senators and representatives. Resolutions of support were sought and acquired from county commissions and municipal councils. All of these documents were secured by early 2002, before the state's U.S. senators and the U.S. representative from the 3rd congressional district introduced legislation in their respective chambers. During the waning days of the 107th Congress, the legislation to designate the Northern Rio Grande National Heritage Area, encompassing the counties of Santa Fe, Taos and Rio Arriba, passed the Senate but met an untimely death when the House of Representatives chose not to take any action on legislative matters, other than homeland security, on the last day that they convened in mid-November.

In the meantime, the steering committee formalized itself into the board of the Northern Rio Grande National Heritage Area, Inc., and is presently seeking to enlarge its membership to a 25-member board as prescribed in its by-laws. The board has begun another round of contacts with governmental officials, county commissions, municipal councils, and non-governmental organizations to seek their renewed support for designating legislation. Once again, the two U.S. senators and the representative of the 3rd congressional district have introduced legislation—S. 211 and H.R. 505, respectively—for the designation of the Northern Rio Grande National Heritage Area.

To summarize, these descendants of the pueblo Indians and the Spanish settlers in the vicinity of north-central New Mexico are serious about pursuing the congressional designation of a national heritage area. They are committed to the concept because:

- They can preserve that which they value;
- They are the most qualified to relate their respective histories;
- Management of their national heritage area is in their hands;
- They can engage local, state, and federal agencies in a collaborative implementation of a management plan for the national heritage area;
- They can employ the principles of tourism management; and
- They can realize a level of respect and national recognition of their rich heritage—a recognition and respect long-awaited and deserved.

This undertaking—a people in control of the preservation and interpretation of their heritage—serves as an excellent case study for the theme of this conference: protecting a diverse heritage. Moreover, this undertaking serves as an excellent case study because *diverse* peoples are pursuing the protection, preservation, and interpretation of their *diverse* heritage! Of the existing twenty-three national heritage areas, very few, if any, focus on the heritage of diverse peoples, thus making this an even greater undertaking.

Promise and Challenge: Interpreting Race and Slavery at Civil War Sites (Session Summary)

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The development of newly expanded interpretive programs presents unique promises and challenges for Civil War battlefield sites. The larger context of the war—the debate about slavery—is slowly becoming a regular part of interpretive programs. Given the strong emotions about and sensitivity to the topic, presenting competing views and memories of the Civil War challenges the well-established practice of remembering it through the narrow lens of military endeavors. Nonetheless, the promise of stimulating dialogue, prompting questions, and fostering new understanding about the Civil War and its meanings for different people is the end goal of developing renewed interpretations at Civil War historic sites.

Pitcaithley's Remarks

With the ending of the Civil War, there was a fervent and triumphant effort by the South to tell its version of the war: its causes, its events, and its legacy. Indeed, white America was preoccupied with reconciling the differences between North and South.

The "Lost Cause" interpretation was forwarded by figures such as Jubal Early, Jefferson Davis, and Alex Stephens. The United Daughters of the Confederacy and other women's groups worked to institutionalize this view of the war and the "Lost Cause" ideology quickly took hold on the popular level. Essentially, the "Lost Cause" contends that the Confederacy is the rightful inheritor of the legacy of the American Revolution; that secession was constitutionally authorized; that the Confederacy was defeated by superior military might, not by a morally superior society; and that the war was about states' rights and not slavery.

The "Lost Cause" became a kind of cottage industry in the South and it expanded at the same time that reconciliation among white northerners and southerners was a powerful force. With no strong opposing interpretation, the "Lost Cause" interpretation took hold not only in the South, but also in many other parts of the country. With few exceptions, the academic community largely accepted it as well.

Change in the dominant interpretation would not come until the 1950s with the work of scholars such as Kenneth Stamp and C. Vann Woodward. Since then, there has been an explosion of scholarship placing slavery at the center of the controversies that caused the Civil War.

These new interpretations were not acknowledged widely throughout the country nor were they integrated into historic site interpretations. The 1998 gathering in which park superintendents developed a consensus to expand the interpretation of Civil War sites to include the causes of the war marked an important beginning to the transformation currently underway. In 2000, a directive from the U.S. Congress stated that Civil War battlefield sites must include in its public educational presentations the broader context of the war's causes, particularly the unique role played by the institution of slavery.

The National Park Service is not doing at Civil War sites anything different than what it does at other sites: we ask and attempt to answer, What happened? Why? and, So what? Change is controversial. However, once the new exhibits go up, the new handbooks are distributed, and other programs are implemented, I think we will find there is little or no controversy about the expanded interpretations.

Hennessy's Remarks

Beginning with the landmark 1998 meeting in Nashville, superintendents of Civil War-related parks initiated the re-evaluation and revision of interpretive programs to tell more than the stories of specific battles. Interestingly, only one of the issues addressed at the meeting was interpretation. We also dealt with roads, landscape issues, recreational uses, adjacent land use, and the like. However, over time, interpretation has emerged as the dominant issue.

This is not because interpretation alone is the most important issue, but because it is so difficult and complex, for many reasons. It is historically complex—social, political, economic, and military come together. This is, of course, for the interpreter both virtue and opportunity. It is politically charged—which is to say it's highly relevant (another virtue). It is culturally difficult; we are firmly rooted in the idea of viewing the Civil War almost exclusively through military eyes. And it is logistically difficult—it is more than just getting certain people to say different things.

Changing or expanding America's interpretation of its single most important national experience requires much more than the simple decision to do so. Understanding why this is so requires us to retreat backward—to understand the origins of the lens through which we view the Civil War.

Most of the legislation for America's battlefield parks is a legacy of the commemorative and reconciliatory efforts of veterans—conceived in a period where a visitor's understanding of context was assumed, when the ownership of the war's memory, legacy, and meaning was unchallenged. Though the veterans are now gone, the National Park Service faithfully carries on the veterans' traditions. We as a nation still use our battlefields to define the nation's Civil War experience in largely military terms—through the eyes of the participants of battle.

There may be many reasons why the Park Service has largely remained faithful to this monolithic interpretation, but there is one very large one: slavery. No issue more frightens public historians than slavery. The great fear is that by acknowledging slavery as a cause of the war, we will all presume that it was, therefore, the cause for which men fought.

We know, however, that different people, depending on one's race, gender, geography, socioeconomic status, and cultural background, experienced the war differently. Focusing on the military experience alone ignores the fact that other franchises are challenging the traditional bastions of Civil War memory. It ignores the reams of research over the last half-decade that clearly reveal the complex web of people, places, trends, and places that comprised the Civil War.

We who manage Civil War parks work in the vortex of a great debate—a great battle raging over how this nation will remember and interpret its Civil War. There are forces on all sides who seek to co-opt history and use it to further an agenda. If we don't act intelligently, someone will act for us—and not necessarily with intelligence and historical validity.

The challenge that faces the National Park Service today is a huge one: to convey the significance and relevance of the Civil War in all its aspects while at the same time sustaining the agency's invaluable tradition of resource-based interpretation (a concept that is at the very foundation of the National Park Service's mission).

Superintendents are working from the bottom up to make these changes. We are working on an initiative that will expand America's interpretation of the Civil War, and we hope to do it by the Sesquicentennial.

For the public to view the Civil War as more than a succession of battles and campaigns, the nation (and therefore the National Park Service) must expand its definition of a Civil War site to go beyond battlefields. While each battlefield must clearly demonstrate how it fits into the continuum of the war, and while each battlefield will be able to illuminate several larger themes, most battle sites are ill suited to tell anything approaching the entire story of the American Civil War. Indeed, for them to do so would be a disavowal of the National Park Service's invaluable tradition of resource-based interpretation.

Instead of asking battle sites to do everything, the National Park Service must look to other sites within the system (or perhaps identify new sites) that can illuminate some of the larger themes of the war. These sites are readily identifiable; in fact, most are anxious to assume their rightful place as part of the Civil War mosaic.

Americans have for 140 years viewed the nation's Civil War largely through the eyes of men who waged battle. The military lens on the Civil War is indispensable and inviolable, but it is not the only lens through which to view the struggle. The National Park Service will give voice to observers and participants with differing, relevant perspectives on key events and places. Such an approach will enhance rather than diminish the perceived significance and relevance of both military and non-military events.

For the National Park Service to expand its interpretation beyond traditional bounds, it needs to be guided by strong thematic statements that are both grounded in solid scholarship and reflective of differing perspectives of the war and its meaning. The themes are intended to act as a point of departure for developing media and live programs and engaging visitors in figurative or literal discussions about the nation's most destructive and transforming epoch.

Gates Moresi's Remarks

The research project, "Presenting Race and Slavery at Historic Sites," will be undertaken through a cooperative agreement between the National Park Service and the Center for the Study of Public Culture and Public History of the George Washington University. We are extending the work of previous visitor surveys, supervised by Professor James Horton, that were conducted at the historic sites of Gettysburg, a Civil War battlefield park, and Monticello, the home of Thomas Jefferson in Charlottesville, Virginia (not a National Park service unit). Under this new cooperative agreement we are planning to conduct surveys at Arlington House/Robert E. Lee Memorial in Arlington, Virginia, the Frederick Douglass Home in Washington, D.C., and at Manassas National Battlefield Park, in Manassas, Virginia.

We are currently in the planning stages for these surveys to take place over the next three years. The previous surveys will serve as models for the next surveys. Here, I describe my impressions, rather than quantitative results, about the Gettysburg and Monticello surveys in which I participated as an interviewer.

A team of graduate students conducted both visitor surveys and one or two interviews with staff interpreters. We asked visitors about the content of both self-guided and guided tours and at both sites, focused on the interpretation of slavery. All interviews were tape-recorded and transcribed.

For both types of interviews we developed questions in consultation with a sociologist in order to elicit four basic things: information on what the visitor saw/heard/read at the site; what they thought about what they saw/heard/read at the site; and how that compared with what they already knew or understood about the topic of slavery in general, or the site in particular. Fourth, the survey was intended to allow people to express their opinion about how the topic was or was not presented at the site.

We were operating very consciously with the understanding that discussions about race and slavery in all kinds of venues are a contested topic with plenty of opinions and opposing ideas. One of the goals of the surveys, then, was to collect information about *how* visitors receive this information and *what* they expect from interpretive programs. Also, a more general goal of the project is to establish dialogue among site historians, site interpreters, and academic resources, because they can learn from each other.

At Gettysburg, we noticed some important aspects of the site that strongly influenced visitor responses to questions about slavery. Because of the high death toll at this site (more than 51,000 soldiers were killed, wounded, or captured over the three-day battle), because the site includes a large cemetery in which soldiers of this battle and other war veterans are buried, and because there are so many monuments to individual infantries who participated in the battle, these realities all work to make Gettysburg a memorial site dedicated to the sacrifice of thousands of young lives. Discussing slavery in this context is more sensitive than at other kinds of historic sites, so we were very careful about where we stood and approached visitors. We also noticed, in contrast to the Jefferson site (which had its own particular issues making it a sensitive topic there) a very somber mood at Gettysburg.

The visitors themselves expressed the idea that the site was "hallowed ground" and some expressed that slavery was not relevant to the Civil War (at that moment) or to the site—in contrast again to the Jefferson site. I believe the new museum and visitors' center plan for Gettysburg is a useful way to contextualize the battle and its larger meaning without detracting from the park setting and its memorial aspect.

While every historic site has its particular issues that make it unique, we did discover some general findings about the presentation of slavery. First, visitors are more receptive and even interested in the topic than one might think. Also, staff interpreters love their job and are excited to be able to work with new material, to use new material in ways that really engage visitors, and to learn more about their topic. Finally, discussing slavery and race relations can be particularly difficult in the public setting: talking about it in the past is hard because dealing with it in the present is hard, too.

We learned that while new interpretive methods were employed, getting information to visitors about slavery, and to relay how it was significant to a particular site, really depended upon the tour guide and the face time that he or she had with visitors. Handbooks and labels are very good and useful, but it is up to the guide to point visitors in those directions.

I think that the most important thing that can happen out of these kinds of collaborative projects between the Park Service and academic institutions is the exchange of ideas and the exchange of experience. Both sides gain from this mutually beneficial project. The site historians and interpreters learn from the surveys and can establish a relationship with an academic institution.

By conducting the surveys, graduate students have a unique opportunity to speak with interpreters on the "front line" of history. In addition, the students themselves are put in a situation that does not happen in the protected world of the classroom nor in the sometimes quite-removed experience of graduate studies research. By conducting these surveys, they have to confront the public. Students are then faced with beginning to understand the unique promises and challenges of interpretation in the National Park Service.

Tucker's Remarks

Fort Sumter National Monument was authorized by an act of Congress in 1948, which simply stated that the site "shall be a public national memorial commemorating historical events at or near Fort Sumter." Without further direction from Congress, the National Park Service relied upon its staff to clarify the interpretive purposes for Fort Sumter National Monument. Interpretation consisted of guides leading small groups to interesting spots within the fort.

When the Park Service published the first master plan for Fort Sumter in the 1950s, the fort's interpretive program was based on the 1860 election of President Abraham Lincoln, the secession of South Carolina, and the subsequent movement of Major Robert Anderson from Fort Moultrie to Fort Sumter. The major focus was on the initial Confederate attack of 1861 and the Federal bombardments of 1863 and 1864, known as the Siege of Charleston.

During the following decade, once the archeology was completed, permanent exhibit facilities were needed to enhance the visitor experience at Fort Sumter. A new museum was constructed with Mission 66 funding in the disappearing gun position of Battery

Huger—an Endicott Battery completed in 1899. But the focus of interpretation did not appreciably expand with the museum exhibits. The events of 1861 and the bombardments of 1863–64 remained the central interpretive themes.

By the 1990s, National Park Service interpretive rangers were beginning to make a re-evaluation of the role of holistic interpretation in programming within the national parks. Those responsible for interpretation began this re-evaluation long before Congress or the Washington Office identified it as a need. Interpretive efforts such as those begun at Fort Sumter in the early 1990s were reflected in many Civil War sites around the country. Washington supported these individual park efforts. National Park Service regional offices helped formalize the efforts with the multi-regional conference of battlefield superintendents held in Nashville during the summer of 1998.

In this new environment, the interpretation at Fort Sumter began to change. Park staff redid the 1960s-era museum at historic Fort Sumter in the early 1990s. Completed in 1995, the new museum retained many of the treasured artifacts that were a part of the old museum, now exhibited in fresh surroundings with a more sweeping story line.

A high priority was bringing the text in line with current scholarship. New exhibit text and graphics includes an introductory section that deals with the growth of sectionalism, antebellum politics, and slavery as the causes of secession and war. Most of the exhibit remains site-specific, dealing with topics such as the fort's construction, people and events leading to the firing of the first shot of the Civil War, and what happened to the fort during the ensuing war. A section was added on the participation of African-Americans in the war, highlighting the role of the 54th Massachusetts on nearby Morris Island.

An even more ambitious exhibit project began in the fall of 1999 with exhibit planning for the new Fort Sumter tour boat facility at Liberty Square. Museum exhibits at Liberty Square are within the new visitor education and transportation center in downtown Charleston. Fixed media in the landscaped area highlight contributions to America's liberties from the Constitution era to modern times.

As it turned out, the name of the site was fortuitous since the word "Liberty" became a unifying interpretive theme that finally brought into focus the interpretive themes of Charles Pinckney National Historic Site, Fort Moultrie, and Fort Sumter National Monument under a single umbrella. The word "Liberty" provided a platform that allowed the staff to explore the advancements of this ideal from our birth as a nation through the Civil Rights Movement in the 20th century. The exhibit plan for the new visitor education center and dock facility at Liberty Square would provide orientation and enticement to visit the historic fort, exhibit and interpret the Garrison flag, and interpret the causes of the Civil War, with a special emphasis on the role of slavery in America and the role of Charleston in particular.

During the intervening months between the time the facility opened and the permanent exhibits were installed, full-scale vinyl color prints of each permanent exhibit were hung on temporary plywood frames. This gave visitors a chance to see and comment on the exhibit program prior to its production. Several comments were received, ranging from glowing to condemning. Most were positive, appreciative, and constructive.

Change is difficult. Even for the dedicated staff assembled at Fort Sumter, changing Civil War interpretation was difficult. Each of us brings to the table a particular set of experiences, education, and cultural background depending on to whom we were born, where we have lived, and how we have been educated. Much has been done over the past ten years to implement an expanded interpretive program. It has involved increasing staff understanding and perception and broadening our community partnerships. The staff has participated in conferences, training programs, dedications, special resource studies, sensitivity sessions, and diverse cultural events to help with the transition. Today the staff sits on the "point of the sword" for the

National Park Service doing their job. They are prepared to tell the story faithfully, completely, and accurately.

[Ed. note: A full version of Tucker's presentation was published in *The George Wright Forum* (vol. 19, no. 3, 2002) under the title "Interpreting slavery and civil rights at Fort Sumter National Monument."]

Perpetuating Natural Wildness

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Adolf Murie had a knack for saying profound things simply. In his book *The Mammals of Mount McKinley,* he wrote: "All the plants and animals enjoy a natural and normal life without human restrictions. Freedom prevails...." Foxes dig burrows where they will; they hunt ptarmigan, ground squirrels, and mice as the spirit moves. Bears wander their ancestral ranges unmolested. The "bad" wolf seeks an honest living, morally on a par with anyone else. Likewise, no species of plant is favored above the rest.

He said that the task of nature's guardians, we here in this room, "is to perpetuate this freedom and purity of nature, this ebb and flow of life—first, by insuring ample park boundaries ... to maintain the natural relationships, and secondly, to hold man's intrusions to a minimum."

So, what is our basic objective? It is to preserve natural wildness in the wilderness.

That objective is under assault from a giant pincer attack. The great debate, in this modern era of more people and shrinking space and resources, is whether we encroach and eventually consume the remnant places where wild things run free—by work (say, extractive industry) or by play (motorized recreation).

Thinking about this session, I just reread Jack Turner's 1996 book, *The Abstract Wild.* He notes that people must spend extended time in expansive space to truly experience wildness in the wilderness. Aldo Leopold said it takes a minimum of two weeks, in a space that takes that much time to traverse. Such spaces are rare indeed. Alaska has them, Canada, Patagonia. The law of wild space/time is simple: the farther from a road, the longer you are out, the wilder your experience, the closer you jibe with nature's rhythms. Few people have such experiences.

Small, crowded wilderness areas usually lack big predators. Without big predators, the wilderness is tamed. The bear track on the trail, or in the mud by the creek, isn't there.

Domestication follows, says Turner, when intensive recreation requires trails, bridges, directional signs—all of which diminish surprise, discovery, the unknown, and the dangerous—the very qualities that make a place wild.

He goes on to say that public policy caters to such recreational uses through artificial modes of tourism, management, and control. These, in turn, spiral out of control—as more human intrusion and more controls in what has become Institutionalized Wilderness—Wilderness for Fun. The "fun hog" approach to wilderness is, in many ways, as destructive of the natural wild as the extractive industry that spawned the wilderness movement in the first place. No wonder the debate between work and play has become so rancorous. Play in the last several decades became another consumptive industry. Well then, why not logging, mining, grazing?

Where does this sad progression lead us?

In my view we must retrace some steps, revisit the spiritual and scientific concerns of the original conservationists. Building on that earlier foundation, we need to add the evolved ecological understandings of modern conservation biologists. And somehow we must convince the gravitational mass of humanity, which will never experience Leopold's time/space-in-the-wild prescription, that human health and survival is daily and directly measured by the health and survival of supporting natural systems, including moose, mice, and microbes.

Only with broad acceptance of that fact can we use the higher social utility of the world's great parks, refuges, and reserves as a reason for saving and protecting them. Until uncaring ignorance is replaced by informed, inspirited caring for these reservoirs of diverse life, we will be unable to perpetuate them as spiritual sanctuaries, as scientific baselines, as new and restored ecological preserves.

Of course we're losing the battle at this point! Deprived and suffering people at home and abroad get little vision from those who can afford to visit parks, refuges, and wild rivers with all their equipage in tow, but with little love. We must deliver that vision, by education and a stern management regime that makes our point: that these priceless places are the archives of evolution and the seedbeds for a livable future on Earth, for all its passengers. They are our last touchstones with the natural world that are reasonably healthy and whole and unaltered by human interventions. Their continued degradation for trivial pursuits is simply unacceptable.

Wasteland, Wilderness, or Workplace: Perceiving and Preserving the Apostle Islands

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> What must have been once a far more striking and characteristic landscape of dark coniferous original forest growth has been obliterated by the axe followed by fire.... The ecological conditions have been so violently disturbed that probably never could they be more than remotely reproduced.[1]

This was the judgment of the National Park Service (NPS) representative who was sent in 1930 to assess the suitability of the Apostle Islands for national park designation. Lest there be any doubt, Harlan Kelsey continued,

> The hand of man has mercilessly destroyed [the islands'] virgin beauty, and, therefore, a largely controlling element as outstanding national park material ... the project does not meet National Park Service standards.[2]

Seventy-three years later, it seems that Kelsey was badly mistaken. By the 1960s, the island forests had grown back. In 1970, in the midst of a national environmental awakening, Congress created Apostle Islands National Lakeshore. Currently, NPS is conducting a wilderness suitability study to determine how much of the park should be included in the National Wilderness Preservation System.

The history of wilderness at the Apostle Islands turns the prevailing narrative of American environmental history on its head. Environmental historians usually explain America's past as a tale of how misguided personal ambition and unchecked industrial capitalism have resulted in a degraded modern environment. This history has helped to make wilderness a precious commodity in the early 21st century. At the Apostle Islands, though, the traditional story is turned upside down. The past is denuded, scarred by logging and other human activity, the present seemingly a wilderness.

One result of this backward narrative is that modern perceptions of wilderness seem to threaten the visible evidence of the islands' human past. Today's Apostle Islands, seemingly so wild, are the product of intricately connected processes of human and natural history. This history includes the experiences of men and women living, and making a living, in a challenging environment.

An archipelago of 22 islands in Lake Superior, the Apostle Islands lie off the northern tip of Wisconsin. Although the Apostles provided a stage for French fur trade and missionary activity since the 1700s, and a home for Ojibwe and other native groups for far longer, the extractive industries that so marked the islands intensified with the opening of Lake Superior to large-scale commerce in the 1850s. Island residents fished, farmed, quarried the region's red sandstone, and participated in a buoyant tourist economy throughout the late 19th century. Without question, though, logging had the greatest impact on island landscapes: nearly all of the islands were logged at one time or another.

How are we to understand this human history, these human stories, in a place that today seems wild? The history of logging and farming in the islands is every bit as important as ecological succession in the creation of the modern landscape. Land use patterns dictated by extractive industries and settlement shape the way that the landscape appears today. The wilderness itself has a history, one created by intertwined human and ecological processes.

Natural and cultural history have combined to shape landscape patterns on a large scale at Outer Island. The Schroeder Lumber Company established a logging camp on the island in 1923. Logging operations there were extensive: the camp housed over two hundred lumberjacks who built a narrow-gauge railroad to transport equipment and logs. Between 1924 and 1930, Schroeder removed an estimated 40 million board feet of lumber from the island. Logging operations on Outer ceased by 1931; over the next decade, fires swept across the southern, logged-over portions of the island, fueled by the slash piles left behind by loggers. These fires did not burn on the northern, unlogged portion of the island. Today, evidence of Outer Island's human history is clear only to those who know what to look for: the old railroad grade now serves as a trail carrying unsuspecting visitors through a seemingly pristine forest, but a close examination of the vegetation pattern reveals a clear break between the 60-year-old second-growth forest on the southern half of the island and mature northern hardwood forest in the north.[3]

This kind of connection between natural and cultural history can be found on a much more intricate scale at Sand Island, the only island within the park that provided a home for a year-round community. At its height around 1910, the Sand Island settlement had about 75 residents, primarily Norwegian immigrant families who participated in a mixed economy that balanced fishing, farming, logging, and tourism. The community boasted a one-room schoolhouse, a post office, a cooperative store, and a road. By the 1920s, though, the community was already in decline, primarily because economic opportunities for the second generation of island residents were so limited. In 1944, the last year-round residents left the island. Some of the homes and farms fell into disrepair, others were converted into summer homes. The fields gradually shrank as woody plants grew in from the margins, and the apple trees disappeared as the forest grew up around them. But to view this transition, this returning of the wilderness to Sand Island, as only a result of ecological succession, as purely a natural and not a human phenomena, misses an essential part of the process.

Consider what is happening to the fields at Burt Hill's farm on the island's southeastern corner. In the 1920s and 1930s, Hill cleared several acres of forest to expand his dairying operations. When maintenance of these fields stopped, woody vegetation moved in from the old boundaries, disregarding the barbed wire fence that Hill installed to mark the edge of the cleared land. In some areas of the clearing, willow, hawthorn, mountain ash, and serviceberry have moved into the meadow in straight, regular lines, following the drainage ditches that Hill dug when he expanded his fields.[4]

The impact of human choices made 60 or 100 years ago can be found all over Sand Island. The Norings were the last family to live on the island year-round; now, all that remains of their homestead are rows of moldering logs. But the spruce trees they transplanted to the northeastern side of their house to form a windbreak still mark the site of their home, as do lilac bushes that Bergitt Noring planted by the side of the house. Nature alone cannot explain the way that Sand Island looks today; history—the choices of individual men and women—helped create this landscape, too.[5]

Environmental historians do not have an accurate term to explain what has happened at Sand Island over the past century. Terms like "exploitation," "degradation," and "destruction" are usually used to describe the impact of American industrial activity on the landscape; terms like "healing" and "recovery" are employed to characterize the return of wilderness characteristics to a once-degraded place. These terms might apply to Outer Island, where a large lumber company logged virgin forest, leaving behind ugly piles of slash, refuse, and fuel for forest fires.

But what about at Sand Island? Is it right to characterize the choices of Burt Hill or Bergitt Noring in this way? Were their decisions to plant apple orchards or lilac bushes acts of destruction and degradation? If not, then perhaps "recovery" is not the correct word to explain what has happened to the Sand Island landscapes that their lives helped to shape. We prefer the term "rewilding."

Rewilding landscapes should be interpreted as evidence neither of past human abuse nor of triumphant wild nature, but rather as evidence of the tightly intertwined processes of natural and cultural history. Rewilding points toward a narrative that explains the seemingly denuded past and pristine present of places such as the Apostle Islands, but does so without characterizing any human activity as a wound in need of recovery. Human activity certainly can be destructive and degrading, but it isn't necessarily so. The Apostle Islands are becoming wild again primarily because of human choices—the choices made by the Hills and Norings to leave Sand Island, but also the choice to turn the islands into national park, to allow some kinds of activity but not others. The narrative of rewilding helps explain human action that is not always destructive and exploitative, as well as the implicit human involvement in the return of the wild to the Apostle Islands.

Federal agencies charged with overseeing wilderness areas struggle to manage rewilding landscapes like those of the Apostles. To guide individual park managers in the interpretation of legislative mandates, NPS has produced a set of management policies, applicable nationwide. Do these policies have room for wild places with human pasts? One reading would seem to indicate that wilderness designation is not inconsistent with preservation of human history:

> Cultural resources that have been included within wilderness will be preserved and maintained according to the pertinent laws and policies governing cultural resources, using management methods that are consistent with the preservation of wilderness character and values.[6]

However, the same document directs,

> The Service will re-establish natural functions and processes in human-disturbed components of natural systems ... [and] will seek to return human-disturbed areas to the natural conditions and processes characteristic of the ecological zone.... Efforts may include, for example ... [r]emoval of contaminants and non-historic structures or facilities....[7]

Passages such as this call into question the place of cultural resources in the midst of a wilderness. Reconciling the contradictions inherent in these mandates will be the key to successfully preserving and interpreting these rewilding islands. How can the agency reconcile these seemingly contradictory imperatives?

NPS management policies do provide some guidelines in reconciling these contradictions. In most circumstances, the decision to treat a site as a cultural resource is guided by the standards of the National Historic Preservation Act. If a site meets National Register criteria, it merits preservation; if not, it is to be removed, along with other "contaminants."

But using National Register status as a litmus test presents its own suite of problems. To state that those traces of human occupation listed on the Register are resources to be preserved, while those not listed are contaminants to be obliterated, is to freeze the interpretation of a site's history to that prevailing at the time of wilderness designation. The history of the National Park System is replete with examples of the rash, and later regretted, removal of features thought by one era to be without significance.

It also forces us to privilege some human stories over others. Again, Sand Island can serve as an example. The West Bay Club, an Adirondack-style lodge, was built in 1911 as hunting and fishing retreat for wealthy St. Paul businessmen. When evidence was found showing it had been designed by the influential architect Henry Buechner, the building was ruled eligible for the National Register as "the work of a master." But across the island is another summer home: less grand, yet to many eyes, more graceful. The small cottage known as "Plenty Charm" was built in 1943 for a schoolteacher named Gertrude Wellisch by a local carpenter named Clyde Nylen. Both Wellisch and Nylen are interesting characters in their own right. Wellisch was a pioneer in her own way, occupying the cabin with the woman who was her life partner. Although lacking Buechner's fame, Swedish immigrant Nylen was locally renowned as a carpenter of unmatched intuitive skill; a half-century after his death, people still speak of his uncanny way with wood. And though unschooled in classical architecture, Nylen built for Wellisch a cabin of extraordinary elegance that fits harmoniously into its surroundings, and never fails to elicit exclamations of admiration from those who encounter it.

However, it has been ruled that Plenty Charm does not meet National Register criteria. Will NPS management policies mandate obliteration of this embodiment of Clyde Nylen's work and Gertrude Wellisch's life? And if such action is taken, will future generations agree with the decision?

Why does NPS employ such rigid policies of wilderness management? Two reasons suggest themselves. First, the definition of wilderness advanced in the 1964 legislation, and the management policies that have resulted from it, is predicated on the standard narrative of environmental history, on the myth of the pristine past and the degraded present. Evident human use—especially modern, Anglo American, use—necessarily degrades wilderness. Scholars from a wide variety of fields have started to tear down this standard narrative. Native Americans everywhere consciously shaped their environments with their agricultural practices, their use of fire, and their residential patterns. Scholars have also analyzed the cultural construction of wilderness. Places such as the Apostles—where the present is more wild than the past—complicate this picture still further. Although the traditional narrative of environmental history has begun to change, the management policies established to tell this story have been slow to catch up.

A second reason NPS employs a rigid definition of wilderness is its need for what might be called a "legible landscape." James Scott, in his book *Seeing Like a State*, uses the concept of legibility to explain practices as diverse as the creation of permanent last names and the codification of property division. Scott explains these as a part "of the state's attempt to make a society legible, to arrange the population in ways that simplified ... classic state functions...."[8] The same logic can be applied to wilderness management. The federal government has rigidly specified the way that a wilderness should look and feel so that wilderness management can be consistent across federal lands, no matter the local conditions in any specific place. Such a management policy is easily applied—and the environment thereby more easily controlled.

Concepts such as narrative constructs and legible landscapes might sound abstract, but they have on-the-ground consequences at the Apostle Islands as NPS conducts its first wilderness suitability study in over two decades. Park managers need to decide which, if any, islands will be recommended for designation as wilderness. Whether Sand Island is included will dictate what NPS managers can do there.

Among the wilderness designation alternatives currently under consideration is one that excludes all of Sand, Basswood, and Long islands, along with small portions of several other islands, from wilderness status. This would still confer wilderness designation upon about 80 percent of the park's land area, yet provide maximum flexibility in the preservation and interpretation of a broad cross-section of the islands' cultural features.

Under currently prevailing interpretations of the Wilderness Act, this scheme may provide the most satisfactory resolution of the conflicting mandates in the case of the Apostle Islands. However, even under this plan, virtually every island will still have a mix of natural and cultural resources to manage and preserve. Moreover, at other park areas faced with similar dilemmas, it may not be possible to draw such convenient boundaries. In the long run, it seems clear that NPS must work toward a wilderness management policy that recognizes the interconnections between natural and cultural history, rather than placing boundaries between them.

Endnotes

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The Wilderness Experience as Purported by Planning Compared with that of Visitors to Zion National Park

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Introduction

Zion National Park, located in southwestern Utah, was established in 1909. It was enlarged in 1918 and again in 1937. Two areas of the park were merged in 1956 into what now constitutes 148,016 acres of picturesque canyon country. The purpose of Zion is to preserve dynamic natural processes of the extraordinary canyon erosion, scenic beauty, archeological features, scientific potential, and opportunities for the enjoyment and enlightenment of the public. Zion is particularly significant because of its unique scenery, geological showcasing, free-flowing Virgin River, biodiversity, and cultural history (NPS 2001).

Zion is a unique place that has a long history of issues associated with its popularity. Currently, a mandatory mass transportation system has been placed in the valley bottom to alleviate an enormous congestion problem. Additionally, many of the backcountry canyons have been permitted to maintain the use level in those areas. In many places within the park, camping is restricted to designated sites, which in turn results in the need for itineraries for overnight use. Popularity continues to increase: the number of permits issued increased by 97% between 1998 and 2002. Thus, it is not surprising that among the mission goals agreed upon in the recently adopted general management plan (GMP) were to:

- Provide park visitors educational and recreational opportunities that foster an appreciation for Zion and its resources; and
- Ensure that visitor impacts do not impair the resources.

In these mission goals, there is an inherent tension between the desire to provide recreational access to this significant and unique place, while assuring that access does not degrade the environmental or social resources over time. The context for the integration of these values is further framed by the fact that approximately 90% of Zion is proposed wilderness. Thus, the recreational opportunities are additionally focused on the concepts of solitude and primitive or unconfined types of recreation.

Background

Zion managers are now engaged in a backcountry management plan that was called for by the GMP. In the GMP, a strategy was designed to develop carrying capacities for the park through use of the Visitor Experience and Resource Protection (VERP) framework. Within that framework, managers committed to using "park staff, with public input" to determine "desired resource conditions and visitor experiences in different areas of the park" (NPS 2001:35). This procedure calls for a process of zoning, identifying indicators of quality, setting standards for those indicators, and monitoring to maintain desired conditions.

Solitude, encounters, and Zion's backcountry experience. Solitude is a common feature of backcountry experience studies (Manning 1999). Guided by the language of the Wilderness Act and widespread adoption of planning frameworks such as VERP or Limits of Acceptable Change, solitude is often measured as a function of the number of encounters a visitor has with other people or groups while in the backcountry (Manning and Lime 2000). Indeed, encounters with other people have been established as a correlate with levels of setting acceptability (Manning et al. 1996) and as an experience variable that people are able to conceptualize in relationship to visitor access (Manning 2001; Manning and Lawson, 2002) or the quality of biophysical settings (White et al. 2001).

However, there is also a concern that focusing management on standards for solitude can deny the visitor opportunities for unconfined forms of recreation or dismiss the fact that experiences are dynamic, that the importance of encounters may change throughout the experience (Borrie and Roggenbuck 2001), and that people will, given the choice, be able to cope with settings in ways to ensure they experience the solitude, privacy, or naturalness they seek (Shafer and Hammitt 1995). Finally, while is it established that people can and will make trade-offs to ensure they get a high-quality experience, they may be less receptive to reducing their freedom or access if they do not see, understand, or appreciate a clear problem (Borrie et al. 2001). There has also been recent concern that the common forms of quantitative social research that have been prevalent in the study of backcountry experiences can be misinterpreted due to an absence of clear descriptions about why visitors respond as they do to framed questions (Davenport et al. 2002; McCool, this volume).

To assist with gaining visitors' input on the integrity of social and biophysical resource conditions (including perceptions of solitude and primitiveness), a two-year study of Zion's summer visitors was developed. The first year's goal was to develop an understanding of how Zion's day users and overnight visitors to the backcountry are defining and evaluating the setting and experience. The second phase of the study will narrow the questions to gain visitor responses to standards for social and resource indicators.

The focus of this paper is a comparison of how the language used in the plan relates to visitor responses to quantitative questionnaire and qualitative interviews.

Study Methods

Quantitative surveys were conducted with several groups of backcountry visitors during the summer and fall of 2002. Surveys addressed baseline data on visitor use and users and potential indicators of the quality of the visitor experience. Visitor questionnaires were administered to day-use hikers in three areas through an on-site questionnaire. A total of 357 completed questionnaires were attained, a response rate of 80%.

Day-use hikers to canyons requiring a permit were administered a mail-back questionnaire. A total of 133 completed questionnaires were attained, a response rate of 74%. Overnight backcountry hikers were administered a mail-back questionnaire. A total of 204 completed questionnaires were attained, a response rate of 78%.

Seventy visitors participated in in-depth semi-structured interviews about their park experience during three one-week blocks during that same summer and fall. Forty-five of the visitors were on day trips and 25 spent at least one night in the backcountry. Visitors were asked about their experience, including the importance of solitude, encounters with other people, whether their expectations were met, and suggestions they may have for the management of the park. Interviews were transcribed and analyzed via the content analysis program Nudist*.

The findings of these interviews provide a contextual foundation for the results of the quantitative studies described above.

Selected Results

In this section selected results for the two forms of data collection are reported. These results were selected in an attempt to link the kinds of language used in the management plan to visitor impressions and the language they used to describe the same concepts. While the two forms of data are reported in such a way as to complement one another, it is important to note that each research method has distinct advantages and disadvantages. The quantitative studies generalize out to the visitors within the sample universe they were selected within. Qualitative interviews do not generalize but are intended to describe some dimensions of why visitors may feel as they do. Together, these data sources assist researchers in refining our questions as inquiry into the Zion experience proceeds.

Day visitors. Zion National Park is popular and busy. Non-permitted day visitors are dominantly traveling with family (64%) and in small groups (median 2, mean 4). The visitors in our sample came from 37 states and 21 foreign countries. For 65% of the visitors, it was their first visit to the park. Scenery and being outdoors in natural surroundings were the highlights of the experience for 75% of the respondents. Non-permitted day visitors encountered an average of 13.2 other groups and 103 other people during their visit. This was more than expected for 28% of the visitors and fewer or about as many as the remaining visitors expected. It was more than about 50% of the respondents preferred to encounter.

When asked about the importance of solitude to their visit, 81% of the visitors said it was very important or important to their experience. When asked about their opportunity to attain solitude, only 11% identified their opportunity to be poor or very poor.

Overnight visitors. Overnight visitor groups are somewhat smaller (median 2, mean 2) and more likely to travel with friends (40%). They were much more domestic, with only three foreign countries represented in our sample. They most often identified scenery as the best part of their trip with solitude as the second most commented-upon feature. Visitors generally did not encounter anyone while in their campsite, but while hiking encountered a range of 3–19 groups per day. Fifty percent of the respondents encountered fewer people than expected while hiking, while only 13% encountered more groups then they expected to. Ninety-six percent of the visitors identified solitude as very important or important to their experience. Only 2.5% suggested their ability to find solitude was less than satisfactory, while 56% suggested it was excellent.

Varying definitions of solitude. As described earlier, the park should be providing "outstanding opportunities for solitude." Our quantitative research indicates that both non-permitted and overnight backcountry visitors to Zion are encountering many people while in Zion's proposed wilderness, yet are still seeking and gaining solitude. Thus, we have a need to better define the relationship between encounters and solitude if indicators relative to encounters are going to be useful for managing that experience.

Results from the interviews suggest that visitors defined solitude as "being by ourselves" where one does not "hear anything else but water"; "[I]t was so quiet. It was very peaceful, and no sign of other people." These definitions are consistent with conventional notions of solitude. The incongruity, however, may be explained by the temporal qualifiers that were often apparent in the responses. Examples would include "were alone most of the time," "there was a lot of time," "in general, we were able to keep to ourselves, for the most part."

Similarly with encounters, the descriptions suggested that encounters occurred at anticipated times, especially at the end of the trip: "[A]t the end, it got busy"; "[W]hat we expected, I guess. Coming down there was a big group of people." People also demonstrated that they were using various coping mechanisms to avoid encounters: "We planned on going early to beat the heat and probably beat some of the crowds." And finally, the behavior of the people encountered had an important influence on the nature of the encounter: "They were respectful. Everyone we met seemed to be pretty well mannered and polite."

Thus, it is not necessarily the fact that visitors to Zion may have low standards for encounters in their definition of solitude, but that they are able to manipulate either their expectations or behaviors to work within the set of conditions that are there to still achieve the solitude they desire.

Zion as wilderness. It is also plausible to consider the possibility that Zion may not be considered a wilderness by the visitors, and thus solitude may have a different meaning for them. When asked about their perception of Zion as wilderness, there was general agreement by day users that Zion's backcountry was a wilderness setting, sometimes exclusively, sometimes qualified: "All of it." "Oh yeah. The whole time almost." *Quiet* was an important variable in defining wilderness: "You don't hear the road until you get right up somewhere in here [indicating trail below]. I stopped to listen for it. I didn't hear a thing." But the size of the area was less important for at least one visitor: "[I]t's nice to have this little section back here that the people that want to do this can do it." But in some cases, the concept of wilderness was quite widely defined. "Q. Would you consider this wilderness then, back in here? To sum it all up. A: Yeah, well I mean even in the main park, some of that is kind of wilderness-type area. But it sees a lot more traffic than it does up here."

A qualified criticism of wilderness was related to the degree of regulation. "Well, there [were] ... regulations. But I guess the main thing is that the campsites were designated. Um, but that's the only part of it that feels developed. The place itself is primitive." But the need for regulation was acknowledged: "[A]gain, I don't look at that as a negative. It's just ... it's just the way it is ... to keep the, you know, to keep it as nice as it is."

"We went backpacking this summer at the trailhead next to our subdivision, within a half-mile it turns into wilderness. And, I mean it's alpine; it's high. I guess I'd have to say that you definitely don't run into as many people." "Well, and there's not designated camps. It's not as regulated ... you don't have to purchase a permit." "I guess it feels more wilderness to me, because there's not the designated campsites." "But I guess because of the place we live, we definitely have a different idea of what wilderness is."

And for some visitors, Zion is too overdeveloped to be wilderness "The perception of, 'Well, I'm in the wilderness, but the fact that I'm on the trail means I'm not.' That I can only get into wilderness if I go off trail. I don't think everybody thinks that way." "But, you know, over in the main part of the park, on those trails, I've never been on a trail like that before, that, you know, gets so much use." "And I mean I understood that, just for erosion, going up to Angels Landing. But then, even when you continue past that, it stays paved."

Conclusion

The connection of the guiding language for Zion's backcountry and the evaluation visitors have of the social and natural conditions in that backcountry are filled with contradictions. Visitors generally see Zion's backcountry as a form of wilderness and seek the kinds of experiences that are consistent with wilderness (solitude and primitive conditions in natural areas). They are also finding that solitude while meeting as many as 19 groups a day while hiking on overnight trips, and often meeting over 100 people on a backcountry day hike.

It appears from these data that people are coming into their experience with a relatively accurate set of expectations about Zion as a popular and busy park. They are often using coping mechanisms that relate to both their expectations and their behavior to manage the encounters they have. They also have a definition of solitude that is not absolute and consider the acquisition of solitude to be something that is important but only needs to happen for portions of the experience.

While they are aware of the effect of backcountry regulations on their experience, they are generally accepting of it to maintain the park's integrity. Thus, it appears that backcountry visitors to Zion have accepted a version of wilderness in which opportunities for solitude and a primitive or unconfined type of recreation can exist in a busy, highly regulated park. In this case it seems that the solitude is acquired through coping and the regulation is accepted to safeguard the area's primitive qualities.

These data should help managers understand the limitations associated with boiling their management down to an indicator-standard monitoring approach. To get specific information on indicators and standards, managers and researchers will need to appreciate that the environment is novel to many visitors and that impact may need to be demonstrated to get meaningful information evaluations of it from visitors. Additionally, current conditions are highly desirable to the existing visitors. Visitors were pleased with their experiences and supportive of the existing management regimes. Thus visitors expect to see many visitors at Zion, and define solitude in terms of quiet, spending periods of time alone, and the absence of roads.

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National Park Service Contribution to Increasing a Virtual Visitor's Appreciation of Wilderness

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Introduction

This research project was designed to answer three questions about wilderness areas managed by the National Park Service (NPS). But rather than just list the questions, I want to begin by briefly discussing how each of them came into existence.

At the George Wright Society conference in 2001, I heard a high-ranking NPS official publicly admit that the agency may not be successful in protecting wilderness in the long run because it focuses on what wilderness is against rather than what wilderness is for. Hypothesis one: Wilderness messages focus on what wilderness is against, rather than on what it is for.

During my sabbatical last year, I took trips to several wilderness areas and areas recommended for wilderness designation. I also went on a patrol with an agency employee who was well intentioned, but woefully inadequately trained in wilderness management. I speculated on how the individual would manage the area differently had he/she at least been to the Carhart Center Wilderness training I had been to earlier in the year. The training included a powerful talk by Roger Kaye on the spiritual values of wilderness. You had the sense wilderness was unique.

On one of my trips, I talked to a man, his son, and their dog who got turned away from the ferry to North Manitou Island (part of Sleeping Bear Dunes National Lakeshore) because they wanted to bring the dog. I wondered why the family didn't know pets weren't allowed. Didn't they do their homework before their visit, or was the information missing on the NPS website (it turns out to be the former rather than latter). The man's question to me was, "We drove from Ohio to get here, is there another wilderness that we can go to?" Clearly there is a powerful allure to wilderness designation; it was a unique resource for this family (note: the island is recommended for wilderness; it has not yet been designated). Hypothesis two: NPS presents little information about the uniqueness of wilderness.

Last summer I read the latest (2002) edition of *Wilderness Management* by Hendee and Dawson in preparation to teach a new course in wildland recreation management. Late in the book, the authors suggested that regulations are most effective if accompanied by explanation as to why they are needed. That didn't seem like an incredibly insightful recommendation. Then I thought about all the park brochures, newsletters, permits, and signs I've seen about wilderness areas, and I concluded that I had seldom seen an explanation as to why regulations exist. Hypothesis three: Wilderness regulations have little accompanying explanation.

If these hypotheses are correct, the following results can be expected:

- Compliance with existing wilderness guidelines and regulations will be low;
- Biophysical impacts will persist or increase;
- Social impacts will persist or increase;
- More management actions will be needed, which may lead to less primitive and unconfined recreation; and
- The enduring resource of wilderness may be eroded.

Methods

A website analysis was conducted because official sources of information are viewed as highly credible and websites are accessible to many prospective visitors prior to their arrival. The reason NPS was selected rather than the other wilderness-managing agencies is threefold. First, NPS has few wilderness areas. Second, NPS's preservation mandate suggests that it should be easier for the institutional culture to embrace wilderness than if it were an agency with a multiple-use mandate. Third, over 75% of the National Park System is congressionally designated wilderness or recommended as wilderness.

The complete website for each NPS unit containing wilderness was downloaded using Adobe Acrobat. I searched on "wilderness" and then examined the information derived. Some of the information was compiled in a spreadsheet for quantitative analysis and the rest of the information was saved in a separate file for textual analysis.

Results

The results are based on an analysis of 21 of the 44 NPS units with wilderness. The remaining sites will be analyzed later this year.

Quantitative analysis. Figure 1 indicates the wide range of wilderness sizes included in this analysis. Figure 2 shows that over half the NPS units examined contain more than 50% wilderness.

The wilderness areas were designated between 1970 and 1994, with most being designated in 1978. Based on the age of designation, one would expect there to have been sufficient time to update websites to include information about the wilderness. Approximately 80% of the NPS units had detailed maps on their websites, but only 60% actually showed the wilderness boundaries on the map.

The standardized main page of each unit was analyzed to determine if wilderness showed up on the designation listing. Only 57% of the parks with wilderness listed it on their main page. The standardized page listing activities was also analyzed. Of the units that listed activities (two did not), all but Mesa Verde listed it. Less than 30% of the parks had clickable links that take a user to a separate page for more information. Of the NPS units that had any clickable links, less than half had a clickable link for wilderness.

Qualitative analysis. All the information that the public would access for trip planning was analyzed; documents such as wilderness and backcountry plans, environmental impact statements, and fire plans were not evaluated. Some NPS units contained no information about wilderness, while a couple of sites contained the vast majority of information. What follows is almost all the information that exists about wilderness on the 21 sites examined.

Values. The first section deals with the values articulated in the Wilderness Act, i.e., that wilderness areas "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

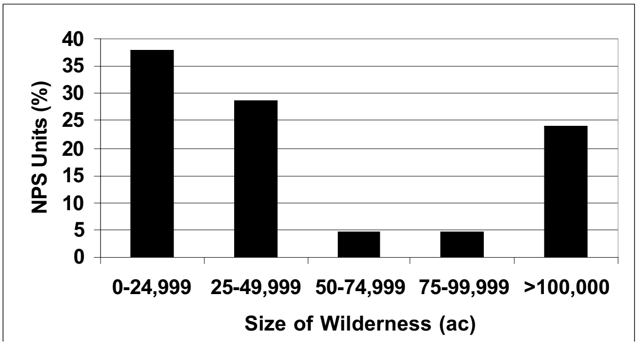

Figure 1. Amount of wilderness in each NPS unit (n=21)

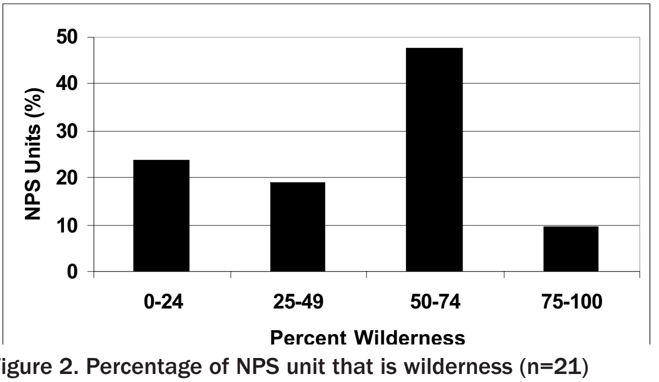

Figure 2. Percentage of NPS unit that is wilderness (n=21)

Ecological Values

- "When trees fall in a wilderness area, they are left alone to provide food and shelter for plants and animals." (Congaree Swamp National Monument)
- "... great diversity of wildlife in Katmai which encompasses millions of acres of pristine wilderness" (Katmai National Park and Preserve)
- "... the cougar is the symbol of wilderness, a large animal ranging freely in wild areas, independent of human interference. At the end of food chain they serve as an indicator of ecosystem's health." (Guadalupe Mountains National Park)

Scientific Values

- "A prairie wilderness. As we attempt to assemble the great biodiversity puzzle, prairie is the heart of the piece." (Badlands National Park)
- "... all objects at these sites are artifacts to be left in place for future study" (Badlands)
- "Wilderness Laboratory—National parks and wilderness areas are key places to conduct scientific studies because of their relatively pristine state." (Lassen Volcanic National Park)

Scenic Values

- "Look closely and you'll see every color of the rainbow painted in delicate brush strokes across this dramatic wilderness" (Badlands)
- "The wild mountain beauty, the clean, clear water of the Buffalo, and the myriad of other sights are ideal subjects to be captured on canvas, film, in print or performance. This place can inspire creativity" (Buffalo National River)
- "Glacier-carved peaks towering over alpine meadows and sub-alpine forests make this a dramatic landscape" (Great Sand Dunes National Park and Preserve)
- "... experience the ... scenic beauty of these special places" (Mojave National Preserve)

Historical Values

- "In the early part of this century, goat and sheep ranchers constructed small check-dams at many seeps. Remains from these activities ... can still be seen" (Carlsbad Caverns National Park)
- "... remnants of these 20th century homesites. Remember that all objects at these sites are artifacts to be left in place ... for other visitors to discover and reflect on the difficulty in living in this beautifully barren place (Badlands)
- "… cultural/historical sites and artifacts are strictly protected and will remain undisturbed" (Guadalupe)
- "Visitors found hiking away from designated trails ... are subject to penalties.... [R]egulations are necessary to protect the fragile and irreplaceable archeological sites and artifacts" (Mesa Verde National Park)

Recreation and solitude. The second section of the analysis focused on recreation and solitude based on the Wilderness Act verbiage: "has outstanding opportunities for solitude or a primitive and unconfined type of recreation."

Recreation

- "Traveling by canoe is a great way to enjoy this primeval wilderness" (Congaree)
- "... primitive qualities provide ... rustic backpacking, wildlife watching, horseback riding" (Badlands)
- "... offer superb opportunities for backcountry hiking and camping." (Great Sand Dunes)

Some of the NPS units have trails in the wilderness:

- "Former roads in wilderness provide many outstanding trails." (Mojave)
- "There are miles of trails to explore." (Great Sand Dunes)"
- Wilderness trails receive no maintenance and have no signs." (Craters of the Moon National Monument)
- "Stay on established trails, and as you

enjoy the view, remember it would not be as pretty if each of us trammeled [sic] wherever we chose." (Guadalupe)

Some of the areas don't have wilderness trails:

- "... cross country travel without the presence of established trails ... forces its explorers to be self-reliant and prepared." (Badlands)
- "Trails have been left undeveloped to preserve and enhance the wilderness experience" (Carlsbad)
- "There are no maintained or marked trails.... [R]outes are difficult to follow.... [H]ikers are expected to find their own way and to be prepared for self-rescue" (Black Canyon of the Gunnison National Park)

Solitude

- "... never encounter another person, hear traffic, or smell car exhaust.... places for quiet contemplation as well as for friends to get away together." (Carlsbad)
- "... offers outstanding opportunities for solitude and primitive recreation" (Carlsbad)
- "You will have the sense of being truly alone" (Craters of the Moon)
- "Some value solitude and hike into the wilderness (80% of the monument) for an overnight camp out" (Craters of the Moon)
- "... experience the solitude ... of these special places." (Mojave)
- "Popular with hikers, equestrians, and fishermen.... [H]ike midweek to find solitude." (Great Sand Dunes)

Wilderness users often confront regulations (i.e., wilderness is "against"), although it is seldom clear as to why they exist:

- "Pets are not permitted in the wilderness" (many sites)
- "... wheeled vehicles are not allowed" (Badlands)
- "No motorized vehicles (including ATVs) are permitted" (Buffalo River)
- "Bicycles and other mechanized equipment are not allowed" (Craters of the Moon)
- "... no roads or permanent structures can be built" (Craters of the Moon)
- "Firearms are prohibited" (Hawaii Volcanoes National Park)
- "Pets, hunting, bicycles, and motorized vehicles are not allowed" (Lava Beds National Monument)

Many wilderness areas do not allow fires, but only two provide a rationale as to why their use is banned:

- "Due to high winds and dry grasses, fires are not permitted.... Coached by the Great Plains wind, a simple dropped match can trigger a massive wildfire in seconds." (Badlands)
- "Why can't I have a campfire? Dams upstream prevent a natural flow and cycle of driftwood entering the lower canyon. What little organic debris makes its way through the canyon is a vital resource for the recycling of nutrients back into the riverbank and the earth." (Black Canyon)

Many areas require a free camping permit, but only two explain the value of permits:

- "Permits help us monitor use of the wilderness.... [H]elp us identify potential emergencies by letting us know your expected itinerary." (Black Canyon)
- "... monitor how many people are using the wilderness, to inform them of regulations, and to make sure that they return safely." (Craters of the Moon)

Much of the wilderness information on NPS websites deals with camping:

- "Camp in wilderness area of park 100 feet away from backcountry trails and water, 500 feet away from visitor center and boardwalk. Primitive camping—no facilities." (Congaree)
- "Backcountry camping is restricted to the designated wilderness area." (Craters of

the Moon)
- "Camping limited to 14 days per year" (Lassen)
- "No person may camp in a nondeveloped or wilderness area with a group size of more than twelve, including horses and pack animals." (Lava Beds)

A few websites explain why camping rules exist:

- "Be considerate of others. Camp at least 400 yards from other campers" (Badlands)
- "To minimize impact on fragile wetland areas, group size is limited to 6 people" (Congaree)
- "In order to restrict human impact to a limited area, please camp at Echo Crater.... [I]f you do select other campsites, use them for only one night and then move on." (Craters of the Moon)
- "The desert is fragile and recovers from human impact much more slowly than many other ecosystems. Roads, trails and campgrounds leave lasting scars. To minimize these scars, designated campgrounds with hardened tent pads have been established.... [R]espect the land—do not camp outside these designated areas." (Guadalupe)

Unique aspects. The third section of the analysis focused on the unique aspects of wilderness.

- "Wilderness offers itself to each of us on our own terms. Some of us are content to experience wilderness of the mind—it's enough to know wilderness exists in the world. Others are compelled to explore designated wilderness to take on its challenges. Hopefully, we do not aspire to conquer wilderness. The legal concept of wilderness has a companion inside all humans: wildness. It is this primitive quality of life that causes innovation, wonder, and exploration. Valuing the wildness in ourselves and wilderness as an American landscape brings us closer to becoming active members in the in the "community of life" described in the Wilderness Act." (Badlands)
- "It is now up to us to accept the challenge of wilderness: to come to the edge of forever and feel complete." (Badlands)
- "... Wilderness Areas are of immeasurable value to our natural and spiritual well-being, and are special places that should be treated with reverence and respect." (Carlsbad)
- "... these areas have as the last best untrammeled landscapes in the nation. Whether we go there for recreational, spiritual, educational, or scientific reasons—or simply to take refuge from the paved and ordered domain of our daily lives—we can find quiet contemplation and solitude in the deep canyons and tree-lined mesas." (Carlsbad)
- "The remote dunes lend themselves to panoramic views of the heavens. Immerse yourself for the night surrounded by swirls of sand. Watch for shooting stars. Listen to the amazing quiet.... [I]t takes effort ... to reach a sandy wilderness campsite, but it's a worthwhile experience to discover the reality of a night surrounded by sand. Listen for the howl of the coyote and the whisper (or gale!) of the wind." (Great Sand Dunes)

Conclusions and Recommendations

NPS websites are only one method of communicating with visitors about wilderness. Despite the fact that the wilderness areas of most of the NPS units analyzed had been designated over 30 years ago, many of the park websites do not list wilderness on their main page, most don't have clickable links from the wilderness section on the activities page, and a few do not show wilderness boundaries on their map.

All three hypotheses seem to be supported: websites discuss what wilderness is against rather than for, regulations seldom have explanations, and there is little information about how wilderness is unique.

Four main recommendations can be gleaned from this preliminary research.

- Wilderness designation should be listed on the main page;
- The wilderness link on the activity page should be "live";
- The wilderness link should lead to a page that presents the positive *and* unique aspects of wilderness; and
- Maps should show the wilderness boundary.

NPS should increase the information about wilderness on its websites for each unit containing wilderness, or it is likely that the enduring resource of wilderness will be lost.

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Extending the Wilderness Concept as a Cultural Resource

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Introduction

Wilderness areas, "wild" places, and landscapes evoking wilderness experiences are the natural environments at the core of many protected area systems. In this paper we explore how people from different cultures view these same wild places and the importance to protected area managers of including an understanding of cultural processes in wilderness management frameworks. Protected area management in New Zealand has been referred to as being about "parks for the people." In the United States, similar sentiments, espoused in policy, highlight the importance and richness of demonstrating cultural equity in park management. Internationally, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and the Biosphere (MAB) reserves program provides management mandates to "promote and demonstrate the balanced relationship between people and nature." An individual's culture affects his or her perception of landscapes, thus mediating behavior and actions and so playing an important role in the ability of managers to manage and mitigate biophysical impacts. The principle of ecological and social resilience, in integrated social–ecological systems, underlies some cultural perspectives toward wild places. Practices based on resilience, found in a range of cultural beliefs, are significant for the sustainable management of protected areas. We present some preliminary findings on cultural understanding of natural environments that highlight the need for park managers to think about wilderness as a cultural resource as well as a natural resource.

The Dominant Culture of Wilderness

Wilderness areas, wild places, and the wilderness experience in countries such as the United States, Canada, Australia, and New Zealand have a strong cultural meaning. The dominant Eurocentric view of wilderness, widely documented (Nash 1973) and enshrined in the United States Wilderness Act of 1964, harks back to a pioneering spirit, a pristine environment void of humanity, and a back-to-basics outdoor recreation that in part could be considered a reflection of a national psyche. This dominant idea of wilderness is therefore a strongly cultural concept—Callicott (2000) refers to the wilderness idea as being ethnocentric. The prevailing notion of wilderness has been the subject of an ongoing research agenda with numerous management strategies and techniques aimed at protecting, enhancing, and managing legislated Wilderness. The National Wilderness Research Conference, held in Fort Collins, Colorado, in 1985 (Lucas 1987), summarized the efforts to understand wilderness as a recreation resource and the biophysical conditions, sociological understanding, and management approaches associated with that resource. This view of wilderness management was perpetuated, though on a foundation of more sophisticated science, in a follow-up meeting, the Wilderness Science in a Time of Change Conference, held in Missoula, Montana, in 1999 (Cole et al. 2000). The post-colonial Westernized view of wilderness is valid, and has a strong science base supporting it, and the places identified as wilderness by its proponents deserve protection and are important as a cultural resource.

A variation on the single purist definition of wilderness à la the U.S. Wilderness Act is that there are different places that are associated with wilderness according to an individual's perception of the environment. This has led to the idea of multiple perceptions of wilderness, devised as a methodology in New Zealand for mapping the variation in areas that elicit a wilderness experience for backcountry users (Kliskey 1994). Other departures from the purist or received wilderness idea (Callicott 2000) have considered alternative environments, for example urban wilderness (Wali et al. 2003), and subterranean or marine places that elicit a wilderness experience (Smith and Watson 1979; Barr 2001). Thus new boundaries in wilderness are possible so that wild places and wilderness experiences are not restricted to terrestrial environments or the land base defined as the National Wilderness System of the United States. These departures are, however, variations on the same theme, since the major components of the wilderness experience are still rooted in the dominant Western cultural view of wilderness that rests on a dualistic idea of nature—the cultural environment being separate from the natural environment. However, there is an increasing awareness that people can be, as they often have been, part of wild places. This includes suggestions that areas perceived as pristine wilderness are frequently in fact complex systems that integrate social and ecological characteristics (e.g., Flanagan 1992; Martin and Szuter 1999).

Alternative Cultural Views of Wild Places

The dominating view of wilderness and its management has been interspersed with contrasting ideas (Colchester 1997) that emphasize alternative cultural notions of wilderness, wild places, and the wilderness experience. These "other" notions of wilderness should inform cultural resource management if resource managers are to encompass the richness of diversity in users of natural environments. For example, the wild expanses of Alaska, whether delineated and protected as wilderness or not, define a range of relationships that cultures and communities have with natural environments (Alessa and Watson 2002). Traditional and subsistence use by indigenous people and by rural Alaskans of the wilderness resource in Alaska is recognized in the National Wilderness Preservation System, acknowledging, whether consciously or not, the cultural nature of these areas. This is apparently at odds with the remainder of the wilderness system, in the lower 48 states of the U.S., where traditional values associated with lands protected as wilderness have been ignored (Alessa and Watson 2002). Wilderness in the Circumpolar North is not empty or excluded from permanent human activity—rather it is a wilderness for work rather than play.

Numerous indigenous cultures with Earth-based beliefs view the human–nature relationship holistically rather than dualistically (Colchester 1997). These viewpoints see society as inseparable from the natural world, and indeed many of the wilderness areas that people from Western cultures consider to be "empty of civilization" are considered by indigenous people as part of their everyday life—both physically and spiritually. In Australia the post-colonial view of wilderness areas as *terra nullius*, or an empty land, is considered a fantasy by Aboriginal people for whom the concept has the effect of denying their cultural relationship with those landscapes (Langton 1998). These are homelands that are "known and loved, sung and recounted, owned and cared for to promote life" (Rose 1996).

In *Aotearoa* (New Zealand), the indigenous Maori similarly view the natural environments that comprise the country's protected area system as landscapes with which they as a people have long-standing generational ties and intimate connection (*whakapapa,* or genealogical association) with—we are one with the world in which we live. These areas may have traditionally been considered *mahinga kai*, or a food-gathering area. Management of natural areas by Maori was (and is gradually becoming again) based on concepts of *mauri* (life force of the natural world), *tapu* (respect for sacredness), *whanaungatanga* (interaction with the environment as kin), *manaakitanga* (care and hospitality), and *kaitiakitanga* (guardianship and responsibility for a place; Patterson 1994). Thus wild places can be harvested from, provided that these traditional virtues are adhered to. So wilderness is a dynamic, multifaceted cultural concept from which the dominant view and approach toward management can learn.

Resilience in Cultural Views of Wild Places

A distinguishing feature of the cultural viewpoint of these indigenous understandings of wild places is the practice of linked systems of people with nature, or what are contemporarily referred to as "social–ecological systems" (Berkes and Folke 1998). The view that wild places are social–ecological systems, as Aboriginals, Maori, and others inherently believe, incorporates the concept of resilience—the capacity of ecosystems and human communities to absorb disturbance and recover from such perturbation (Folke et al. 2002). Recent work has shown that visitors to protected areas who perceive high ecosystem resilience in coastal ecosystems exhibited significantly more depreciative behavior than those who perceived low ecosystem resilience (Alessa et al., in press). So building social–ecological resilience requires an understanding of ecosystems that incorporates the knowledge of local users, including the longstanding knowledge of indigenous societies and local communities. We represent this as a conceptual model (Figure 1) where the human/cultural component of the system interacts dynamically with the biophysical/ecological component and in which management may intercede in adjusting this interaction. Such management processes are inherently dependent on the values, perceptions, and understandings of people and their result-

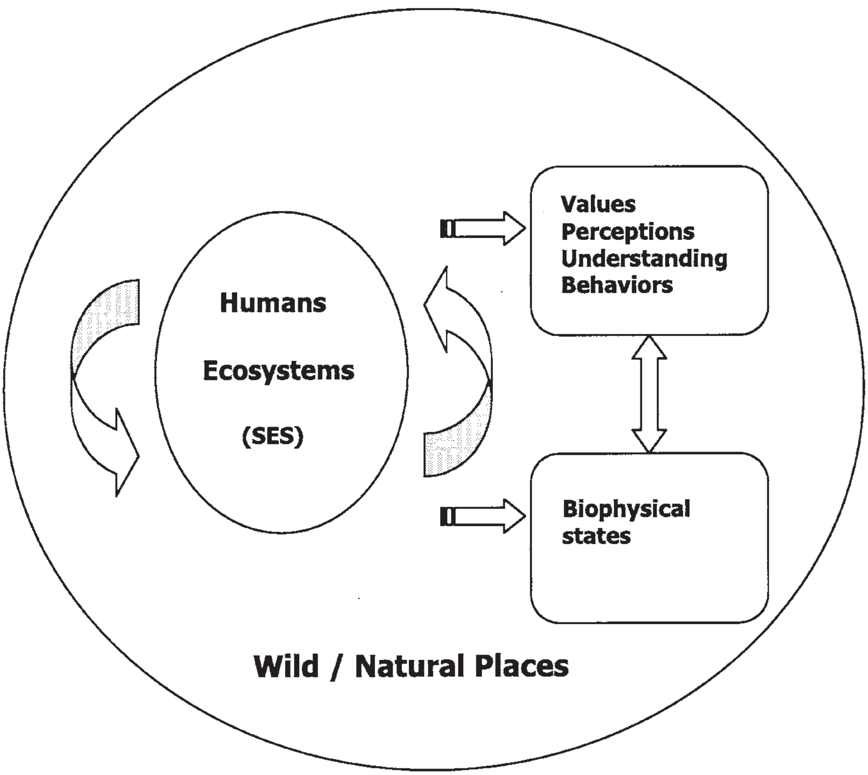

Figure 1. Conceptual model of wild places as a social–ecological system

ant behaviors with respect to potential biophysical states of the environment.

We documented the knowledge of people from a Maori *iwi* (tribe) in New Zealand in order to identify similarities and contrast differences in values and perceptions of natural environments by local indigenous users of wild places. Using focal group discussions and open-ended questionnaires, the following perceptions, values, and understandings were elicited from 12 respondents:

- Natural environments important to them;
- Images these environments evoke;
- Reasons for going to these environments;
- Activities carried out in these environments;
- Experiences or feelings that arise from being in these environments;
- Factors that influence their experiences in these environments;
- Factors that threaten their experiences in these environments; and
- Ways of minimizing these threats to their experiences.

These perceptions, values, and understandings of indigenous people toward the natural environment were compared with the dominant wilderness view (e.g., Lucas 1987; Cole et al. 2000). There were a number of broad similarities in images of natural environments between the indigenous sample and the dominant wilderness view, including forests, lakes, rivers, wildlife, and tranquility, indicating some consistency in these two views. However, specific points of difference were the recognition of *whakapapa* (an individual's inherent connection to a place), *mauri* (life force within elements of a place), and *mahinga kai* (traditional food-gathering places) in the Maori view. Major reasons for being in natural environments that accorded with the Maori view only included the life essence of elements of the environment, reminders of identity and ancestry, and a strong wish to undertake traditional food gathering. There were numerous activities in common between the Maori view and the dominant wilderness view, including fishing, recreation, wildlife watching, meeting with friends, and spiritual activities. An activity that accorded strongly with the Maori view was sharing and meeting with families. Although this is also an activity that is consistent with the dominant wilderness view, it tends to be emphasized less. Specific activities consistent with the Maori view but not the dominant wilderness view included gathering food and greeting ancestors. Awareness of ecosystems, therapeutic feelings, and spiritual renewal were experiences realized in natural environments consistent with both Maori and dominant wilderness views, while connection to the world, awareness of the past, *mana* (pride in places as home), and sadness at the health of places were experiences that were important in the Maori view but not obvious in the dominant wilderness view.

Important influences on experiences of natural environments that were specific in the Maori view were the *mauri* (life-giving force of a place) and the oral knowledge and customs. There were several threats to the experiences of natural environments that both views recognized, including increasing recreational and tourism use, loss of biodiversity, and encroaching resource extraction. Specific threats in the Maori view included lack of tribal consultation (although this could be compared with lack of local community consultation in the dominant wilderness view), legislation that restricts traditional food gathering, and sickness (biophysical and spiritual) of a place. There were numerous suggested ways of minimizing threats to natural environments that were common to both views, including restricting recreational use, protection of biodiversity, restoration of habitat and ecosystems, and increased education and research. Approaches to minimizing threats that were specific to the Maori view included acknowledging customary food gathering in legislation, and tribal involvement in management.

Implications

These results highlight contemporary views of Maori with respect to natural environments and contrast how these differ from the dominant wilderness view. Notably concepts of *mahinga kai* (food gathering), *mauri* (life force), *whakapapa* (genealogical tie to the land), and *whanaungatanga* (kinship and family activity with the land) set the Maori view apart from the dominant wilderness view. These concepts are all consistent with the customary virtues of Maori toward the environment (Patterson 1994). We acknowledge the small sample size used in this pilot study and from which these exploratory results have been derived. Yet the results indicate a valuable direction for research coupled to management and a larger study is now in progress that will further explore Maori views toward natural environments and compare and include Alaskan Native views using more substantial sample sizes.

The concepts that are uniquely identified above as Maori are ones that tightly intermesh people with ecosystems, consistent with viewing wild places as social–ecological systems (Figure 1). Such cultural concepts and this cultural–ecological integration can, we believe, strongly accommodate resilience in the management of wild places. This knowledge of values, understanding, and perceptions is likely to be a valuable tool in preventing depreciative behavior (Alessa et al., in press). The value in treating wild places as social–ecological systems lies in the integration of values, perceptions, and understandings of local communities (indigenous and rural societies) with biophysical knowledge to identify vulnerable ecosystems and social systems (Figure 2). In ecosystem management we have to accommodate both natural variability and human activities (the source of stress in a system) and so we are constantly dealing with social and biophysical change as multiple stressors in social–ecological systems. Current approaches are largely missing an important component by focusing predominantly on highly valued areas. The awareness and incorporation of alternative cultural views of natural environments are necessary if wilderness management approaches are to include vulnerable social systems and indigenous or local rural groups, and therefore be effective for high-risk systems, both social and ecological (Figure 2). We reiterate Flanagan's (1992) recognition of the need for wilderness to be inherently important to all people, transcending its bio-

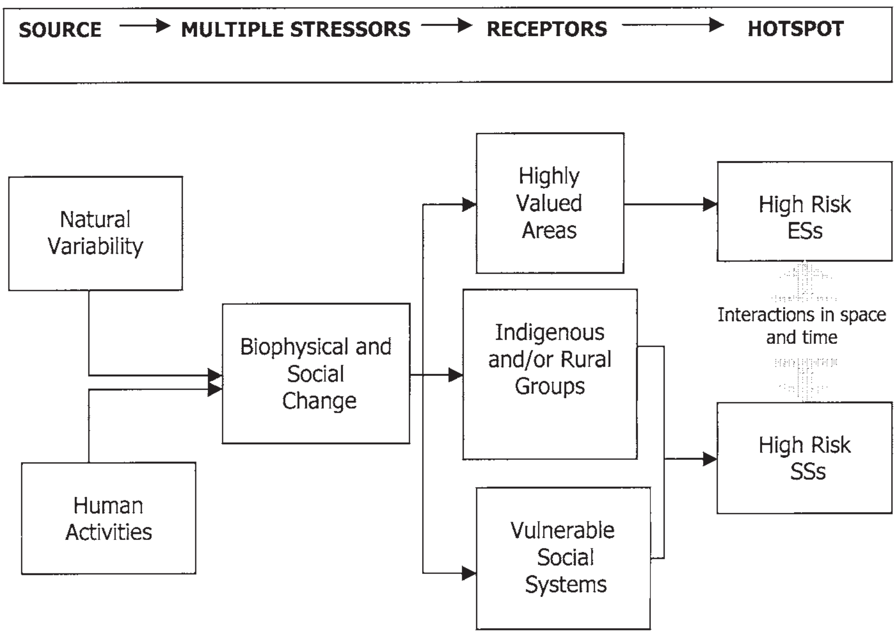

Figure 2. Conceptual model for resilience and impacts in social–ecological systems of wild places

physical boundaries, a step that will only happen when we cease to see wilderness as something separate from ourselves, and recognize that it is an integral aspect of our individuality and our collective societal existence, and that we are an integral part of wilderness.

Acknowledgments

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The Essence of Indecision: The Hayduke Principle and Wilderness Policy Paralysis on National Park Service Lands

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Undisputed areas of wilderness exist within several "crown jewel" National Park Service (NPS) units, especially Grand Canyon National Park, Glacier National Park, and Yellowstone National Park. However, since the late 1970s these areas have only been provisionally protected, which leaves open the possibility for change (particularly on the fringe) with new park leadership despite the NPS policy to retain the character of land with wilderness potential. Gary Everhardt, who director of NPS during the mid-1970s, warned Congress in 1976 that "many people ask why have wilderness in National Parks at all. I think our answer to that is very simple: It precludes capricious action by a future land manager which might have the result of allowing development or use practices what would be inconsistent with out congressional mandate to preserve units of the National Park System for future generations. It is the recognition by law of the highest land classification that the nation can bestow on its natural resources" (Congressional Record 1976:18). In fact, 13 million acres in 40 NPS units have been recognized as potential wilderness and await official permanent protection (Watson 1996). In 1994, the Congressional Research Service noted that almost half of the pending recommended wilderness areas waiting for designation are in areas of the National Park System (Gorte 1994).

At the bottom of the indecision to formally designate these wilderness areas is a cultural barrier to wilderness compromise. Wilderness is unnecessarily seen as either "on/existent" or "off/nonexistent." Indeed, novelist Edward Abbey's famous character in *The Monkey Wrench Gang,* George Hayduke, measured driving distances in six-pack increments—36 six-packs to New York City, for instance. And the empty cans went out the window because it's not the litter that is the problem—it's the road. Any sign of civilization spoils the area for an indeterminate distance, completely and forever. The divisive argument that any particular area does *not* qualify for wilderness works to the advantage of either pro-wilderness advocates or anti-wilderness organizations. Pro-wilderness NGOs (nongovernmental organizations) may argue for the complete and absolute elimination of some activity for wilderness, or opponents of designation may suggest that an indistinct and ancient road disqualifies thousands of acres. We call this the "Hayduke Principle." This dualism prevents compromise over wilderness designations. With closer inspection of designated and undesignated wilderness areas, we find that neither nature, nor human use, conforms to this strict division. Expecting such clarity provides serious barriers to designation, even areas that are geographically remote. Other areas that are highly contested experience high human use but low levels of development, such as the Colorado River corridor in Grand Canyon National Park.

The Wilderness Debate and the Hayduke Principle

Roderick Nash wrote: "The bitterness of the controversies that climaxed in the establishment of the National Wilderness Preservation System suggested that clear-cut, opposing factions were rallying to the standards of either the civilized or the wild" (Nash 1967:226). This struggle and the cultural values that surround it have promoted a dualism of pure nature and nature which has been soiled by human activity. Thus, areas receiving this important protection are strictly "untrammeled by man, where man himself is a visitor who does not remain" (1964 Wilderness Act).

Linda Vance (1997) criticizes this dualistic thinking: "Wilderness is more than a land-use designation: it is the part of our environment that is idealized as 'perfect nature,' as, indeed, the highest or purest form of nature we have. In defining wilderness by the absence of humans, we are saying, in effect, that nature is at its best when utterly separated from the human world. The idea of wilderness is thus an extreme manifestation of the general Western conceptual rift between culture and nature" (Vance 1997). Places that are heavily used but not overtly developed, places within eyesight or earshot of roadways, places with established mountain bike use, or places in need of extensive restoration and anti-invasive weed measures do not fit our black-and-white expectations. These areas then complicate surrounding areas that otherwise clearly do fit. The debate is visceral. For instance some analysts suggest that in southern Utah there is a significant number of people who will not, under any circumstances, allow the government to have any wilderness, anywhere, at any time (McCool 2002).

Perhaps this duality comes out of a contrast with industrial expansion. Craig Allin argues that wilderness developed in relation to national development and expansion. Initially, wilderness was viewed as a "worthless impediment to progress" (1982:4). As a result, wilderness became more scarce and eventually more valued as a function of this scarcity. Thus, wilderness preservation, according to Allin, occurs as a result of the abuses of industrial expansion where wilderness becomes that place where development has not occurred. This same dynamic can be seen in other countries as well and strategies to protect those wild lands have been shared across international boundaries (Ostergren and Hollenhorst 1999).

If the standard for wilderness is too high, few places will qualify, and those that do will be subject to a high burden of proof that will be less likely to succeed and more easily defeated. Consequently, and importantly, less political power is needed to block wilderness designation than is needed to push it through, which is important information for wilderness advocates. In fact, sometimes 99 votes in the U.S. Senate aren't enough. One senator can put a "hold" on a bill until circumstances encourage him or her to acquiesce. This means that vigorous opposition (or almost any opposition) from the local congressional delegation must be avoided for designation to take place. The political reality is that some compromises may need to be made to get wilderness designation. The reality for wilderness advocates is that of the 2.3 billion acres in the United States, only 106,302,240 acres (Wilderness Information Network 2003) are protected to the highest extent of the law, and nature has compromised enough.

Grand Canyon National Park

Grand Canyon National Park is an illustrative example of wilderness policy paralysis. The vast majority of this park is undisputed wilderness; however, *none* is designated. This does not seem to be a result of Arizonan congressional resistance. Nine laws from 1964 to 1990 designate wilderness in Arizona, which has over 4.5 million acres of wilderness in ninety-three units. Arizona holds over 4% of the National Wilderness Preservation System, and has more wilderness than 46 other states. About 10% of these acres are managed by NPS in four designated areas: Chiricahua National Monument, Organ Pipe Cactus National Monument (the largest NPS Arizona wilderness unit), Petrified Forest National Park, and Saguaro National Park (National Wilderness Preservation System 2002). Nor does the problem seem to be the National Park Service. Most of Grand Canyon National Park has been treated as wilderness at least since 1980. Currently, the general management plan for the park reads: "Over 90% of the park will be managed as wilderness, in accordance with the park's 1993 wilderness proposal."

The problem is the division over designation within the Colorado River corridor. The river flows freely for 240 miles, but also experiences at least 23,000 floaters a year, a majority of whom ride with commercial river runners who use motors (Grand Canyon National

Park 1997). The subsequent generation of \$23.3 million in regional economic impact is a strong force in the debate (data are from commercial and non-commercial motorized and non-motorized raft trips from 2001; see Hjerpe 2003). The status of the river has been so ambiguous and irreconcilable that the park's wilderness plan has not even been forwarded to the secretary of the interior, from which it would go to the president after a new or refurbished environmental impact statement, and then to Congress—a trek longer than Bright Angel Trail itself. A solution that allows for designation of the gray area—the river—seems unlikely. The implication is that including the river takes the designation process of the whole park off the table.

Discussion and Suggestions

One issue that we only consider parenthetically is the bureaucratic behavior of NPS. Is it conforming to the 1964 Wilderness Act? We suggest that, yes, NPS is conforming to the best of its ability and is, in many cases, doing a very good job. On-the-ground implementation is just as the political science literature would predict. Regardless of the impasse at the congressional level, NPS has a policy to maintain the wilderness character of lands that may qualify. Some superintendents have a reputation for zealous preservation and observation of using the least-intrusive tool. Others may be a little more willing to employ motor-driven tools and vehicles, but several environmental NGOs we talked to felt that in some conditions, even helicopters *are* the minimum tools, compared with a long line of horses to supply remote sites or a series of burial pits for refuse. In the few cases where NPS refuses to forward recommendations, or put any effort into developing a wilderness plan ("backcountry plan" by another name), wilderness advocates ought to keep up the pressure. The unfortunate byproduct of the NPS doing the best that any bureaucracy in its place can, is that outside organizations will inevitably do the best they can and turn to the courts. The recent suit by the Wilderness Society to compel NPS compliance is a tool to urge reallocation of funds and resources to wilderness (filed in the U.S. District Court for the District of Columbia against Secretary of the Interior Gale Norton and NPS Director Fran Mainella). Unfortunately, NPS should expect such actions, and more in the future. If the United States is to protect its wilderness assets within the National Park System, then some agent or interest group must take a proactive stance. The group may be an NGO, a federal agency, or the general public itself through elections and actions. Of course, Congress may suddenly allocate additional funds for wilderness plans, management, and designation and thus preclude any further legal action.

If the nature/culture dualism is operating as we believe it is, then the policy solution would be to overcome it by allowing for complexity and compromise in our conceptions of what "good nature" looks like—and allowing for a more gradual change in perception, which presumably would take generations. Were the latter to occur and people were able to view human interaction with nature as neither dominion nor alien, then perhaps wilderness policy would become obsolete (to the extent that natural degradation is a result of human dominion and humans would live with wild nature rather than domesticating nature). Both of these developments are important, but policy decisions are needed in a more timely manner.

One strategy toward wilderness designation in the Grand Canyon is to separate the bulk of the park's wilderness from the Colorado River management plan. This is a strategy that seems to be taking place already, but is still under review. The local congressional delegation could meet with the NPS congressional liaison and Grand Canyon wilderness managers to negotiate two things.

First, this meeting should establish what areas are *uncontroversial* in order to free them for permanent, immediate protection. If both the congressional delegation from the region and the administration can agree on areas that are indisputable wilderness, it would be difficult for other members of Congress to argue against this. No riders—e.g. trading to keep other wilderness areas out of the process—

should be accepted at this time. Some congressional delegations we interviewed have said they would consider designating NPS wilderness if Title II precluded future designation of areas under the U.S. Forest Service (USFS) and Bureau of Land Management (BLM). This is the type of negotiation that stops wilderness bills in Utah: the environmental NGOs will not allow politicians to adopt "a shade of green" in Title I while developing the USFS and BLM areas that are more at risk.

Next, the ambiguous areas should be discussed in geographic detail with potential exemptions used to further protect areas that receive heavy use but maintain many wilderness qualities, such as the Colorado River. If negotiations over the river allow for permanent protection of that system, it may be worth allowing for a motorboat exemption, which is clearly permissible both by precedent, such as in Glacier Bay National Park and the Boundary Waters Canoe Area Wilderness, and by the wording of the original 1964 act under section 4(d)(1) (National Park Service 1998). If policy-makers and wilderness advocates struggle to keep motors out of the river in order to preserve "good nature," it will take a great deal of time and political capital that apparently is more easily used to stall rather than forward wilderness protection. Also, the exemptions allowed in wilderness are not inherently "on or off" any more than wilderness itself; these exemptions should be heavily negotiated to at least reduce motor use in the river and balance out the distribution of passengers to private and commercial boaters. Even if wilderness advocates vehemently disagree with this specific recommendation, there seem to be very few good reasons for gambling the entire wilderness area in the Grand Canyon that can be permanently protected today on the less than 1% that cannot.

The Hayduke Principle assumes that wilderness designation is paralyzed by dualistic thinking and a dichotomy of what good nature and bad nature can be. We don't expect that all groups will compromise in all areas, although there is a chance that policy inertia could be overcome to decide on many NPS areas and allow managers to move forward. The resulting conversations and differences may linger for many years, while old issues pass and new ones arise to complicate the wilderness debate. On the other hand, a chapter could close on millions of acres within the National Park System.

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Inholdings within Wilderness: Legal Foundations, Problems, and Solutions

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For many people, the wilderness ideal is a vast and contiguous tract of unspoiled wild land. However, unknown to many is the fact that well over 1 million acres (404,700 ha) and thousands of parcels of private or state-owned lands may be contained within designated wilderness in the United States. These lands, termed *wilderness inholdings*, present challenges to wilderness advocates that require creative solutions and deliberate action due to serious concern about motorized access to inholdings, land speculation and threatened development, uses of inholdings that are incompatible with wilderness, legal ambiguities of ownership rights, and multiple legal guidelines for wilderness managers.

In the western United States, land inholdings in wilderness are largely a result of five legislative acts: the 1872 Mining Law (17 Stat. 91), the 1862 Homestead Act (12 Stat. 392), the 1864 and 1870 Land Grant acts (12 Stat. 503 and 26 Stat. 417), and the Alaska Native Claims and Settlement Act (ANCSA; P.L. 92-203). Under the first four acts, public lands were distributed to the private sector and states to advance westward expansion and development of the land; ANCSA distributed public lands to Alaskan Natives as a land settlement. Many inholdings in wilderness areas are quite large. Under the 1872 Mining Law, parcels were claimed in units of 20 acres (8 ha), and 160 acres (64 ha) were turned over to individuals under the Homestead Act. While these four acts distributed land to private individuals, the Land Grant acts distributed land to states in 640-acre (259-ha) parcels. ANCSA awarded a total land grant of 44 million acres (18 million ha) to Alaskan Natives for renouncing all claims to the rest of the state (Zaslowsky 1986). The result on the landscape was a patchwork of private and state-owned land scattered across public lands.

In contrast, much of the land in the eastern United States was privately owned before public lands were established by the federal government. When the government decided to establish public lands in the East, it was difficult to do so without some private or state-owned lands being contained within them.

Thus, wilderness throughout the United States often contains inholdings; it would have severely limited the National Wilderness Preservation System (NWPS) to have excluded such areas. Table 1 lists the acres of private and state land inholdings contained within designated wilderness administered by the U.S. Forest Service (USFS), Bureau of Land Management (BLM), and National Park Service (NPS). Data on the acreage of inholdings within U.S. Fish and Wildlife Service

Federal Agency	Privately Owned	State-Owned
USFS	132,603 acres (53,667 ha)	305,453 acres (123,616 ha)
BLM	311,554 acres (126,086 ha)	267,653 acres (108,319 ha)
NPS	2,462 acres (996 ha)	15,208 acres (6,155 ha)
USFWS	not available	not available

Table 1. Extent of private and state-owned inholdings in wilderness areas managed by federal agencies.

(USFWS) wilderness areas are not available.

Problems Associated with Wilderness Inholdings

Inholdings present wilderness advocates and federal agencies with a number of problems, which can be summarized into five main situations: motorized access across wilderness to inholdings, land speculation and threatened development of inholdings, uses of inholdings that are incompatible with wilderness, legal ambiguities related to the property rights of inholding landowners, and multiple legal guidelines for wilderness managers.

Motorized access to inholdings. The use of motor vehicles on wildlands was a serious concern in the early wilderness movement and is one activity the Wilderness Act (P.L. 88-577) tried to guard against. Increasingly, agencies are granting motorized access through wilderness to inholdings based more on landowner convenience rather than the adequacy of nonmotorized access for the inholder. Thus, there is an increasing amount of motor vehicle traffic within the NWPS lands. In some cases, motorized access through wilderness has been allowed when travel by foot or horse would be adequate for reasonable use of the property by the inholder. In addition to impacts upon the biophysical characteristics of wilderness, motorized intrusions are damaging to the wilderness experiences of users.

Land speculation and threatened development of inholdings. Land speculation and development are not words typically associated with wilderness, but some inholders have recently begun to employ such practices to make a large profit off of their land by threatening to develop or mine it.

Incompatible uses of inholdings. Designated wilderness area are the most protected public lands in the U.S. Incompatible use of inholdings can affect the ecological health, aesthetic value, and character of the adjoining wilderness. Incompatible uses can include major building construction, use of airfields, mining, and introduction of exotic species (e.g., fish stocking).

Legal ambiguities related to the property rights of inholding landowners. Access to wilderness inholdings is subject to the restrictions imposed by the Wilderness Act (P.L. 88-577) and the legislation that designated that particular wilderness. Section 5(a) of the Wilderness Act serves as the legal basis regarding land inholdings contained within a wilderness, in the absence of any other legislation relevant to a particular wilderness. The Wilderness Act directs agencies to offer adequate access or an exchange of lands. Subsequent wilderness legislation relevant to inholdings sometimes only included provisions to grant adequate access (not necessarily motorized) if it is requested, but the legislation does not preclude the agencies from offering a land exchange. In addition to the Wilderness Act, the most important pieces of wilderness legislation relevant to land inholdings are the Eastern Wilderness Act (P.L. 93-622), Alaska National Interest Lands Conservation Act (ANILCA; P.L. 96-487), and California Desert Protection Act (P.L. 104-433), which are listed in Table 2 along with key legal provisions related to inholdings.

While all four federal agencies managing wilderness under the NWPS are bound by the Wilderness Act and other relevant legislation, agencies promulgate their own regulations or policies that serve as their interpretation of those laws. While both regulations and policies serve as the foundation for the agencies' management of wilderness, regulations are legally binding, whereas policies are only administrative guidelines. However, should a legal issue be brought before the courts and there is found to be a conflict between the legislation and agency regulations or policies, the legislation has precedence over the regulations or policies of the agencies. Table 3 lists the federal agency regulations and policies concerning wilderness inholdings.

With regard to inholdings, wilderness legislation contains inconsistent language that has led to multiple interpretations by federal agencies. These varied interpretations have caused difficulties both in determining the type of access to be permitted to inholdings and the intended scope of some legislation. Two pieces of legislation at the center of this

Table 2. U.S. legislation concerning private and state-owned inholdings in the NWPS.

Legislation (Public Law and Section Number)	**Statutory Language**
Wilderness Act (P.L. 88-577 § 5(a))	"In any case where State-owned or privately owned land is completely surrounded by national forest lands within areas designated by this Act as Wilderness such State or private owner shall be given such rights as may be necessary to assure adequate access to such State-owned or privately owned land by such State or private owner and their successors in interest, or the State or privately owned land shall be exchanged for federally owned land in the same State of approximately equal value...."
Eastern Wilderness Act (P.L. 93-622 § 6 (b) (3))	"The Secretary of Agriculture may acquire such land or interest without consent of the owner or owners whenever he finds such use to be incompatible with the management of such area as wilderness and the owner or owners manifest unwillingness, and subsequently fail, to promptly discontinue such incompatible use"
Alaska National Interest Lands Conservation Act (P.L. 96-487 § 1110 (b))	"The State or private owner shall be given by the Secretary ... adequate and feasible access for economic and other purposes ... subject to reasonable regulations issued by the Secretary to protect the natural and other values of such lands."
Alaska National Interest Lands Conservation Act (P.L. 96-487 § 1323)	(a) "... the Secretary of Agriculture... shall grant access to non-federally owned land within the boundaries of the National Forest System as the Secretary deems adequate to secure to the owner the reasonable use and enjoyment thereof...." (b) "... the Secretary of the Interior ... shall provide such access to non-federally owned lands surrounded by public lands managed by the Secretary under the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701-82) as the Secretary deems adequate to secure to the owner the reasonable use and enjoyment thereof...."
California Desert Protection Act (P.L. 104-433 § 708)	"[T]he Secretary shall provide adequate access ... which will provide the owner of such land or interest the reasonable use and enjoyment thereof."

Table 3. Extent of private and state-owned inholdings in wilderness areas managed by federal agencies.

Federal Agency Regulation or Policy	**Regulation or Policy Language**
BLM (43 CFR 6305.10)	"If you own land completely surrounded by wilderness, BLM will only approve that combination of routes and modes of travel to your land that— (1) BLM finds existed on the date Congress designated the area surrounding the inholding as wilderness, and (2)BLM determines will serve the reasonable purposes for which the non-Federal lands are held or used and cause the least impact on wilderness character."
USFWS (50 CFR 35.13)	"Rights of States or persons and their successors in interest, whose land is surrounded by a wilderness unit, will be recognized to assure adequate access to that land. Adequate access is defined as the combination of modes and routes of travel which will best preserve the wilderness character of the landscape. Mode of travel designated shall be reasonable and consistent with accepted, conventional, contemporary modes of travel in said vicinity. Use will be consistent with reasonable purposes for which such land is held."
USFS (36 CFR 251.110 (c))	"... as appropriate, landowners shall be authorized such access as the authorized officer deems to be adequate to secure them the reasonable use and enjoyment of their land."
NPS (Director's Order #53 §10.4)	"Except as specifically provided by law, there will be no permanent road, structure or installation within any study, proposed, recommended, or designated wilderness area. This includes the installation of utilities. (See the Wilderness Act *16 USC 23*). The NPS will not issue any new right-of-way permits or widen or lengthen any existing rights-of-way in study, proposed, recommended, or designated wilderness areas." [At present, NPS policies target only right-of-ways to wilderness inholdings.]
Department of Interior (USFWS, NPS, & BLM) Regulations for Wilderness inholdings in Alaska (43 CFR 36.10)	"(a) This section sets forth the procedures to provide adequate and feasible access to inholdings within areas in accordance with section 1110(b) of ANILCA. As used in this section, the term: (1) Adequate and feasible access means a route and method of access that is shown to be reasonably necessary and economically practicable but not necessarily the least costly alternative for achieving the use and development by the applicant on the applicant's nonfederal land or occupancy interest."

controversy are the Wilderness Act and ANILCA.

Section 5(a) of the Wilderness Act directs agencies to provide adequate access or offer a land exchange for the inholding. This section of the legislation has been interpreted a couple of different ways. Some have implied that the appropriate federal agency must, if an exchange offer is not acceptable to the property owner, make adequate access available. Conversely, if the property owner does not see the granted access as adequate, then an offer for exchange must be made. However, a 1980 U.S. attorney general opinion interpreted the section to mean that the appropriate federal agency has the option of choosing *either* an exchange *or* granting access to the inholding, and once one of the two offers has been made, the agency has satisfied its responsibility (Civiletti 1980). Also, as subsection 5(a) states, regardless of which option is chosen, the action is subject to the preservation of wilderness character.

ANILCA is one of the most important pieces of wilderness legislation since the Wilderness Act of 1964. After a decade of legislative debate, more than 104 million acres of federal lands in Alaska were preserved as national parks, wildlife refuges, and conservation areas, and 56.5 million acres of those lands were designated as wilderness (The Wilderness Society 2001). Just as important as the designation of protected areas, the ANILCA specified management directives for all 224 million acres of federal land in Alaska.

Two sections of ANILCA are particularly relevant to wilderness inholdings: sections 1110 and 1323. Subsection 1110(b) specifically addresses access to wilderness inholdings in Alaska, regardless of the managing federal agency, and declares that "adequate and feasible access for economic and other purposes" shall be provided "subject to reasonable regulations issued by the Secretary to protect the natural and other values of such lands." Since approximately half of our nation's designated wilderness is in Alaska, including the majority of national park and wildlife refuge wilderness, 1110(b) is an exceptionally important subsection of law.

Section 1323(a) directs the secretary of agriculture to provide adequate access to land inholdings located within the National Forest System that will secure the owner the reasonable use and enjoyment of the inholding. USFS has interpreted section 1323(a) to apply to wilderness nationwide, including Alaska, and consequently the agency has adopted it as its policy governing access to wilderness inholdings. However, subsection 1110(b) applies to all designated wilderness in Alaska, including national forest wilderness; therefore, current USFS policies regarding access to Alaska wilderness inholdings should be in accordance with 1110(b).

Multiple Guidelines for Wilderness Managers

The variety of legislation relevant to wilderness inholdings has created some confusion as to which legislation is applicable for a particular wilderness. Since there are numerous pieces of wilderness legislation, and some legislation regarding access to wilderness inholdings may not be applicable to all agencies managing wilderness, access is often regulated differently depending on which agency administers the particular wilderness. Different directives for access to wilderness inholdings are found not only inter-agency, but also intra-agency. For a particular agency, the permitted access to wilderness inholdings in Alaska under ANILCA may be substantially different from what it allows to wilderness inholdings in the lower 48 states.

Solutions to Problems with Wilderness Inholdings

Some possible solutions include clarifying and strengthening wilderness legislation and agency regulations regarding wilderness inholdings, supporting land trusts, and, in extreme cases, allowing condemnation of lands. Combining creative solutions with public support ideally will result in a resolution of the dilemmas encountered when wilderness areas contain public and state land inholdings.

Adherence to wilderness legislation and legal clarification. While, in most cases, agencies managing designated wilderness are required to grant access (not necessarily motorized access) to inholdings, the access granted is conditional and depends upon the wilderness designation legislation and the Wilderness Act. Thus, agencies have an opportunity to practice wise stewardship by denying any access that is contrary to fundamental wilderness principles. For example, an inholder in the Absaroka–Beartooth Wilderness recently requested that the USFS construct an 8.6-mile road to his inholding and grant motorized access. The USFS denied the request based on the concern for the preservation of the wilderness character. The USFS decision was upheld in a federal district court. We recommend that managers prioritize wilderness protection over the convenience of inholders, and existing legislation will enable them to preserve wilderness character in most cases.

Land trusts. Ultimately, it may be advantageous for agencies managing wilderness to purchase all private and state land inholdings in order to preserve wilderness character in the designated area. Such an approach is expensive and, consequently, agencies are unable to afford to purchase all wilderness inholdings. In the event that an agency is unable to purchase an inholding from a willing seller, land trusts—organizations devoted to acquiring lands in the spirit of conservation—can purchase the land and hold it in the spirit of wilderness stewardship, or sell the land to the agency when more public funding for land purchases is available. Land trusts have traditionally been an effective tool in combating problems with wilderness inholdings. For example, since its origin in 1992, the Wilderness Land Trust (2002) has acquired 180 private inholdings in 35 designated wildernesses.

Condemnation of wilderness inholdings. The Fifth Amendment of the U.S. Constitution allows federal agencies to condemn lands if the lands will be turned over to public use. The Wilderness Act does permit condemnation of lands, but does not grant this authority to federal agencies. Instead, it is stipulated in section 5(c) of the act that authorization of the U.S. Congress is necessary to condemn lands within wilderness boundaries. With the passage of the Eastern Wilderness Act, 16 national forest wilderness areas were established east of the 100th meridian and USFS was authorized to condemn inholdings in them if the use of the inholding was found to be incompatible with the protection of the wilderness and the owner were unwilling to discontinue the incompatible use. No inholdings have been condemned under the Eastern Wilderness Act. While condemnation is a last resort for managers to solve a problem, such an approach may be necessary for the preservation of a wilderness area's character.

Conclusion

The management of the designated wilderness areas in the NWPS has often proven to be an arduous and delicate task. The five types of problems arising from wilderness inholdings, outlined in this paper, certainly raise concern among wilderness managers. For many wilderness areas, there is potential for a few inholdings to shape the character of the entire wilderness. Thus, with a significant number of wilderness areas containing inholdings, timely and effective solutions to the problems associated with them are needed.

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Fire Management and Resource Management at Big Cypress National Preserve

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Big Cypress National Preserve is located in southwestern Florida, north and west of (adjacent to) Everglades National Park. Wetland communities, especially those dominated by bald cypress *(Taxodium distichum)* trees, make up much of the preserve's landscape. Topographic relief in the preserve is limited, with a gradual slope (about 1 foot per mile) toward the coast, so that most of the preserve is under at least few inches of water during the summer rainy season. The flat nature of the land also supports large areas of shortgrass prairies and sawgrass marshes. These graminoid communities naturally burn every few years, so that fire is a common and significant ecological factor.

Fire Management

The Big Cypress prescribed fire management program is the largest in the National Park Service (NPS) in terms of the amount of burning accomplished. The preserve burns about 40,000 acres annually to reduce accumulated fuels in plant communities. This program has about 20 full-time employees, and in 2002 made up about half of the area in the National Park System that was burned for fuel reduction. Property owners in areas that may be affected by nearby fires are contacted when they are available; prescribed fires are almost always well received by adjacent property owners, as fires historically were used to reduce fuels or improve forage for domestic or game animals. Preserve fire management staff work closely with the state of Florida's Division of Forestry, as state restrictions often constrain fire operations.

Resource Management

Resource management at Big Cypress actively shares information about the preserve's natural resources with other divisions in the preserve. This is a practical application of the science needed to understand natural systems. Communication with fire management staff is especially valuable, as fire is a common and important abiotic component of southern Florida's ecology.

Wildlife management. Management concerns for fauna in the preserve include fire's impact on species such as Florida panther *(Felis concolor coreyi)* and its prey animals that reside in mesic-to-hydric communities in the preserve. Red-cockaded woodpeckers *(Picoides borealis)* require old-growth pine forests for nest colony sites; these communities became uncommon after timber cutting in the southeastern United States during the last century. Several colonies occur in Big Cypress, and consideration is given to possible impacts on this bird when planning for burns in these areas. The Cape Sable seaside sparrow *(Ammodramus maritimus mirabilis),* an endangered bird that resides partly on the southeastern part of Big Cypress, relies on graminoid marshes for nesting. The effect of fire on this community is being studied to determine its possible effects on the marsh and nest site availability. Florida tree snails *(Liguus fasciatus)* reside in hardwood hammocks in Big Cypress. These hammocks are identified so that effects of fires on snails can be minimized.

Cultural resources and controlled fires. Several historic and prehistoric cultural sites have been identified in Big Cypress with help from fire management staff. Sites have been surveyed by NPS Southeast Archeological Center archeologists after burning, when they are more easily located with vegetation removed. Also in early 2003, fire management staff used hand tools to clear a dense stand of exotic Brazilian pepper *(Schinus terebinthifolius)* trees from a Calusa Indian shell mound, so that excavation and artifact recovery could most effectively take place at this archeological site.

Exotic plant removal and habitat restoration. Whenever possible, exotic plant management staff coordinates with fire management staff at Big Cypress to burn areas from which exotic Melaleuca *(Melaleuca quinquenervia)* trees have been removed. These areas are burned after the Melaleuca seeds have germinated, but before they are large enough to tolerate fires (usually within a year of germination), as recommended by Myers et al. (2001).

USGS long-term fire ecology project. The U.S. Geological Survey (USGS) Biological Resources Division has maintained a field station to study fire effects on hydric and mesic pinelands in Big Cypress for about 20 years. Data gathered from this long-term study will help managers understand what fire frequencies may be appropriate for these woodland communities.

Major Communities and Fire Regimes

Cypress and mixed hardwood swamps. Cypress and mixed hardwood swamps cover about 50% of Big Cypress. Wade et al. (1980) suggested that these wetland communities are probably more common now than before disturbance by logging, and that pre-drainage fire frequencies may have been 100–200 years in dense cypress sloughs. Myers and Ewel (1990) indicated about 20-year fire intervals in cypress forests. These are communities with long hydroperiods and high humidity, so fires are not well supported here except during times of extreme drought. Fire, however, is apparently important to these communities in maintaining dominance by cypress. Dwarf cypress, an ecotonal community with elements of cypress slough and marl prairie, burn more frequently (see below under "Marl prairies and marshes").

Wade et al. (1980) provided no estimate for natural fire frequency in mixed cypress and hardwood sloughs, but suggested that the very wet, dense, interior parts of the sloughs probably seldom burn. The edges of these communities that are ecotonal with marl prairies or with mesic pine flatwoods, however, may experience fires as often as the adjacent communities, and areas closer to the hydric interior of the slough will experience less frequent fires. As slough community areas typically are linear with little topographic relief, these ecotonal areas can be extensive, but here they are considered outside of the slough and mixed hardwood community. Much variation occurs in mixed hardwood and cypress communities, so that fire frequency is estimated at 50–100 years.

Marl prairies and marshes. Marl prairies and marshes are hydric communities that are dominated by ground cover, and occupy about 20% of Big Cypress National Preserve. Duever et al. (1986) cited works that suggest fires occur in these communities about as often or more often than in pinelands, but indicated that some prairies are less productive than pinelands so that fuel loads may not accumulate fast enough to support more frequent fires. Areas dominated by sawgrass *(Cladium jamaicense)* may burn every 2–5 years, but Wade et al. (1980) cited estimates of pre-disturbance frequency at 3–25 years, suggesting that frequencies near the low end of this estimate may have been most common. These estimates suggest a natural fire frequency of 3–5 years.

Mesic and hydric pine flatwoods. Pine flatwoods communities are mesic-to-hydric communities that are dominated by open-canopied slash pines *(Pinus elliottii);* these communities cover about 20% of Big Cypress National Preserve. Mesic pine flatwoods are usually co-dominated by saw palmetto *(Serenoa repens)* shrubs, and hydric pine flatwoods are usually co-dominated with graminoid ground cover. Myers and Ewel (1990) indicated variation of fire frequencies in these communities with environmental variables. Wade et al. (1980) indicated much variation in pine flatwoods fire frequencies, but pointed out that in closely related pine rockland communities, fire every five or six years was enough to inhibit effective recruitment of pine seedlings, so that natural fire intervals may be greater than seven years. These communities are often adjacent to frequently burning prairies, and may be subject to ignition by those fires, so that more frequent fires can occur. Duever et al. (1986) cited studies of fire frequencies in pine forests at 3–7 years, and studies that demonstrated succession to hardwood communities after 15–25 years without fire. These estimates suggest a natural fire frequency of 7–20 years.

Mesic hammocks. Mesic hammocks are slightly elevated insular areas that are dominated by hardwood trees. Inland, these tree islands usually are dominated by temperate trees; in coastal areas, by tropical trees. Duever et al. (1986) and Wade et al. (1980) mentioned that hammocks are usually insulated from fires by wetlands that surround the islands; also, hammock soils are usually moist, with water tables within 1 m of the soil surface for most of the year. Duever et al. (1986) conservatively estimated fire frequencies in hardwood hammocks of 50 years or more. Wade et al. (1980) provided no estimated fire frequency, but cited evidence of an interval of 200+ years for fires in hammock interiors.

Seasons and Naturally Occurring Fires

Rainy and dry seasons. Seasons in southern Florida are less defined by temperature than in more northern parts of North America; however, wet and dry seasons produce predictable annual changes. Spring months are usually the driest of the year, followed by the rainy summer season. Daily afternoon thunderstorms begin to build from about mid-May to mid-June and occur through early autumn. Lightning that is part of these storms creates fire activity during the summer rainy season. Wade et al. (1980) indicated that 75% of thunderstorms in southwestern Florida occur from June through September. Duever et al. (1986) indicated May as the month most likely for fires. Records of fires occurring at Big Cypress over the past 20 years indicate that natural fire frequencies are greatest during summer, when thunderstorms are most common. Areas burned by naturally occurring fires are greatest early in the summer when conditions are driest and lightning becomes common (Big Cypress National Preserve Fire Operations 2003).

Plant community activities and fires. A primary ecological consideration for prescribed fires should be the seasonality of naturally occurring fires. Fire may be considered a stochastic event, so that its occurrence involves a statistical likelihood in each community, but the actual time of the event is random. This should not be taken to mean that fires should occur with regularity, but that over time, most fires naturally occur during a particular season, and fewer occur during the rest of the year. In southern Florida, we may consider late spring as a likely season for fires, based on several ecological observations: (1) late spring is usually the driest season; (2) dry conditions occur through much of this season; and (3) afternoon lightning becomes common. Comparing plant activities in several natural communities that are affected differently by fires can partly test this hypothesis.

Methods

Growth and reproduction in plant communities often varies with seasons. Plant communities largely are a function of physical surroundings, so that fires may be considered an important factor in their structure. By looking at flowering plant reproductive activity (flowering), seasons of reproductive activities can be compared with seasons of naturally occurring fires. Reproductive activity is only one factor that should be considered as part of the ecology of communities subject to fire.

Seasonal flowering of vascular plants that are commonly found in four communities in Big Cypress were compared with estimated fire return intervals for each community. The species selected were from lists of plants found in several locations in southern Florida near to and within Big Cypress. The communities selected are marl prairies (118 plants), pine flatwoods (104 plants), mixed hardwood and cypress swamp (119 plants), and tropical hardwood hammocks (130 plants). Seasons of flowering were taken from Wunderlin (1998). Estimates of fire return frequencies were interpreted from several authors (see above, "Major Communities and Fire Regimes"). Fire is assumed to occur most often during spring as a result of lightning from thunderstorms during dry conditions.

Results and Management Implications

Reproductive activities of plants found in major biological communities in Big Cypress National Preserve varied with estimated naturally occurring fire return frequency. Communities with short fire return intervals had fewer resident plants with reproductive activity during the spring, suggesting that natural fire regimes may influence the species compositions of these communities (Table 1).

Marl prairie communities have the highest fire frequencies with the lowest percentage of plants flowering in spring (dry season), and the highest percentage of those flowering in summer (wet season). Wade et al. (1980) indicated that a fire frequency of 2–5 years is necessary in sawgrass marshes to minimize fuel build-up. Duever et al. (1986) mentioned that low vegetation, burned back to the substrate surface level, can recover well when re-growth occurs before the summer rains. Wade et al. (1980) recommended spring burning for sawgrass, if soils are damp or inundated. This allows fire to remove the dead or old growth, but offers protection of meristem tissues that occur near the soil surface. Frequent prescribed fires (3–5 year intervals) should be considered for these communities.

Pine flatwoods that occur in Big Cypress also have fire returns of only a few years, similar to adjacent marl prairie communities. These communities represent most of the mesic habitat here, and are important for the success of at least two listed animals (Florida panther and red-cockaded woodpecker) that reside in the preserve. Maintaining these uplands in current successional stages is important for these animals, so that fire frequencies of 7–20 years should be considered for these plant communities.

Mixed cypress and hardwood sloughs and tropical hardwood hammocks are communities that apparently have fire return intervals on the order of decades or centuries. Soils, plants, and hydrology in these communities do not promote fires (Wade et al. 1980; Duever et al. 1986), and the proportions of plant reproductive activities in these communities is higher during times of greater fire probability than in marl prairies or pine flatwoods (Table 1). Hammocks have the longest fire return frequencies, and the greatest percentage of spring-flowering plants. These communities occupy relatively little area in Big Cypress, but contain at least one State of Florida listed animal (Florida tree snail), and many state-listed threatened or endangered plants (mostly epiphytic orchids and bromeliads). Prescribed fire should not be promoted in these communities, as naturally occurring fires apparently were rare.

Table 1. Seasonal flowering of plants and fire frequencies: estimated percentages of flowering plants that produce flowers during each season and year-round in natural communities with different fire frequencies in Big Cypress National Preserve. Seasons of flowering were taken from Wunderlin (1998). Fire is assumed to occur most often during spring, as a result of dry conditions and lightning from thunderstorms.

	Marl Prairies	Pine Flatwoods	Mixed Swamp	Tropical Hammocks
Spring	53	64	67	87
Summer	91	83	79	81
Fall	82	74	66	73
Winter	22	21	24	44
All Year	20	19	22	40
Fire Frequency	3-5 yrs.	7-20 yrs.	50-100 yrs.	100+ yrs.

Conclusions

The ecology of biological communities should be considered in planning fires. Wade et al. (1980) indicated that 70% of plants endemic to southern Florida occur in pyroclimactic (fire climax) communities, and plant reproductive activities outlined here appear to be related to fire frequencies and seasons. Duever et al. (1986) indicated that out-of-season fires may change life cycles of native plants and animals and may promote growth of some exotics. At Big Cypress, decisions on timing and use of prescribed fire are based on information collected by USGS and NPS scientists on the conditions of natural systems. However, in general, frequencies and timing of prescribed fires largely reflect human requirements. Efforts should be made to set prescribed fires during seasons having conditions most similar to those conducive to naturally occurring fire.

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Water Quality Data Collection and Analysis in Support of Anti-Degradation Standards: A Case Study with General Lessons

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Summary

Protecting water quality unimpaired for future generations is a primary goal for many national parks and conservation areas. The National Park Service's (NPS's) Natural Resource Challenge includes funding and programs to increase water quality monitoring in national parks. However, designing and implementing technically sound water quality monitoring programs and regulations that prevent degradation may be more difficult than generally recognized.

A case study covering 121 miles of the Delaware River (Pennsylvania, New York, and New Jersey), including the Middle Delaware Scenic and Recreational River (MDSRR) and the Upper Delaware Scenic and Recreational River (UDSRR), illustrates some of these difficulties—and ways overcome them. This case study focuses on comparisons of monitoring data with numeric "anti-degradation" regulatory standards for 12 water quality parameters (such as dissolved oxygen) pertaining to the MDSRR, and 10 parameters pertaining to the UDSRR. In the vast majority of cases, the data failed to conform to the regulatory standards: out of a total of 59 comparisons, the data fit within the standards in only five cases (8%). Most of the discrepancies resulted from technical problems and inconsistencies with the regulatory standards, the sampling (data generating) program, and the "recommended" data analysis procedures.

To be effective, regulatory standards, sampling programs, and data analysis procedures must be developed and implemented in a technically sound, consistent, and thoroughly integrated manner. Spatial and temporal variability (such as seasonal, diurnal, and flow-related variability) of each parameter of interest must be taken into account in developing regulatory standards and sampling and data analysis procedures.

Maintaining organizational focus and accountability also can be challenging, but is very important. External professional review of monitoring and regulatory programs can be very helpful. Timely (annual) and appropriate data analysis and reporting are necessary to recognize and fix problems quickly, and maximize the benefits of monitoring programs.

Background of Monitoring Program and Special Regulations

Since 1984, the Delaware River Basin Commission (DRBC) and NPS have cooperatively conducted the "Scenic Rivers Water Quality Monitoring Program" in the upper 121 miles of the Delaware River. This section of river includes the MDSRR and the UDSRR. While there is no dam on the main stem of the Delaware River, water released from dams on the major tributaries to the river typically comprise 70% or more of the main stem flow through this section of river. Much of the region has been experiencing rapid human development throughout the past 20 years.

The DRBC has primary regulatory authority over waters of the Delaware River. In December 1992, after six years of effort, the DRBC, with support from NPS, adopted "Special Protection Waters" regulations. These regulations are intended to prevent degradation of this section of the Delaware River (DRBC 1996), while allowing human development to continue. These regulations stipulate that: (1) there be *"no measurable change* in existing water quality except towards natural conditions"; (2) *"existing water quality"* is defined numerically by "reach-wide" means and 95% confidence limits for the concentrations of selected water quality variables (such as dissolved oxygen) at UDSRR and the MDSRR; (3) *"measurable* *change"* is defined as "a mean concentration outside of the 95% confidence limits that define existing water quality."

Numeric water quality standards for 16 parameters for the MDSRR and 14 parameters for the UDSRR are specified in these regulations (DRBC 1996). The numeric standards were derived from pre-existing data compiled from a variety of sources (the Scenic Rivers Monitoring Program [SRMP], the U.S. Geological Survey, and state agencies of New York, Pennsylvania, and New Jersey). For some water quality variables, such as biological oxygen demand and fecal coliform, the regulations stipulate that sample data must be collected in the period May–September if they are to be compared with the standards. For other variables, such as conductivity and dissolved oxygen at MDSRR, the regulations allow sample data to be collected anytime throughout the year and compared with the standards.

From 1984 to 1993, water quality samples were collected approximately every two weeks during the period May–September as part of the SRMP. The data collected through 1991 were included in the data sets used to create the regulatory, numeric definitions of "existing water quality." In 1994, the monitoring program was "redesigned" (DRBC and NPS 1995), and water quality samples were collected only once a month—but throughout the entire year, to the extent feasible. Part of the rationale for this change was that intensive sampling during May through September was no longer necessary, since the regulatory standards had been established, and that sampling throughout the year might provide other useful information.

Monitoring Data Compared with the Regulatory Standards

Unfortunately, ten years passed before the water quality monitoring data collected after the regulations were established were compared with the regulatory standards. Changes in organizational structures, priorities, and personnel within the DRBC and NPS contributed to this delay. In 2002, I completed a report that compared water quality data (collected from 1992 through 1998) for 12 parameters pertaining to the MDSRR and 10 parameters pertaining to the UDSRR with the numeric regulatory standards (Evans 2002).

Methods. In accord with the regulations (DRBC 1996) and guidelines for the monitoring program (DRBC and NPS 1995), "cumulative means" for each of the water quality variables were calculated and compared with the regulatory standards. Cumulative means are averages calculated from a required minimum number of data points; in this case, 200 (DRBC and NPS 1995). The time required for the SRMP to accumulate this number of data points for any given parameter was typically three to four years; hence the term "cumulative."

As an alternative, I calculated "yearly means and 95% confidence intervals"—calculated separately for each year of data, regardless of the number of data points included—and compared these with the standards. I also evaluated seasonal changes in dissolved oxygen and specific conductance, and compared these with their "non-seasonal" regulatory standards.

Results. A total of 59 cumulative means were calculated and compared with the regulatory standards. Only 5 (or 8%) of these means fell within the regulatory standards; 54 (or 92%) were outside of the standards. At least 13 (22%) of the cumulative means represented change away from, rather than towards, natural conditions. Specifically, these were (1) low dissolved oxygen in the MDSRR, (2) high specific conductance in the UDSRR, and (3) high "seasonal" total Kjeldahl nitrogen in both the MDSRR and UDSRR.

A total of 86 yearly means with 95% confidence limits were calculated and compared with the regulatory standards. The yearly 95% confidence intervals included the regulatory standards in 26 (30%) of these comparisons; the confidence intervals were outside of the regulatory standards in the other 60 (70%) comparisons. At least 11 (13%) of these comparisons indicated change away from, rather than towards, natural conditions. Again, these were (1) low dissolved oxygen in the MDSRR, (2) high specific conductance in the UDSRR, and (3) high "seasonal" total Kjeldahl nitrogen in both the MDSRR and UDSRR.

Dissolved oxygen and specific conductance showed pronounced seasonal changes in the MDSRR, in contradiction to the "non-seasonal" regulatory standards. Dissolved oxygen concentrations increased dramatically through the fall and winter, in concert with decreasing water temperatures. Specific conductance decreased dramatically through the fall and winter, and reached peak levels in July and August.

Mean dissolved oxygen concentration in the MDSRR was significantly higher in 1994 (about 10.5 mg/l), when year-round sampling occurred, than in 1993 (about 8.8 mg/l) when sampling occurred only during May through September. Specific conductance was dramatically lower in 1994 (about 42 *u*mhos/cm, 25^{o}C) when year-round sampling occurred, than in 1993 (about 80 *u*mhos/cm, 25^{o}C), when sampling occurred only May through September.

Conclusions and Recommendations

The fact that only 5 of 59 cumulative means (8%) calculated from SRMP data between 1992 and 1998 fell within the established regulatory standards is clearly a problem. At least 13 (22%) of the means represent change away from, rather than towards, natural conditions. If these results do not reflect real changes away from natural conditions, they reflect problems with the monitoring (data generating) procedures, the data analysis procedures, and the regulatory standards.

Regulatory standards. Several technical flaws appear to exist in regulatory standards. The "non-seasonal" regulatory standards for dissolved oxygen and specific conductance in the MDSRR do not reflect the very pronounced seasonal changes in these variables, and therefore are of little or no use. These regulatory standards should be revised to be seasonally specific. What I have been referring to as "specific conductance" is actually listed in the regulatory standards simply as "conductivity." Whereas specific conductance is adjusted for water temperature, and so would be more stable through the changing seasons of the year, Conductivity is not. Similarly, it would be advantageous to develop a standard for *percent oxygen saturation,* which would be relatively stable throughout the year, rather than dissolved oxygen, which is not.

The lower limits of the regulatory standards for all the parameters considered here, except dissolved oxygen, do not seem to have any practical use. Thus, for simplicity and clarity, these lower limits could be removed from the regulations.

Completely separate "non-seasonal" and "May–September" regulatory standards exist for ammonia + ammonium, total Kjeldahl nitrogen, and nitrite + nitrate for the MDSRR. But this is not logically defensible, because a "non-seasonal" standard must include the values of a seasonal standard.

Comparison of fecal coliform data with the regulatory standards is difficult because typically some samples have fecal coliform colonies that are "too numerous to count" (TNTC). A fecal coliform standard based on the frequency of occurrence (percentage) of samples having more than 200 colonies/100 ml (the limit for contact recreation such as swimming) would avoid or minimize this problem. This approach would simplify data analysis and interpretation, and be directly useful to park managers.

Sampling. The dramatic changes in MDSRR dissolved oxygen and specific conductance from 1993 to 1994 and later were most certainly due to changes in the time of year that samples were collected (from May–September to year-round). Such changes in any monitoring program should not be made without first determining the effects of the changes on the data produced.

Data analysis. The "cumulative mean" is not necessary and has several major disadvantages. The supposed need for this method developed out of the mistaken idea that enough data must be accumulated to "replicate" the data set used originally to calculate the regulatory standards. This is just erroneous. Furthermore, this method does not incorporate any information about the amount of uncertainty associated with the calculated cumulative mean. Because several years of data must be combined (typically three to four years), changes from year to year are "damped," and thus less detectable. Also, when there is substantial variation between years, the amount of hidden variation within a "cumulative mean" increases greatly, and can easily exceed that of a yearly mean. Finally, the combination of several years of data precludes (or at least severely complicates) analysis for trends. In short, yearly changes and trends are more difficult to detect, and take longer to detect, using this method than using the yearly mean and confidence interval method.

The yearly mean and confidence interval method has many significant advantages. This method provides valuable information about uncertainty (precision) of the calculated mean. In many cases, the statistical precision obtained using the yearly mean method is as good as—and in some cases much better than—that obtained using the cumulative mean method. The yearly mean and confidence interval method also allows independent, annual comparisons of the data with the standards, and statistical analysis of trends.

Improving programs. A number of the changes suggested above are under consideration and are likely to be implemented in the near future. For example, a May–September dissolved oxygen standard for the MDSRR has been proposed, as well as a standard for percent oxygen saturation. For the past two years, the MDSRR has used the yearly mean and confidence interval method to analyze data and produce informative annual reports. Critical analysis and evaluation is leading to improvements in our monitoring and regulatory program and better protection for water quality of the Delaware River—and, one hopes, other waters as well.

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Lakewater Chemistry at Acadia National Park, Maine, in Response to Declining Acidic Deposition

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Introduction

Title IV of the 1990 Clean Air Act Amendments (CAAA) sets target reductions in the United States for sulfur and nitrogen emissions from industrial sources to reduce the acidity in deposition. These reductions have continued the trend of reductions in emissions and deposition of sulfur during the past 30 years, with the rate of decline accelerated by Phase I of the 1990 CAAA that was implemented in 1995 (Lynch et al. 2000). Slight reductions in nitrogen emissions have occurred since 1996.

One of the intended effects of the CAAA reductions was to decrease the acidity of low-alkalinity waters and thereby improve their biological condition. The key science and policy questions related to the CAAA are whether (1) the declines in emissions yield reductions in acidic deposition; (2) changes in deposition cause changes in surface water chemistry; and; (3) biologically relevant water chemistry has improved in acid-sensitive regions as a result of changes in deposition.

Documentation of acidification of surface waters began in Scandinavia (e.g., Oden 1968), although reports of acidic lakes date back to the 1950s in North America (Gorham 1957). Recognition of the issue became common in the U.S. in the early 1970s (Likens et al. 1972), with identification of impacts on fish by the mid-1970s (e.g., Schofield 1976). Trend assessments for surface waters have been common in the literature for more than a decade, with the general conclusion that surface water recovery is slow to non-existent (Stoddard and Kellogg 1993; Webster et al. 1993; Kahl et al. 1993; Driscoll and van Dreason 1993; Dewalle and Swistock 1994; Driscoll et al. 1995; Likens et al. 1996; Mattson et al. 1997; Stoddard et al. 1998; Driscoll et al. 2001; Skjelkvåle et al. 2001; Evans and Monteith 2001; Stoddard et al. 2003).

This paper reports on lake chemistry data collected at Acadia National Park since 1982 (Kahl et al. 1985; Figure 1), and puts the response to acidic deposition in the context of the recent assessment of the response of surface waters in the northeastern United States to changes in atmospheric deposition (Stoddard et al. 2003).

Why do we care about lake and stream chemistry? Long-term chronic acidification and short-term temporary episodic acidification are of concern in regions receiving acidic deposition. Surface water chemistry is a direct indicator of the potential deleterious effects of acidification on biotic integrity. Because surface water chemistry integrates the sum of processes upstream in a watershed, it is also an indicator of the *indirect* effects of watershed-scale impacts, such as nitrogen saturation, forest decline, or soil acidification.

Biologically relevant surface water chemistry. The main cause for concern over the effects of surface water acidification in the U.S. and elsewhere is the potential for detrimental biological affects (Baker and

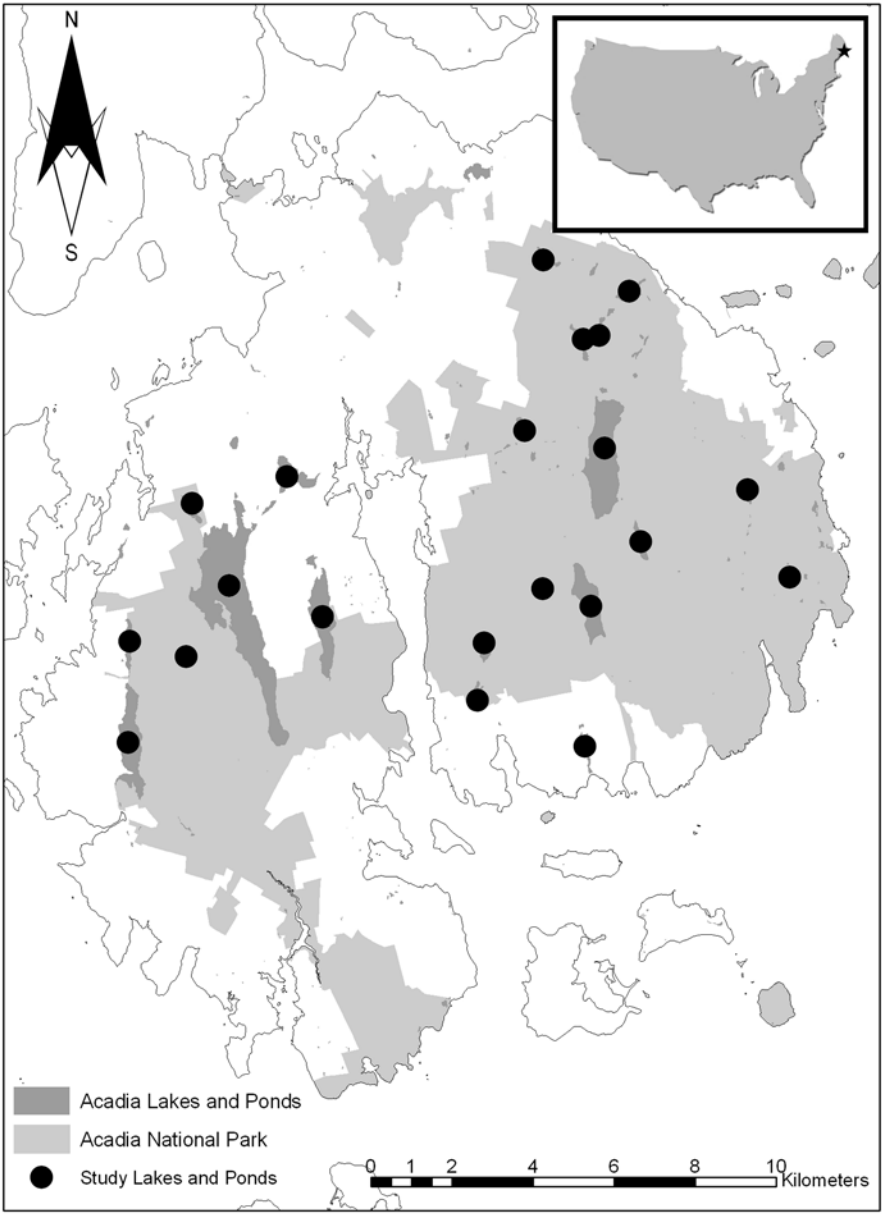

Figure 1. Location of Acadia National Park on Mount Desert Island in Maine, USA, with locations of study lakes and ponds.

Christensen 1991; NADP 1998). Typically, there is concern for biological impact if surface water pH is less than 6. At low pH values, aluminum may be present at concentrations that are toxic to biota, including sensitive life stages of fish and sensitive invertebrates. Aluminum is an abundant and normally harmless component of rocks and soils. However, it leaches from silicate minerals when they come in contact with low-pH waters. While much of the aluminum present in surface waters is organically bound and relatively non-toxic, certain inorganic species are highly toxic.

Nitrogen saturation. One of the key remaining research issues is the role of nitrogen in watershed responses to acidic deposition. The concept of *nitrogen saturation* (Aber et al. 1989; Stoddard 1994) received increasing attention in the 1990s (Mitchell et al. 1996; Williams et al. 1996; Aber et al. 1998). "Nitrogen saturation" is defined as deposition of nitrogen to a watershed in excess of the assimilative capacity of soils and vegetation, resulting in the export of nitrate (NO_3). Nitrate export can contribute to acidification (especially episodic acidification), mobilization of aluminum, and leaching of cations from soils (Aber et al. 1998).

Methods

This paper uses long-term records of wet deposition from the NADP (http://nadp.sws.uiuc.edu/), repeat surveys of lake chemistry at Acadia National Park dating back to 1982 (Kahl et al. 1985; Kahl 1996), data collected by the park's resource management division, and long-term records of lake chemistry from research conducted in New England (Kahl et al. 1991; Stoddard et al. 2003). The lake data from Acadia cover the period from 1982 to either 1998 or 2000, depending on the availability of data at each site. Accepted Environmental Protection Agency (EPA) methods and quality assurance are documented in various publications (Nelson and Kahl 2003; Morrison 1989; Newall et al. 1987; Hillman et al. 1986).

Results and Discussion

Declines in sulfate deposition. Sulfate concentrations declined substantially in the northeastern U.S. at a median rate of between –1.0 and –1.5 μeq/L/year for the period 1990 to 2000 (Table 1). At Acadia's NADP site, the rate of change in sulfate was –0.53 μeq/L. Changes in sulfate emissions correspond directly to changes in sulfate deposition.

Declines in nitrate emissions and deposition. Decreases in NO_x emissions were more modest than those of sulfur (Table 1). There was a slight increase in nitrogen deposition at the park. Since 1990, total utility NO_x emissions (Phase I and II sources) were reduced an average of 23% nationally, following implementation of Phase I of the Acid Rain Program. However, electric utilities contribute only about one-third of total NO_x emissions. Total NO_x emissions from other sources have remained relatively constant (motor vehicles and other industrial sources also contribute significantly), and therefore the reductions achieved under the Acid Rain Program have not resulted in a significant change in total NO_x emissions and deposition.

Increases in pH and base cations in deposition. Lynch et al. (2000) found significant declines in hydrogen ion at many NADP stations during 1990–2000, at rates that were less than the decrease in sulfate. Wet deposition of hydrogen ion decreased in every region (Table 1). Base cation deposition increased non-significantly in the northeastern U.S., continuing the pattern of flat-to-increasing base cation deposition at most stations in the

Table 1. Regional trend results (1990–2000) for atmospheric deposition (wet-only annual concentration data from NADP/NTN network) in acid-sensitive regions (from Stoddard et al. 2003). All units are μeq/L/yr. Values are the median slopes for each region, with significance determined by calculating confidence intervals around each regional median. Data for Acadia are the NADP results for the station at McFarland Hill (NADP 2002). Base cations are defined here as the sum of Ca + Mg (^{ns} regional trend not significant, $p > 0.05$; * $p < 0.05$; ** $p < 0.01$).

Region	SO_4	Nitrogen	NO_3	Base Cations	Hydrogen Ion
New England	-0.96**	-0.26*	-0.20**	+0.02^{ns}	-0.81**
Adirondacks	-1.47**	-0.37**	-0.38**	+0.01^{ns}	-1.48**
Acadia NP	-0.53**	+0.04^{ns}	+0.05^{ns}	+0.17**	-0.29*

region during the past 20 years. Deposition of base cations increased significantly at Acadia, driven by decadal increases in deposition of marine salts from the Gulf of Maine (Figure 1).

Status of surface waters. The National Surface Water Survey (NSWS) documented the status and extent of chronic acidification during probability surveys conducted from 1984 through 1988 in acid-sensitive regions throughout the U.S. (Linthurst et al. 1986; Landers et al. 1988; Kaufman et al. 1988). The NSWS concluded that 4.2% of lakes in the northeastern U.S. were acidic. The Adirondack Mountain region had the greatest proportion of acidic surface waters (14%) for lakes larger than 4 ha. Counting smaller lakes, the Adirondack Lake Survey Corporation estimated that 26% of lakes larger than 0.5 ha were acidic (Driscoll et al. 1991). The large numbers of lakes in these regions translate to several hundred acidic waters in each region. At Acadia, Sargent Mountain Pond and Duck Pond are acidic, representing 9% of the 21 lakes sampled. This is a higher percentage than in the rest of Maine, reflecting the granitic bedrock and thin soils common at Acadia.

Changes in surface water chemistry. Our analysis of surface water response to changing deposition focuses on the key variables that play major roles in acidification and recovery: sulfate and nitrate, base cations, pH and ANC (acid neutralizing capacity), and DOC (dissolved organic carbon), a possible indicator of changes in natural organic acidity.

Sulfate (SO_4) declined in surface waters in the glaciated regions of the northeastern U.S. by median values of between –2 and –4 μeq/L/year (–0.4 μeq/L at Acadia; Table 2). The declines in SO_4 concentrations are almost certainly direct responses to declining emissions and SO_4 deposition in the 1990s, and represent the most dramatic effects of Title IV of the CAAA and previous emissions regulations. These changes in emissions and deposition continue the trend in declining SO_4 that has been occurring for three decades (Stoddard et al. 2003).

Stoddard et al. (2003) concluded that surface waters in glaciated terrain have, on average, responded relatively rapidly to the decline in sulfate deposition. Additional reductions in deposition will result in additional declines in surface water concentrations of sulfate in glaciated terrain.

Changes in NO_3 were much smaller than changes in SO_4, with the only significant changes occurring in the two regions with the highest ambient NO_3 concentrations. Most waters at Acadia have low NO_3 concentrations. However, sites such as the PRIMENet sample site at Hadlock Brook have significant leakage of NO_3, and there is no indication in the data that NO_3 concentrations have declined at Hadlock Brook as they have in many other areas during the 1990s. These

Table 2. Regional trend results for long-term monitoring sites for the period 1990 through 2000 (Stoddard et al. 2003). Values are median slopes for set of sites in each region. Units for sulfate, nitrate, base cations [Ca + Mg], Gran ANC and hydrogen are μeq/L/year. Units for DOC are mg/L/year (insufficient historical data at Acadia). Units for aluminum are μg/L/year (^{ns} regional trend not significant, $p > 0.05$; *$p < 0.05$; ** $p < 0.01$, NA insufficient data).

Region	SO_4	NO_3	Base Cations	Gran ANC	Hydrogen	DOC	Aluminum
New England Lakes	-1.77**	+0.01^{ns}	-1.48**	+0.11^{ns}	-0.01^{ns}	+0.03*	+0.09^{ns}
Adirondack Lakes	-2.26**	-0.47**	-2.29**	+1.03**	-0.19**	+0.06**	-1.12**
Acadia lakes	-0.39*	-0.06^{ns}	-0.43*	+0.33^{ns}	+0.02^{ns}	NA	+0.05^{ns}

unexplained changes in NO_3 in many surface water concentrations at a time of stable nitrogen deposition underscore the complexities of nitrogen biogeochemistry. We expect that that a decline in nitrogen deposition will lead to general declines in surface waters, but the timing and the correlation cannot be predicted at this time.

Increasing ANC is the main indicator of recovery from acidification. In the northeastern U.S., there were modest increases in the Adirondack region and at Acadia (Table 2). Hydrogen ion (acidity) followed ANC with small declines in each region.

The largest recovery should be possible at sites that have undergone the most severe acidification. Stoddard et al. (2003) analyzed Gran ANC trends by ANC class and determined that the most impacted sites recovered faster in the 1990s. Sites with ANC less than zero gained ANC four times faster than sites with ANC greater than 25 μeq/L. The average increase in ANC was 12% for acidic lakes, 7% for low-ANC lakes, and less than 1% for lakes with ANC greater than 25 (Figure 2), suggesting that ANC values are converging during the recovery process toward an ANC that may be in the range of 25 to 30 μeq/L ANC (Stoddard et al. 2003).

One of the most universal watershed responses to acidic deposition is the mobilization of base cations from soils. As rates of acidic deposition decline, and the supply of acid anions to watershed soils decreases, the rates of cation mobilization are also expected to decrease. Lowered rates of cation mobilization translate to declines in surface water base cation concentrations, a change widely observed in the northern hemisphere for more than a decade. All of the glaciated regions in the northern and eastern U.S. exhibited significant declines in base cation [Ca + Mg] concentrations in the range of –1.5 to –2.5 μeq/L/year. This decline in base cations offsets some of the decline in sulfate concentrations, and limits the extent of recovery.

Conclusions

The rate of change in surface water ANC appears to largely be the result of changes in acid anions versus base cations, as represented by:

Change in ANC = change in [Ca + Mg + Na + K] minus change in [SO_4 + NO_3 + Cl]

Regionally, SO_4 has decreased at a rate of approximately –2.5 μeq/L/year (the mean of regional median slopes), and NO_3 at a rate of

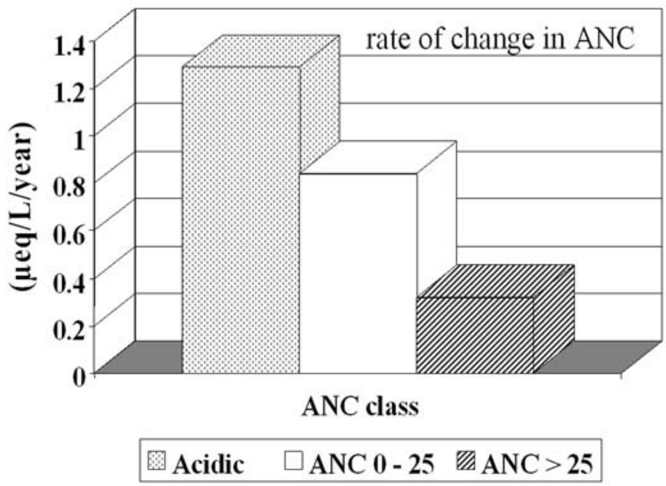

Figure 2. The lowest ANC (highest-acidity) lakes in the Northeast are responding fastest to declining acidic deposition.

−0.5 μeq/L/year, in surface waters of glaciated terrain. These rates of change set an upper limit to our expectation of ANC recovery of +3 μeq/L/yr (i.e., the sum of declines in SO_4 and NO_3). The actual increase in Gran ANC is about +1 μeq/L/year, because the decline in SO_4 and NO_3 (acid anions) has been offset by a decline of 1.8 μeq/L/year in base cations. At some sites, the decline in base cations has exceeded the decline in acid anions, and these sites have acidified.

This general pattern occurs in the lakes at Acadia. For example, Ca + Mg in Bubble Pond declined at a rate of 0.6 μeq/L per year, while sulfate was declining faster, at 1.2 μeq/L per year. The difference is a 0.6 μeq/L-per year increase in ANC, exactly the rate of increase in the data. Conversely, The Bowl has acidified slightly because base cations decreased faster (–0.6 μeq/L per year) than the acid anions (–0.3 μeq/L per year).

Regionally, there has been some recovery in ANC, especially in the lowest-ANC waters. Stoddard et al. (2003) estimated that there are about one-third fewer acidic lakes (ANC < 0) in the Northeast during the past 15 years, although these lakes still have very low ANC. At Acadia, Sargent Mountain Pond and Duck Pond both have higher ANC (less acidity) in 2000 compared with 20 years ago, but both are still acidic (i.e., negative ANC).

We do not know if the rates of increase in ANC will continue without further reductions in deposition. This is the major uncertainty for rates of recovery: to what extent is recovery resulting from recent changes in deposition already reflected in current surface water chemistry, or are further reductions in deposition necessary to continue the present trends? The only way to answer this question is to maintain the commitment to long-term assessments of surface water chemistry in regions such as Acadia that have waters that are sensitive to the effects of acidic deposition.

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California Condors of the Colorado Plateau

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The spring of 2001 brought a significant event to the skies over the Colorado Plateau and the hidden caves and ledges of Grand Canyon National Park. For the first time in over 100 years, California condors laid an egg in the wilds of Arizona. Although they promptly broke the egg, hopes for successful breeding of condors and restoration of this extirpated species were encouraged. Then, in the spring of 2002, two pairs of condors laid eggs in remote caves below the South Rim of the park. Although the eggs initially appeared viable, both nests failed.

The discovery of these eggs came at an opportune moment for the condor restoration program, which, at the time, was about to begin a five-year review of reintroduction efforts. The program has been under fire lately by some scientists who argue that too many of the released birds are dying due to various causes. Back in the wild, condors continue to succumb to old hazards. In spite of aversive training and conditioning to keep condors away from humans and their structures, condors continue to be killed by collisions with power lines, consumption of antifreeze, and lead poisoning. These dangers create a quandary for the biologists trying to restore the species in both Arizona and California. How can they save these creatures from near-extinction, only to release them back into a world where the same threat awaits them?

At Grand Canyon National Park, staff biologists took a proactive approach. Power lines and poles throughout the developed zone have been fitted with devices to deter collisions. Human structures in locations where condors are tempted to perch or roost have an aluminum wire deterrent called *Nixalite* temporarily affixed to the rooftops to prevent landing. Funded by the National Fish and Wildlife Foundation and the Grand Canyon National Park Foundation, a condor biologist constantly patrols the areas of high visitor use, tracking birds and managing visitors, in hopes of decreasing encounters between humans and condors.

The release program has provided strong support for the hypothesis that the decline of the original wild condor population, in progress since at least about 1950, was due primarily to lead poisoning. Many biologists hypothesize that ingestion of lead bullets found in animal carcasses scavenged by condors may have been a primary factor in their decline. To address this concern, rangers in the park use copper slugs to dispatch animals wounded by vehicles. Moreover, a breakthrough that biologists are cheering is a so-called "green bullet" developed by the U.S. Army. Instead of lead, the bullet's core is made of tungsten and tin or tungsten and nylon, and the cost is just slightly higher than lead. Recently, the resource staffs of Lake Mead and Glen Canyon national recreation areas and Grand Canyon National Park met to discuss placing restrictive measures on the use of lead in hunting and fishing activities within the parks and recreation areas. Discussions are in early stages and are very complex. The resolution of this one issue may result in a sharp decline in scavenger, waterfowl, and raptor mortalities across the West in the near future. Further discussions will take place at the next California Condor Recovery Team meeting.

While the existing monitoring and release program is an important aspect of the recovery efforts, more scientific data collection will be incorporated in order analyze habitat utilization by the birds. For Grand Canyon National Park, this is necessary in order to incorporate recent and pertinent information into park planning and NEPA (National Environmental Policy Act) documents and to help analyze potential recreational impacts. Continued monitoring through the use of radio transmitters in addition to new satellite tracking units will allow for critical data collection in canyon country, where logistics are difficult at best.

As reintroduction efforts in Arizona continue, so do similar efforts with the California population. Defenders of Wildlife and the Ventana Wilderness Society have developed an environmental assessment for both the National Park Service (NPS) and U.S. Fish and Wildlife Service (USFWS). Led by the USFWS condor recovery coordinator and the staff at Pinnacles National Monument, scoping meetings resulted in favorable public support for the reintroduction efforts. Staff at Pinnacles hope to have condors flying over another NPS unit very soon.

Following the five-year review process, Grand Canyon National Park, USFWS, and the Peregrine Fund are working closely with adjacent land management agencies, such as the Bureau of Land Management (BLM), U.S. Forest Service, and the Navajo, Hualapai, and Havasupai tribal nations, to prepare for the upcoming breeding season and the challenges it holds.

The park is also launching a long-term monitoring plan for this highly endangered bird. The plan will include the development and implementation of a park-wide plan that addresses the conflicts between human and condors. To date, grants from the Grand Canyon National Park Foundation and National Fish and Wildlife Foundation have funded the salary of a condor technician, travel to critical Recovery Team meetings, and telemetry equipment that includes receivers for BLM staff to monitor the birds as they move across the Arizona Strip area. The importance of these tasks cannot be overstated. This program operates on a mere $20,000 per year, awarded from the Grand Canyon National Park Foundation. In order to expand the program and meet the goals and objectives of the Recovery Team, serious consideration must be given to base-funding the threatened and endangered species program at Grand Canyon National Park.

It is critical that the ecological aspects of the recovery efforts be given high priority. It is not merely enough to "preserve" the species; we must examine and collect the appropriate data on distribution, abundance, and ecological relationships of the California condor. We must ensure that suitable habitat for survival, reproduction, and recruitment is stable, both inside and outside of park boundaries, in order to reach a long-term goal of a viable yet *unmanaged* population of condors in the wild.

Grand Canyon National Park is a primary cooperator in the multi-agency project to re-establish the California condor to the southwestern United States. In addition to providing input on project issues and direction, the park also has protection and management responsibilities for condors within the park. Therefore, the primary goals of this project are to (1) contribute to the monitoring effort and daily management of condors within the park; (2) manage condor/visitor interactions and educate the public about condor natural history and the recovery effort; and (3) record a variety of biological information (e.g., habitat use, movement patterns, breeding activity, feeding and roosting patterns, intra- and interspecific social interactions, etc.) regarding condor activity inside the park.

During the 2002 season, two condor pairs nested in caves near the South Rim of the Grand Canyon. This was truly a landmark event since the nests represented two of only eight total nests in the wild that have been established between Arizona and California since the beginning of the reintroduction program. Biologists spent a considerable amount of time monitoring the breeding activity and helped coordinate a volunteer nest-watching program consisting of over 25 volunteers. Although the nesting attempts were unsuccessful, the information learned will be critical for monitoring the upcoming breeding season. In addition to monitoring the breeding activity, we also documented 13 carcasses on which condors fed within the park, and 21 carcasses just outside the park. Furthermore, three main communal roosting areas for condors were documented near the South Rim.

The year 2003 has proven to be an exciting and eventful one for the program. At the time of this writing, biologists are eagerly awaiting the fledging of the Arizona's first wild condor chick in over 100 years! The chick appears healthy and active in a remote canyon near the South Rim. Fledging in expected in late October or early November.

In upcoming seasons, we will again focus on monitoring the breeding activity of the condors inside the park, documenting movement corridors of condors moving to and from the park, and studying the condors habitat use and feeding/roosting activity. Currently, Grand Canyon National Park is involved in a formal consultation with USFWS regarding the effects of the air tour industry on condors. One priority will be to improve our understanding of condor flight patterns and movement corridors, and contribute scientific information to the consultation process. Finally, we will work with the Federal Aviation Administration (FAA) to organize safety classes to educate pilots in the Grand Canyon area about the condor project, condor behavior, and ways for avoiding conflicts with condors.

Future Goals and Objectives

Grand Canyon National Park biologists will work toward achieving the following goals and objectives in order to ensure the success of the recovery of the California condor in northern Arizona:

1. Develop a long-term monitoring plan and protocols coordinated with the agency members involved in the reintroduction efforts in the field. This plan will address, respond to, and prevent negative condor and human interactions.
2. Develop effective and innovative educational materials addressing condor issues that can be utilized throughout the home range of the condor.
3. Work closely with the western regional EPA coordinator to locate sources of lead within the park and clarify lead's effect on wildlife species.
4. Analyze tissue samples collected from the condor's prey base (deer, elk, and bighorn sheep), when carcasses are accessible, by working closely with the Arizona State Veterinary Laboratory in Tucson. Samples of road kill, relocated animals, and other scavenger species within the park (deer, elk, bighorn, squirrels, rabbits, coyote, gray fox) will be collected for lab analysis of lead, environmental contaminants, and other human-associated toxins. Tissues from carcasses along the river corridor will be collected during the annual wildlife monitoring trip and other park resource trips to sample the river corridor prey base and its environment.
5. Prepare and implement standard operating procedures and protective measures. These will be incorporated in NEPA documents, and communicated to park and project staff in conjunction with general management plan construction activities. A similar protocol will be established that addresses the Fire and Aviation Program as it directly relates to helicopter traffic in the park. This is critical when pairs are nesting in a typical administrative flight corridor.
6. Coordinate with Peregrine Fund field staff to test and implement appropriate hazing techniques and effective perching and roosting deterrents in order to decrease human/condor interactions and to ensure protection from hazardous sites, such as the Orphan Mine and areas of dense human concentration.
7. Implement more sophisticated monitoring of the condors. This will allow for better coordination between USFWS, Peregrine Fund, and NPS field crews and improve methods of recording, summarizing, and analysis. It will also assist in determining the location of contaminated carcasses in hopes of responding in a timely manner before more birds feed on them and then succumb to lead poisoning or other toxins. This will provide information regarding established flight corridors within and outside of the park in order to consult with USFWS on FAA overflight issues, as well as in-house administrative flights.
8. Coordinate a Condor Nestwatch Program, consisting of interested volunteers and staffed by a seasonal technician, in order to collect pertinent breeding, nesting, and brooding data.

9. Work closely with the Grand Canyon National Park Foundation and the National Fish and Wildlife Foundation to raise funds for the continued implementation of the condor program within the park.
10. Work closely with the National Fish and Wildlife Foundation to fund a park technician, purchase telemetry equipment, and assess the issue of lead in the environment.
11. Continue to work closely with Recovery Team partners in achieving goals and objectives associated with the long-term recovery of the species.

A Historical Overview of Consumptive Use Patterns in National Park Service Areas

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Perhaps for the sake of argument, I'd like to begin our discussion by deconstructing the broadly held notion that consumptive uses really have no pleace, or at best a marginal place, in the National Park System. Most if not all of us, after all, grew up with the idea that parks were special places, and to many of us, what made them special was that they were havens safe from all those consumptive, ecologically destructive practices that took place everywhere else.

So I'd like to look a little deeper into this notion—not so much to debunk it but to put it into broader historical perspective. Because what rises to the surface, after a little historical investigation, is that consumptive uses, to some degree, have been allowed in quite a number of park units. Political necessity, changing societal attitudes, and the agency's growth over the years have created a constantly changing context for consumptive use patterns.

Perhaps the best template for establishing the National Park Service's (NPS's) philosophical stance toward consumptive uses is the well-known 1918 letter that was written by Horace Albright and signed by Franklin Lane, President Wilson's Interior Secretary. That letter unequivocally noted that "hunting will not be allowed in any national park," but it also noted that "mountain climbing, boating and *fishing* will ever be the favorite sports" [author's emphasis]. The next general statement on the subject took place in 1938, when the first Code of Federal Regulations (CFR) was published. The CFR stated that "the parks and monuments are sanctuaries for wildlife of every sort, and all hunting ... of any wild bird or animal ... is prohibited within the limits of the parks and monuments." The CFR also stated that "fishing with nets, seines, traps ... or for merchandise or profit, or in any other way than with hook and line ... is prohibited."

But what neither the Lane letter nor the general regulations noted, however, was that many of the so-called crown jewel parks allowed exceptions to the no-consumptive-use rule. For instance:

- Yellowstone allowed unrestricted hunting and fishing from 1872 to 1894;
- At Yosemite, in the years both before and after 1900, Native Americans quite visibly carried on hunting, fishing, and gathering activities in Yosemite Valley;
- At Mount Rainier, authorities went to great lengths to arrest Native hunting parties in the park, but they tolerated and even encouraged spear fishing because of its interpretive value;
- At Glacier, Blackfeet Indians responded to the park's 1910 establishment by ignoring the law and hunting as they had for generations; and
- At Mesa Verde, Ute Indians responded to a 1911 park expansion by also flouting the law, when they regarded as hostile and unfair.

By the time NPS was established in 1916, some of these consumptive uses had ended of their own accord, and in a few other cases, these uses were slowed or stopped by NPS enforcement actions in later years. Congress, however, selectively bucked that trend by allowing new exceptions to the no-consumptive-use rule. In the Territory of Alaska, the 1917 act that established Mount McKinley National Park specifically allowed local prospectors and miners "to take and kill game or birds ... as may be needed for their actual necessities when short of food," and the 1938 law that expanded Hawaii National Park along the Kalapana coast—also in a U.S. territory—allowed subsistence fishing by local residents. And in other cases of new parks, as at Everglades and Olympic, harvesting by local native groups was tacitly allowed to continue. There were regulations against these activities, but harvests were so small that NPS officials tactfully decided against enforcement actions.

Perhaps more important than these individual cases, a number of structural changes in the National Park System have collectively softened the agency's anti-consumptive-use stance. Beginning in 1936, for example, the agency began administering its first national recreation area. Further clouding the picture, in 1937, was the first national seashore, and the first national lakeshore came along in 1966. Many of these recreation areas, seashores, and lakeshores allowed hunting, and several allowed commercial fishing as well.

In October 1974, a major new step in the agency's stance toward consumptive uses took place when Congress created the first two national preserves, at Big Thicket in Texas and Big Cypress in Florida. This designation specifically allowed hunting. The acreage in these units wasn't really all that large—about 800,000 acres—but what made them important was that they provided a bureaucratic mechanism for the establishment of new NPS units that similarly permitted hunting. During the mid-1970s, Congress was in the midst of considering the establishment of tens of millions of acres in new parklands in Alaska, and sure enough, December 1980 saw the Congressional passage of the Alaska National Interest Lands Conservation Act, which brought an additional 44 million acres into the National Park System. Of that total, all but about 3 million acres were open to hunting, fishing, and other subsistence activities by rural Alaska residents, and more than 21 million of those 44 million acres were part of national preserves, which were open to sport hunting by anyone with a valid hunting license.

So, by way of conclusion, it's true that Alaska's national park units contain far more acreage open to a broad range of consumptive uses than are available elsewhere in the National Park System. However, this generality is largely true because most of Alaska's park units were established fairly recently, and because society's attitudes toward our park neighbors have changed a good deal over the years. Finally, it's worth noting that the prohibitions in the 1918 Lane letter need to be seen as a product of their time. For a number of reasons, many NPS units have allowed consumptive activities over the years without jeopardizing the values and resources contained within them.

Mexican Spotted Owl Distribution and Habitat within Grand Canyon National Park

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Introduction

Because of significant threats to its habitat, the Mexican spotted owl *(Strix occidentalis lucida)* was listed as a "threatened species" in 1993 by the U.S. Fish and Wildlife Service (USFWS 1995). The Mexican spotted owl is widely distributed in montane and rocky canyonland ecosystems throughout the southwestern United States (Figure 1). The *Recovery Plan for the Mexican Spotted Owl* (USFWS 1995) listed the general inventory of Mexican spotted owls on National Park Service (NPS) lands as a primary research objective. In the Grand Canyon, the Mexican spotted owl uses the myriad tributary canyons of the Colorado River, where it nests and hunts in the steep rocky habitat distinctive of the Colorado Plateau province.

Figure 1. Distribution of the three subspecies of spotted owls inhabiting western North America (from USFWS 1995).

The patterns of habitat use observed for spotted owls in Grand Canyon contrast sharply with the owl's classic dependence on old-growth conifer forests (Ganey and Balda 1989; Willey 1995). Willey and Spotskey (2000) examined the characteristics of spotted owl breeding habitat at known nesting areas in Grand Canyon National Park using a geographic information system (GIS). They found that spotted owls use narrow, steep-walled canyons where ledges and caves provide cover from high temperatures, as well as nest sites and foraging habitat. In essence, complex, rocky terrain has been substituted for old-growth forest. Willey and Spotskey (2000) used GIS to identify key features of owl habitat and then map the extent of suitable habitat within the park's interior (Figure 2).

Given the owl's threatened status and recent evidence of population declines in the southwestern U.S. (Seamans et al. 1999), understanding the distribution of spotted owls and the extent of suitable breeding habitat in Grand Canyon is germane to the owl's long-term management. Therefore, we conducted this research to meet three main goals: (1) to test predictions of GIS models, and (2) to understand the distribution and (3) abundance of spotted owls in Grand Canyon National Park. We believe that the success of spotted owls inhabiting the Grand Canyon is relevant to the owl's conservation in the region because these owls may represent an important source population to surrounding areas (USFWS 1995). In addition, information on the distribution and status of the owl is needed by park managers for resource management planning and to construct baseline information on this threatened species.

Our primary goal during this project was to conduct systematic field surveys within predicted suitable breeding habitat within the interior of Grand Canyon National Park. We hoped to locate many new spotted owl territories and determine the distribution of spotted owls in the park. Accordingly, we implemented the following objectives:

1. We identified unsurveyed tributary canyons with accessible canyonland breeding habitat along the main Colorado River corridor through the Grand Canyon between Soap Creek and National Canyon.
2. Using the GIS habitat model, we proposed

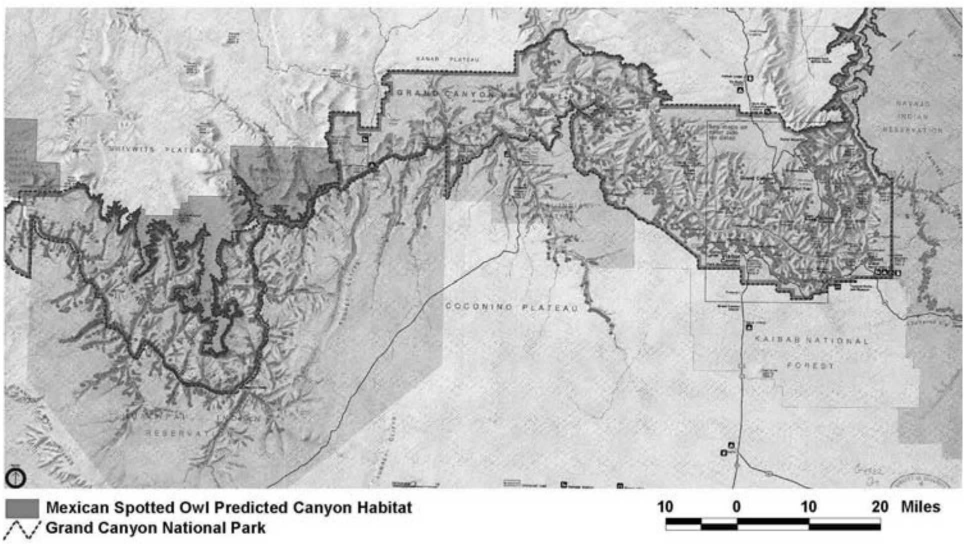

Figure 2. Distribution of predicted Mexican spotted owl breeding habitat, showing the primary cover types in Grand Canyon National Park, Arizona.

three key breeding habitats (strata): high-elevation steep-slope mixed conifer forest; mid-elevation steep canyonlands; and low-elevation steep canyonlands.
3. We selected sampling units within each habitat class within the park.
4. We systematically conducted point calling surveys for Mexican spotted owls within each habitat stratum for those tributary canyons accessible via the Colorado River between Soap Creek and National Canyon. The surveys were done March–August in 2001 and again in 2002.

Methods

We used a stratified-random sampling procedure in ArcGIS (ESRI 1996) to select 80 survey sites within each of three habitat classes identified by our GIS model (Willey and Spotskey 2000): high-elevation steep-slope mixed conifer forest; mid-elevation steep canyonlands; and low-elevation steep canyonlands. All sites were visited once during the breeding season (March–September) and most sites were accessed using river expeditions starting at Lee's Ferry and floating downriver to Diamond Creek.

Field survey procedures followed standardized protocols developed by spotted owl field biologists (Willey 1989; Franklin et. al 1990; Rinkevich 1991). At each survey area, a team of two to six owl hooters left the river and hiked up the side canyons to establish calling routes within suitable habitat identified at the survey sites by the GIS field maps. At each survey site, we established calling routes that systematically surveyed all suitable habitat. Along routes we placed calling stations every 0.5–1.0 km, and at each calling station we imitated spotted owls by producing a variety of standard calls for 30 minutes (Ganey 1990). All calling points were surveyed once during the field season. We also visited several historical spotted owl territories located along the river to assess occupancy status.

Results and Discussion

During the first year of field surveys (summer 2001), we conducted four river expeditions. The surveys were completed within 37 tributary canyons using 240 independent calling stations. Mexican spotted owl adults were detected at 15 of the 37 sites (Table 1). Results in 2001 included eight sites with single owls and seven sites with owl pairs (Figure 3). Although no previous nesting evidence had been observed prior to our work, we observed direct evidence of nesting by spotted owls. The first active nest was confirmed in Grand Canyon when two owlets, approximately 50 days old, were observed near Fossil Bay.

During the 2002 field season, surveys were completed at 43 unique study sites using 240 calling stations. Single adults were detected at eight sites and pairs at five sites. Thus, we located 13 new owl territories during the 2002 field season. In addition, from the set of 28 historical owl sites in the park, i.e., sites located during previous study, we randomly selected 13 sites that we visited during the 2002 field season to assess occupancy and nesting status. All 13 sites were occupied, including nine sites used by single owls and four sites occupied by pairs. Although no young owls were observed during the 2002 field season, this was likely a result of visiting too early in the nesting period (i.e., during incubation) to observe young owls.

The surveys in Grand Canyon during 2001 and 2002 located 34 previously unknown spotted owl territories. Twenty-two historical records were already known prior to this study (Willey 1995), bringing the park's grand total to 56 territories, or approximately 112 owls in the park. All owls were located within mid- and low-elevation steep canyon habitat identified by the GIS model, highlighting canyonlands habitat for this species. To date, surveys have covered about 50% of suitable steep canyon habitat predicted by the GIS models; thus a population of over 200 spotted owls could be present in these habitats in Grand Canyon. All of the territories we located occurred within the upper reaches of large tributary canyons within steep and rugged rocky canyon terrain located below the main canyon rims. Although a single male was heard outside of a canyon (1 km south of Grand View Point), the true level of forest rim use by spotted owls is unknown and will

Table 1. Study site locations of Mexican spotted owl field surveys in the interior wilderness of Grand Canyon National Park, Arizona, 2001.

Study site	Number of calling points	Species detected *(spotted owls in italics)*
16-Mile Canyon	4	none
Hot Na Na	4	great-horned owl
19-Mile Canyon	3	great-horned owl
24.5-Mile Canyon	4	none
Buckfarm Canyon	4	great-horned owl
Saddle Canyon	5	great-horned owl
Little Nankoweap	5	northern pygmy-owl
Nankoweap	12	*male spotted owl*
Unkar Creek	12	*single male; spotted owl pair (nest)*
Red Canyon	6	*male spotted owl*
Sinking Ship Point	10	*spotted owl pair; flammulated owl*
Cremation Canyon	8	*male spotted owl*
Boulder Canyon	8	*spotted owl pair*
Salt Creek Canyon	5	*spotted owl pair*
Pipe Creek	8	*spotted owl pair*
Boucher Canyon	3	*spotted owl pair (nest)*
Travertine Canyon	5	none
Slate Creek	5	*spotted owl pair*
Turquoise Canyon	5	*male spotted owl*
Topaz Canyon	6	none
Ruby Canyon	6	none
Shinumo Canyon	10	none
Waltenburg Canyon	6	*male spotted owls*
Forster Canyon	4	*spotted owl pair, 2 owlets*
Tapeats Creek	15	western screech-owl
140-Mile Canyon	8	great-horned owl
Deer Creek	4	none
Fishtail Canyon	7	none
150-Mile Canyon	4	none
Tuckup Canyon	12	*single male, spotted owl pair (nest)*
National Canyon	15	great-horned owl
Mohawk Canyon	4	none
The Cove	4	none
Spring Canyon	6	none
Parashant Canyon	8	none
Trail Canyon	8	northern pygmy-owl
Indian Creek	8	western screech-owl

require further research.

In addition to locating Mexican spotted owls, the field surveys also detected western screech-owls *(Otus kennicotti),* flammulated owls *(Otus flammeolus),* great-horned owls *(Bubo virginianus),* long-eared owls *(Asio otus),* and pygmy owls *(Glaucidium gnoma)* within Grand Canyon. Great-horned owls were the second most common species located in the park (spotted owls being the most common), and great-horned owls were located in terrain similar to that occupied by Mexican spotted owls, i.e., steep canyonland habitats. During surveys conducted in the forested habitat along the canyon rims, flammulated owls were the most common species observed, particularly in forests dominated by ponderosa pine.

The project survey results support the GIS-based approach to prioritizing inventory locations and streamlining field efforts. We learned through this process that nesting and roosting areas used by spotted owls are generally located in the upper reaches of steep-walled canyons in the park. Owl sites were located below the main canyon rims within arid vegetation and rocky canyonland terrain. Although spotted owls may travel up to rims and out into plateau forests, most activity appears to concentrate below the rims within the rugged canyonland habitat predicted by our GIS model. Although potential effects of

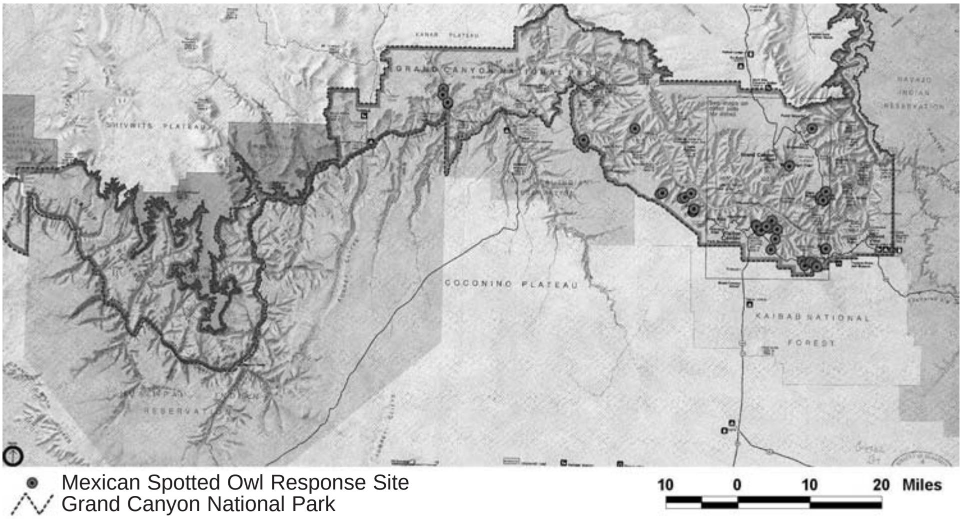

Figure 3. Locations of Mexican spotted owls located during the 2001 and 2002 field seasons in Grand Canyon National Park, Arizona.

rim-based management actions on the owl's habitat are currently unknown, our results suggest that most spotted owl territories are located below areas proposed for management activities, e.g., trail construction along the South Rim and prescribed fire along the North Rim. In a study using radiotelemetry, Willey (1997) examined the effect of prescribed fire on the movement of several spotted owls in Saguaro National Park's Rincon Mountains. Following low-intensity ground fires, spotted owls continued foraging within heavily burned ponderosa pine stands, and no significant influence of fire on home range size and shape was identified. Thus, fire management activities on the rims of Grand Canyon may not pose threats to the owl and its habitat.

The results from our GIS analysis, predictive mapping, and field validation surveys support the concept that spotted owls in Grand Canyon are not dependent on classic old-growth forests (Ganey and Balda 1989; Willey 1998). All known breeding sites in Grand Canyon have been located in steep-walled sandstone canyons, despite many survey points placed in forest habitat. In Grand Canyon, the owl is thus associated with steep sandstone canyons with relatively open Great Basin or Mojave desert scrub or Great Basin conifer woodland vegetation communities (Brown 1982). The canyonland breeding habitats used by the owl in the park are rather unusual considering the classic, late-seral forest habitat requirements typically reported for the owl (Zwank et al. 1994; Seamans and Gutierrez 1995; Miller et al. 1997). Our results in Grand Canyon provide strong evidence that rocky canyon habitat is an important landscape cover type for the owl. Grand Canyon likely supports an active and important local source of spotted owls.

Management Recommendations

The potential effects of activities such as trail building, prescribed fire, and construction activities on the owl and its habitat in Grand Canyon are unclear. However, we think that our survey results suggest that effects from rim activities on spotted owls may be minimal or absent because few territories have been detected near or on the rims. Trail building and prescribed fire could affect owls that are located below the rims, but understanding these effects are beyond the scope of this paper. We recommend additional research efforts designed to examine movements and habitat use by spotted owls located below the rims.

Prescribed fires are designed to reproduce natural fire regimes and restore the long-term health of Grand Canyon forests (Mast et al. 1999; Wolf and Mast 1998). Using radiotelemetry, Willey (1997) examined the effect of prescribed fire on the movement of several spotted owls in Saguaro National Park's Rincon Mountains. Following low-intensity ground fires, several spotted owls continued foraging within ponderosa pine stands, and no significant changes in home range size or shape was detected. Prescribed fire and healthy spotted owl habitat may not be mutually exclusive in Grand Canyon National Park. We see no major threats to spotted owls in the park from planned prescribed fire activity, but we urge the park's scientists to design and support investigations that study the relationship among owls, forest habitat, and fire in Grand Canyon.

Surveys for Mexican spotted owls within the park have located 56 territories, and nesting was confirmed by the observation of young owls in a side canyon below the Great Thumb (Willey and Ward 2001). Habitat at these interior canyon sites ranges from low-elevation desert shrub to higher-elevation mixed conifer forest. Willey and Spotskey (2000) categorized these sites as falling within the "steep canyon habitat cover type." Our results on the rims provide additional support that the owl primarily occupies the interior canyon cover types composed of Great Basin desert scrub and Great Basin conifer woodland vegetation communities (Brown 1982).

In closing, we recommend the following research and management goals for spotted owls in Grand Canyon: (1) continue compliance-clearance surveys in areas with important spotted owl habitat, e.g., forests on the canyon rims where park activities may modify the habitat; (2) continue to use GIS-based approaches to identify habitats that may require additional surveys; (3) continue to survey for spotted owls in interior canyonlands identified by the GIS model as being potential breeding habitat, and estimate the abundance and nesting status of owls in the park; (4) investigate the relationship between habitat changes related to fire and Mexican spotted owls; and (5) designate protected activity centers (USFWS 1995) around each spotted owl location in the park. If followed, we believe these recommendations will protect the owls and their habitat. Future research efforts can provide park personnel with information relevant to the owl's management and streamline future decisions for the forests and interior canyonlands in Grand Canyon National Park.

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Museum Affinity Group Meeting (Session Summary)

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The session was structured as follows:

- **Introduction and overview**—Joan Bacharach, NPS Museum Management Program
- **Documenting collections.** Managing non-collection digital images—Phil Bedel, Santa Monica Mountains National Recreation Area
- **Preserving and protecting collections.** Collections management issues—Giles Parker, Northeast Museum Services Center
- **Access to and use of collections.** Teaching with Museum Collections, or, "How do we work with interpreters and other park colleagues to get collections out in the open and on-line?"—Joan Bacharach, Museum Management Program
- **Staffing.** Out-sourcing museum operations—Bob Wilson, Southeast Archeological Center
- **Professionalism and training**—Kent Bush, Pacific West Region
- **"Significance of Collections" discussions**—Abby sue Fisher, Keweenaw National Historical Park
- **Questions from the Floor**—Blair Davenport, Death Valley National Park (discussant).

Managing non-collection digital images *(Phil Bedel, Santa Monica Mountains National Recreation Area).* Parks may receive and create digital images that are not appropriate for accession and therefore do not become part of the Automated National Catalog System (ANCS+) database. Yet these images, along with the information associated with them, may contain valuable historic information and should be managed with the same care as the park's regular archives. What is the best way to store, manage, and retrieve this archival information that is inherently unstable? How do the National Park Service (NPS) guidelines for accessioning apply to digital media? What is an appropriate database for managing digital information that does not belong in ANCS+?

Collections Management Issues *(Giles Parker, Northeast Museum Services Center).* Parks in the Northeast Region confront challenges similar to most collecting institutions in the areas of documentation, records management, security, fire protection, storage, staffing, and programming. In the fifth year of a regional initiative to support cultural resource management during the general management plan process, the Northeast Museum Services Center (NMSC) identified common objectives and priorities in the stewardship of over one-third of the museum collections in NPS. The session will focus on the comparable issues and corresponding recommendations with a highlight on the processes and technology used by the NMSC to streamline collection management planning documentation.

Teaching with Museum Collections, or, "How do we work with interpreters and other park colleagues to get collections out in the open and on-line?" *(Joan Bacharach, Museum Management Program).* The Teaching with Museum Collections (TMC) initiative introduces collections-based, student-centered activities to enrich NPS education and interpretation programs. TMC will emphasize the links between the "real things": cultural and natural collections, and the places where those collections were found, collected, or used. Park TMC activities will highlight park interpretive themes, link to national education standards, and be made available online. Collaboration between curators and interpreters and educators will also be discussed.

What is A76 out-sourcing of museum

operations? *(Bob Wilson, Southeast Archeological Center).* Wilson presented background on A76 out-sourcing and described web sites containing a new definition of "museum operations" and new amendments to regulations. He defined relevant terms, including "inherently governmental work," "museum operations," "performance work standards (PWS) service provider," "residual efficient organization," and "most efficient organization." He then discussed various issues, including staff time, quality control, funding, the Volunteers in Parks (VIP) program, inventory, minor property, use of equipment, past contracting, and reductions in the number of contractors.

Professionalism and training *(Kent Bush, Pacific West Region).* Museum collections in NPS are being endangered at an increasing rate do to inactive management. Key curatorial positions at the park, regional, and national levels have been allowed to remain vacant for extended periods of time, or be filled by individuals without the necessary education and experience. Some key positions have been abolished. In addition, there is no established training program for individuals entering the curatorial professions, and no training program for the continuing education of curatorial workers currently in the NPS work force. These issues need to be recognized and addressed. [Ed. note: the full text of Bush's presentation is presented elsewhere in this volume.]

"Significance of Collections" discussions *(Abby sue Fisher, Keweenaw National Historical Park).* At the GWS/CR2003 conference, Fisher will represent Laurel Racine, who was asked by to lead the Museum Collection Significance Criteria Committee. The update will include a brief history of significance criteria in the NPS, how the committee was assembled, committee tasks, and progress-to-date. She will also outline what the committee plans to accomplish at their meeting on Tuesday, April 15.

Determining Use Patterns for Museum, Archives, and Library Collections

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In the middle 1990s, National Park Service (NPS) Western Regional Curator Jonathan Bayless proposed a different way of doing collection management plans (CMPs). Three of us had been doing the classic "operations evaluation" type of CMP in the Southeast, Western, and Pacific Northwest regions for a number of years, and they just were not being accepted and used by the parks.

Bayless proposed changing the approach: rather than address technical issues in collections management procedures, address the core "issues" that were preventing the park staff from implementing a viable museum management program.

Along with this change in philosophy we realized that our view of any park museum operation was very single-dimensional, and that we had been relying mostly upon information from a single individual, or single park division, to identify and document the needs of the park as a whole. In order to expand our view of park operations and needs, we decided to survey the park staff in advance of our on site visit. Since I had an interest in survey methodology, I volunteered to develop the system.

Development of a meaningful survey requires some background study and testing. Through the annual conferences of the American Association of Museums (AAM) I had become acquainted with the Visitor Studies Association, and their quarterly publication *Visitor Studies.* I also used Randi Korn's book *Visitor Surveys: A User's Manual* (an AAM publication) and Judy Diamond's *Practical Evaluation Guide: Tools for Museums and Other Informal Educational Settings* (University of Nebraska Press), among other references.

We took the survey through two beta tests: one at Sequoia–Kings Canyon National Parks while doing a collections storage plan, and one at Yosemite National Park when developing a programmatic outline. In addition to tightening up the survey format, these test runs documented two other required factors:

- First, the survey must have "buy-in" from park management, and must be sent out under the superintendent's signature.
- Second, the survey must go to every member of the park staff, including both permanent and temporary-status employees.

With these two condition in place, we began getting some interesting results that were useable in understanding what was required in planning for museum operations in a specific park.

Survey Objectives

The primary objectives of the survey are to determine the following information:

- Percentage of staff using the park collections and library;
- Percentage of staff using non-park information resources;
- Primary areas (categories) of material use, and reasons for use of those specific resources;
- Primary reasons staff do not use park museum collections and library;
- What measures may be necessary to promote resource availability and use; and
- General impressions concerning the value and use of archives and museum collections.

In addition, some limited demographic information is collected to develop a collective length of service and experience profile, and to demonstrate equitable response to the survey from each park administrative unit. Demographics can also assist in understanding the motivation and needs of the respondent population.

Survey Methodology

The survey is distributed to the temporary and permanent park staff under a memorandum from the superintendent, requesting that the survey be completed by a certain date and returned directly to the responsible CMP team member. Two types of questions were used to collect different types of information:

- *Checklist questions* designed to determine what types of services were being used, and what types of services were needed; and
- *Evaluative questions* designed to determine the respondents' attitudes toward park-specific operations, and servicewide operations in general.

Respondents were also given two opportunities to add comments: one in the "services used" and the other in the "services needed" sections. Write-in responses are not generally used in this type of survey because they often fail to elicit a statistically valid response, and any response that is generated is often difficult to quantify.

A response rate of 12% is required for this "mail-out/mail-in" type of survey to be considered statistically valid. The responses are then considered the "sample population" and results are considered to be representative of the "sample universe." Higher response rates naturally translate into more reliable statistics. In the twenty surveys conducted thus far, we have discounted the results in three due to inadequate response (less than 12%). The remaining 17 parks have various response rates between 12% and 83%, for an average response rate of 48%. As a result, we are confident these compiled results are accurate for the Pacific West Region (represented by ten parks) and the Intermountain Region (represented by seven parks).

We have documented some interesting trends:

- Over half the park staff use the park library, and under half use the park collections. More than one-third of the staff use non-NPS collections for their information needs.
- Park photo collections are used the most, followed by resource management records, historical archives and administrative records. Archaeological and historical collections were used less.
- Herbarium collections are used most among the natural science material, followed by geology, insect, mammal, and bird specimens.
- Project-related research drives most use, followed by information for visitors as a distant second reason. Use for maintenance and repair information accounts for a large segment of collections use (presumably park records and photographs).

We have discovered some interesting reasons why park staff do not use collections. Remember, anything over 10% is statistically significant:

- 45% don't know what types of collections are available;
- 32% don't know where the collections are located in the park; and
- 23% don't know who can get them into the collections.

It appears that the collections are a well-kept secret in most parks.

Park staff had some specific ideas on what was needed to improve the way collections were managed:

- 57% suggested providing a listing of what was in the collections;
- 42% suggested providing a finding aid to the collections;
- 27% suggested providing on-line services to support research;
- 22% suggested providing professional staff to manage the collections;
- 22% wanted remote computer access to the collections; and
- 19% wanted to combine the museum collections with the library.

These figures provide a good cross-check to the section on why collections were not being used. The implication is that we may solve the former by instituting the latter—which are just the kind of results you are looking for in a survey.

The evaluative section of the survey documented the value the staff ascribes to the management and use of archival, library, and museum collections in NPS.

- 85% think collections should be used to document park resources;
- 83% think there is value in parks maintaining these collections for use;
- 83% think the park collections should contain copies of all studies and reports done about the park;
- 78% think that the collections serve as an "institutional memory" for the park;
- 67% believe the collections should be consulted for information prior to beginning resource management projects; and
- 65% believe that park visitor centers should exhibit more material from park collections.

The implications documented here are overwhelming. It is apparent that park staff thinks the collections should document the park resources, should be maintained for study and use, and should be exhibited more to the public.

Conclusion

Over the past several years the survey has proved a useful tool in documenting the needs of park collections management, particularly in the Pacific West Region. It has provided park staff with a method to make their needs concerning archival, library, and museum collections known to park management. Moreover, it has given those of us involved in planning for these resources the ability to define and quantify those needs in an efficient manner. The survey also allows us to document and quantify the value the park staff ascribes to these resources. In turn, this knowledge should allow park management to better allocate available resources to collections preservation and management.

The compiled 17-park survey is appended below.

SECTION I

These first questions will help us determine use patterns for museum, archives, and library collections. For the purpose of this survey, a "visit" to the collections also includes verbal, telephone and e-mail requests for information that would require the Collections Manager to find and communicate that information to you.

1. Do you use the park library? **250** No **310** Yes

If yes, about how many times in the past year? **4,872 (15.5 visits average)**

2. Do you use the park collections/archives? **300** No **257** Yes

If yes, about how many times in the past year? **3,433 (13 visits average)**

3. Do you use non-NPS collections or archives? **375** No **173** Yes

If yes, about how many times in the past year? **1,402 (8 visits average)**

4. What parts of the collections/archives do you use (check as many as apply):
(% from number of responses divided by 257 positive responses from #2, above)

❒ Historic Archives **141 (55%)**
❒ Photo Collections **212 (82%)**
❒ Archeological Collection **77 (30%)**
❒ Herbarium **64 (25%)**
❒ Insect Collection **29 (11%)**
❒ Mammal Collection **33 (13%)**
❒ Administrative Records **104 (40%)**
❒ Historic Collection **87 (34%)**
❒ Ethnological Collection **37 (14%)**
❒ Paleontological Collection **20 (07%)**
❒ Geological Collection **39 (15%)**
❒ Bird Collection **30 (12%)**
❒ Resource Management Records (such as building files, natural resources studies, archeological excavations reports) **143 (56%)**

5. What are the primary reasons you use the collections (check as many as apply):
(% from number of responses divided by 257 positive responses from #2, above)

❒ Administrative Research **81 (32%)**
❒ Develop Summer Programs **53 (21%)**
❒ Maintenance/Repair Information **61 (24%)**
❒ Publication **49 (19%)**
❒ Exhibit/Programs **42 (25%)**
❒ Environmental Impact/Remediation Research **48 (19%)**
❒ Other (please list):
❒ Project Research **198 (77%)**
❒ Comparative Studies **43 (17%)**
❒ Historic Structure Information **62 (24%**
❒ Information for visitors **133 (52%)**

SECTION II

We realize there might be many different reasons park staff do not make use of the museum, archives, or library collections in their work, and it may well be possible to fix some of the situations if we know what to look for. Your open and honest response to this question would be appreciated.

6. What are the primary reasons you **do not** use the collections (check as many as apply):

❒ Don't know where the collections/archives are located **181 (32%)**

❒ Don't know what types of collections are available **251 (45%)**

❒ Don't know how to find the collections I need **149 (27%)**

❒ Don't know who can get me into the collections **127 (23%)**

❒ There is no place to look at/study the collections/archives **80 (14%)**

❒ There are no supporting archives (reports, maps, photos) **37 (06%)**

❒ The collections don't have the items I need **34 (06%)**

❒ The collections are not relevant to my job **142 (25%)**

❒ There is no place to work **52 (09%)**

❒ No wet laboratory**19 (03%)**

The collections not physically accessible **72 (13%)**

no dry laboratory **19 (03%)**

❒ Not electronically accessible **102 (18%)**

❒ No preparation area **15 (03%)**

❒ There is no supporting library **25 (04%)**

❒ No study area **28 (05%)**

❒ There is no computer printer **14 (03%)**

❒ No copy machine **21 (04%)**

❒ Collections are not organized **41 (07%)**

No one to let me in **30 (05%)**

❒ Not open on a regular schedule **65 (12%)**

❒ The staff is not friendly **n/a**

❒ There is no one to help me find things **39 (07%)**

❒ The staff is not helpful **n/a**

❒ Collections are too far away from where I work. **35 (11%)**

(% based on number of responses to each question divided by 559, the total number of respondents to the survey)

SECTION III

There is always room for improvement. We are looking for some general trends and areas that may require innovation and shifts in the way museum, archives and library collections are managed. Again, your open and honest response to this question would be appreciated.

7. What could the collections/archives do to be more useful to you (check as many as apply):

❐ Move collections/archives to a more central location **74 (13%)**
Suggestions: **Consider development of "branch" collections located at points of use.**

❐ Open collections/archives different or longer days and hours **87 (16%)**
Suggestions: **Consider staggered days/hours of operations**

❐ Provide a listing of what is in the collections **317 (57%)**

❐ Provide a finding aid to the collections **232 (42%)**

❐ Combine museum collections with archives **91 (16%)**

❐ Combine museum collections with library **107 (19%)**

❐ Provide a work area **82 (15%)**
❐ Wet lab **25 (04%)** ❐ Dry lab **37 (06%)** ❐ Other: **20 (04%)**

❐ Provide a computer hook up **75 (**
❐ Printer **43 (08%)** ❐ Copy machine **48 (09%)** ❐ Other: **13 (02%)**

❐ Provide on-line services to support research **151 (27%)**

❐ Provide professional staff to organize and work on collections **124 (22%)**

❐ Organize existing collections **101 (19%)**

❐ Organize existing collections in a different manner **25 (04%)**

❐ Provide professional staff to assist with access to collections **114 (20%)**

❐ Provide remote computer access to collections/archives **125 (22%)**

❐ Provide the type of collections I need **16 (03%)**
Suggestions:

(% based on number of responses to each question divided by 559, the total number of respondents to the survey)

SECTION IV

We are interested in your general and overall impressions regarding the value and use of museum, archives, and library collections within the NPS.

8. Please indicate the intensity of your opinion by circling one letter for each statement below.

A	U	D	A = Agree U = Uncertain D = Disagree
85%	6%	2%	Museum collections and archives should be used to document park resources.
10%	14%	68%	Park collections and archives are of no value to me in the completion of my job.
67%	17%	11%	Park archives, collections and libraries need professional management and care.
67%	27%	1%	Park collections and archives should be consulted prior to beginning resource management projects.
57%	22%	15%	Park collections and archives should be more available for park staff use.
60%	23%	7%	Park museum collections and archives are primary resources for the park.
54%	27%	10%	The best use for park collections is reference and research.
43%	42%	8%	Park collections would be more useable if combined with the archives and library.
26%	55%	13%	There is not enough emphasis on natural materials in park collections.
4%	15%	74%	Parks should not be expending staff, time and funding on museum collections.
83%	11%	1%	Park archives should contain copies of all studies and reports done about the park.
17%	50%	27%	There is not enough emphasis on cultural material in park collections.
2%	8%	83%	There is no value in parks maintaining park museum collections or archives.
78%	14%	1%	Park collections and archives serve as the "institutional memory" of the park.
65%	20%	8%	Park Visitor Centers should exhibit more material from the park collections.
5%	32%	56%	Funds spent on museum collections and archives would be better spent on preservation of other park resources.

(% based upon number of responses in each category divided by 559, or total number of respondents to the survey)

SECTION V

In order to assure a well represented response from a cross section of park staff, we would appreciate a minimum amount of demographic information.

Number of years in the NPS **11 average**

Number of years at current park **6 average**

Number of park units you have served in **3 average**

Current position (optional) **Administration: 71 Interpretation: 62 Maintenance: 50 Ranger: 79 Resource Management: 81 other and/or not recorded: 216**

Number of years in current position **4 average**

Are you currently:

❐ Permanent staff **315** ❐ Term/Seasonal/Temporary staff **216** not recorded: **28**

Please estimate the time you spent responding to this survey: **10 minuets average**

Parks Surveyed:

Redwood National & State Parks
Bents Old Fort National Historic Site
Hopwell Culture National Historical Park
Cabrillo National Monument
USS Arizona Memorial
Mesa Verde National Park
Hagerman Fossil Beds National Monument
Southeast Utah Group
- **Arches National Monument**
- **Canyonlands National Park**
- **Hovenweep National Monument**
- **Natural Bridges National Monument**

Mount Rainier National Park
Whiskeytown National Recreation Area
Olympic National Park
Hawaii Volcanoes National Park
Great Basin National Park
Lassen Volcanic National Park

Total Number of Survey Forms Distributed:......1,143

Total Number of Survey Forms Returned:........ 559

Response Rate.. 48%

Professionalism and Training

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Item: The Yellowstone park curator vacates her position in the summer of 2002 after a protracted illness and lengthy absence. The park archivist position is also vacated. The park collections are expanding, and will be moved into new storage in 2003. Park management combines the two positions and downgrades the composite from a GS-12 to GS-11. The position has been advertised, but currently remains vacant.

I can think of no other profession in a park where the lead position is combined and downgraded. It doesn't happen with the rangers, and it doesn't happen with maintenance.

Item: The National Park Service (NPS) Southeast Region's regional curator vacates the position in 1995. The region abolishes the position, and turns the duties over to a person whose previous job was secretarial. This leaves the 64 parks in the region without professional and technical guidance for five years. The position of regional curator is filled in 2000, but is paid with "soft" money at a reduced grade, a situation that is continuing.

I can think of no other profession in a region where the lead position is vacated and filled with a clerical-grade person, or filled with a position on soft money. It doesn't happen in contracting, and it doesn't happen in personnel.

Item: The servicewide Museum Management Program is given the task of policy and program development for NPS. The program was left without professional management for one year. The chief conservator position has been vacant for some 16 months, and the funds have been pulled for the remainder of fiscal year 2003. The chief archivist has now filled the management position, but it is uncertain whether the archivist position will be back-filled. This leaves two professional positions vacant at the national program level.

I can think of no other profession at the agency level where the lead position is vacated, and not filled for over a year. It doesn't happen in concessions management, it doesn't happen in wildlife management, it doesn't happen in ranger activities, and it doesn't happen in budget and finance. (By the way: the program funds for both the chief archivist and chief conservator positions come from the Museum Collections Protection and Preservation Program [MCPPP]. Parks and regions are not allowed to re-direct these funds in this manner. How come they get do it at the national level?)

These three examples are not "exceptions to the rule." For the most part, they are more like the normal way the National Park Service does business when dealing with the Museum Management Program at the park, region, and national level. So we have to look at these three examples and figure out why it happens with museum management, and why it happens at all levels.

One reason is poor program definition. We obviously have not adequately defined what it is that a professional museum curator does that can't be done just as well by a secretary. Water treatment plant operators have done it. Personnel officers have done it. Archeologists have done it. When was the last time you saw an untrained person doing water treatment, or ranking job applications? You need at least a four-year degree plus specialized training and experience to manage an archeological investigation. Do professional-level collections documentation and preservation and management require any less education, knowledge, and skill than archeology? (By the way: In one park recently I saw an injured fire fighter assigned curatorial duties. He was cataloguing historic collections. I have never heard of a curator being pulled out of the collections to build a fire line; you need training to do that.)

The question of "professional training" and "continuing education" logically follows the above. Consider the following:

- In order to apply pesticides you are required to attend a basic course, and periodic training is required to maintain your certificate.
- In order to fight fire you are required to take a basic course, then additional training in various specialties (such as felling trees, operating a pumper truck, being a crew boss). Annual refresher training is required.
- In order to supervise contracts, you are required to take 40 hours of contract officer's technical representative training, followed by an eight-hour refresher course every two years.

The last regular servicewide curatorial methods training course was in 1995. Many of our "collateral-duty collection managers" have not had *any* curatorial training other than the Automated National Catalog System (ANCS+). Most of our professional-level GS-1015 curators have not had professional-level training since their basic-level curatorial methods course received upon their entry to NPS.

This is partly the result of poor identification with the larger profession. We have not made a collective effort to tie our Museum Management Program to the larger archival and museum professions. Consider the following:

- Most law enforcement rangers I know are members of at least one organization—the Association of National Park Rangers, if nothing else. How many curators belong to at least one professional museum organization?
- Most historic architects I know subscribe to at least one professional journal. How many curators regularly read at least one professional journal?
- Most historians I know read several books each year dealing with their specialty. How many curators regularly read new books dealing with our profession (other than *Museum Handbook* updates)?
- Most archeologists I know present at least one professional paper at a conference, or write at least one article for a journal, every year. Over the past year, how many curators have presented a paper or written an article for publication?

A third reason is program myopia. For the past twenty years museum management in the National Park Service has emphasized museum documentation and storage, mostly at the expense of other program missions. What should be a diversified program offering useable tools to park staff and the public has been reduced to a series of handbooks, numbering schemes, tables, checklists, and other accounting tools. Collectively we have promoted a pseudo-professional approach which presumes that basic documentation and safe, secure storage are results sufficient to justify the existence of archives and museum collections.

Example: When asked why the park was making and keeping collections, a park curator responded "Why, to preserve them, of course!" As well as that collection had been documented and cared for, it was obvious the curator was not looking at the bigger picture.

The *Museum Handbook* insists on artificially high security and preservation standards for all materials on exhibit. As a result, the exhibit design people are using fewer and fewer actual objects and specimens, or are going to ridiculous lengths to secure all exhibit cases.

Example: A very expensive environmentally controlled exhibit case, complete with tamper alarm, is used to "exhibit" trash picked up along a park trail as part of a permanent environmental exhibit. Park Service people are not dumb, and this sort of thing sends a message: "We curators don't really know what we are doing, and we are wasting money that could be better spent elsewhere."

When is the last time you saw a new exhibit in a visitor center that contained a lot of real things? Most park interpreters will tell you that NPS does not have "museums"—we run "visitor centers." This is partly an attempt to get around often needlessly restrictive standards suggested by the *Handbook* and applied by people who don't know better.

Also in the name of "preservation" we have locked collections up, and locked out the primary users. The plain fact of the matter is that everything NPS owns is not a 16th-century panel painting, or a signed George Armstrong Custer letter, or a passenger pigeon specimen. We own a lot of fairly ordinary, run-of-the-mill stuff whose primary value lies in what it can tell us about the park and our management of the resources. For many of our frequently used collections, we can afford a much more liberal use policy than what is in the *Museum Handbook.*

Example: A collateral-duty collections manager reads the *Handbook,* and makes the case to the superintendent that the park herbarium needs to be taken away from resources management and locked in the collections room. The following week the resource management staff goes out and starts collecting specimens for a "comparative collection" that will not be "official" and thus not documented. As a result the "official" collection goes static, does not receive any new specimens, and is not used by the park staff.

This was the result of a non-professional having no understanding of how natural science collections are used, but aggressively applying poorly written "standards" from the *Handbook.* There has been a real curator at the park for three years now, but the resource management staff is still very leery about having "their" collections documented.

Since we have imposed draconian conditions on their access and use, park staff and the public have found other avenues to get their information. The in-house surveys we have been doing in the Pacific West Region show that about half the staff at any given park don't know what is in the collections, where they are located, or who can get them in to use the material. If people don't use the collections, who cares about their accessibility or condition?

Example: It is the close-out for a collections planning effort at San Francisco Maritime National Historical Park, and we have been talking with the superintendent and senior staff about the poor conditions in museum storage. The former superintendent turned in his chair, pointed to the ships outside and said: "If one of those ships sinks I get fired. If the collections fall apart, I still have a job."

It is apparent from this remark that there is currently there is no downside to poor or mediocre management of archives and collections. We have not provided management with the necessary indicators needed to distinguish between a job well done, a job partly done, and a job not done.

So, what do we need to do to fix the situation? Unfortunately there is no single answer, no "silver bullet" to make the problem go away. But there are some things that we can start doing, at the park, at the central office, and at the national program levels.

We need to develop a message that answers the question: "Why should management care?" We need to begin developing our own support groups in each park, each region, and on the national level. If we do so, there is someone who will complain, long and loudly, when the collections deteriorate, are not available for easy access, are poorly documented, or when the curator's position is not filled quickly and with a qualified applicant.

We need to stop hiring the untrained, the half-trained, the poorly trained, to do professional-level work. Even though the qualification standards for the positions of museum technician, museum specialist, and museum curator were written in 1956, they are still considered the *standards* and we need to insist that they be followed when filling professional jobs in these series.

Park managers need to start insisting that professional positions currently in their parks be filled by professionals when they become vacant, and at professional-level grades (GS-11 and above).

Regional and central office curators need to start insisting that park-level positions be filled with qualified professionals, and curatorial work be supervised by qualified professionals. This year in the Pacific West Region we have started insisting that the expenditure of BAC-CAT (backlog cataloguing) and MCPPP funds be supervised by at least a GS-11 curator. We are tired of untrained seasonal employees being supervised by untrained collateral-duty employees. We are not ending up with professional products, and the money is too hard to come by to waste in this manner. From now on in the Pacific West Region, you will need an approved work plan, or an approved scope of work statement, or an approved treatment plan in order to get your money. You can use seasonal employees to catalogue and do basic-level collections management, but they need to be supervised by a GS-11 curator. If you don't have a curator on the staff, you need to employ one, rent, or borrow one from a neighboring park. This requirement was instituted by the Pacific West Cultural Resources Advisory Committee, and approved by the regional director.

The national Museum Management Program needs to insist that regional and central office positions be filled by qualified professionals on base (ONPS) funding, and vacancies need to be filled in a timely manner. If regions are reluctant to do so, try withholding BAC-CAT and MCPPP funding. This is done for inadequate documentation, so why not for inadequate professional supervision?

The national Museum Management Program also needs to take ownership and give direction to the need for both basic-level curatorial training and continuing education for practicing professionals. The Museum Management Program council needs to develop a "certification program" based on professional standards and regular refresher training, and pass it along to the NPS director for implementation. Remember, similar programs are required by our counterparts in maintenance, law enforcement, fire control, personnel, and contracting, to name a few.

Finally, at the national level we need to break out of the narrow mind-set about curatorial work that has dominated the last two decades. We have done a fairly good job of reducing the catalogue backlog, and addressing the deficiencies in the storage and protection of collections. We now have to look for ways to make the collections we manage more available for many kinds of use. If we don't, park management will start looking at the meager resources they are currently spending, and wondering whether this might be a good place to implement out-sourcing.

And if we have not done everything in our power to make the collections available and useful to the staff and public, they will be right. For without using these things to help us manage the park resources, and tell the story of the parks and our stewardship to the public, we really don't have collections in the large sense. We have pathetic assemblages of fur and feathers, meaningless symbols of past culture, wood pulp with printers ink, and fading images that no one looks at.

A Note on Performance Standards and Conservation Specifications for Exhibit Cases

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A conservation-grade exhibit case is a well-designed and carefully fabricated display enclosure. It is possibly the most important and cost-effective tool for preserving vulnerable collections on exhibition.

Park museums put their most significant objects onto display and, by doing so, place these collections at much greater risk than if they had remained under the controlled conditions of protective storage cabinetry. Although display in cases and vitrines is the norm for most museum exhibits, the pitfalls and benefits of conventional display enclosures are only now being calculated by conservation and exhibit specialists.

The display case, unfortunately, has been taken for granted as an effective means of mitigating damage while objects remain on exhibit. The truth is that, until recently, exhibit specialists have had little information on the impact of common exhibit cabinetry on vulnerable collections or the degree to which they actually provide protection. As we learn more about the traditional exhibit cabinet from scientists, we have serious reason to be concerned. Research indicates that the exhibit case has an alarming potential for adding to the deterioration of its contents.

The good news is that an enclosure that is properly engineered has an equally surprising potential for protecting and preserving vulnerable collections. When objects on display are housed in well-designed and carefully fabricated cases, they can be effectively preserved at levels remarkably close to those provided in storage.

The technology is now available for National Park Service (NPS) staff to insist that their display enclosures balance the need to present and interpret cultural resources aesthetically with the conservation characteristics necessary to protect them from needless loss. Conservation features can be specified as standard components if the staff is aware of what constitutes a conservation-grade case. In weighing the advantages and costs of different exhibit enclosures when procuring new casework, NPS exhibit specialists will soon have access to new tools to specify what preservation features and levels of performance are to be expected.

The NPS publication *Exhibit Conservation Guidelines* is currently available through the Harpers Ferry Historical Association by calling 1-800-821-5206; a companion publication, *Performance Standards and Conservation Specifications for Exhibit Cases,* is under development.

On the Road to Democracy: The Gulag Museum at Perm-36

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In December 1999, Marie Rust, director of the National Park Service's (NPS's) Northeast Region, became a founding member of the International Coalition of Historic Site Museums of Conscience. At the coalition's first formal meeting, Rust met Victor Shmyrov, director of the Gulag Museum at Perm-36 in Russia, another founding member/institution of the coalition, and the two agreed to begin a collaboration.

Shmyrov's museum preserves and interprets a gulag camp built under Joseph Stalin in 1946 in the village of Kutschino, Russia, near the city of Perm. Known as Perm-36, the camp is a typical labor camp—this one being focused on timber production. If you've read *One Day in the Life of Ivan Denisovich,* this is very much like the camp described by Aleksandr Solzhenitsyn.

Later, the camp became a particularly isolated and severe facility for high government officials. In 1972, Perm-36 became the primary facility in the country for persons charged with political crimes. Many of the Soviet Union's most prominent dissidents, including Vladimir Bukovsky, Sergei Kovalev, and Anatoly Marchenko, served their sentences there. The camp closed in 1987. Many believe this to be the last preserved unit in an intricate chain of prisons, labor camps, and remote areas of exile stretching across thousands of miles in Russia. Although there were over 12,000 camps like this one in Russia, Perm-36 is the last surviving intact example from the system.

Scholars estimate that 20 million people died in the labor camps as a result of Stalin's repressions. Many millions more were imprisoned or deported to remote areas. The gulag system affected everyone in the country. This was a way of controlling the entire population; the country was industrialized on the backs of its forced labor. Let me be clear here: this is not a system of jails—those existed for criminals. This was a system of repression and fear for everyone else. Being late to work three times merited a five-year sentence. An unexcused absence from work or failure to make daily work quotas usually meant ten years in the gulag.

In the 1990s, the camp complex was rediscovered by a group of historians who decided that preserving this difficult story from Russia's past was critical to the country's future. The Gulag Museum at Perm-36 was created to "promote democratic values and civil consciousness in contemporary Russian society through preservation of the last Soviet political camp as a vivid reminder of repression, and an important historical and cultural monument." Civic engagement was part of this museum's mission from its inception.

Since 1996, the museum has undertaken the task of preserving and reconstructing the camp as a historic site and providing a range of interpretive and dialogue experiences for schoolchildren and visitors to the site. The museum has sent several delegations to the United States to learn from NPS. These groups observed interpretive and educational programs, looked at self-financing examples, and visited significant American sites that deal with difficult issues and recent history. They also asked NPS to send a team of preservation and museum professionals to Perm-36 to provide technical assistance, and I was honored to lead that group.

Civic Engagement at the Gulag Museum

Over the past several years, the Gulag Museum has developed a number of impressive educational programs for visitors to the site and for schools throughout the Perm region.

First and foremost, the Gulag Museum is a historic site. It uses a real place to teach about the history of totalitarianism and political repression in the former Soviet Union. A rich program of sharing the complex history of the place and discussion is presented to the site's 30,000 annual visitors.[1] The museum staff sees the site as a vehicle to teach visitors about the darker side of the Soviet past: to understand how a population is affected living under a totalitarian system of government. Although they are concerned with questions such as "What happened here in this place?" they are even more interested in such questions as "How does a totalitarian state affect the individual citizen?" In addressing these questions to Russians today, they ask how the system of repression that existed not even a generation ago *still* affects Russian citizens and all of Russia today.

The site itself possesses great power. Even unfurnished and in its present state of incomplete rehabilitation, it conveys a remarkable sense of the power of the state and the vulnerability of the individual. The labor camp's remote location, its spartan structures, the rows of wooden and barbed wire barriers—all convey a powerful story even without the narrative intervention of tour guides, exhibits, or furnished interiors. The museum is lucky to have a remarkable understanding of the site's history and significance already.

However, the museum has struggled with many of the same issues that American sites such as Manzanar National Historic Site have. Should the fencing and guard towers be reconstructed where missing (Figure 1)? Is it enough to evoke the sense of imprisonment—or do you need the eight rows of security perimeters to truly understand how people were made to feel here? Through active engagement with former prisoners and guards, the museum staff has decided that restoring key features, such as the guard tower from the maximum security unit, is appropriate.

Shmyrov has clearly articulated one key point in developing the desired visitor experience: knowledge and education must be primary to the experience; emotion must remain secondary. Visiting the Gulag Museum is a truly powerful experience. Visitors, particularly Russians, often respond emotionally to this experience because it brings up highly charged feelings about the nation's recent past. There is certainly a place for emotion and reflection in the desired visitor experience, but it cannot be at the sake of educating the public about the system of political repression that permeated Russia under the gulag system. Visitors are encouraged to discuss, debate, and engage the subject matter intellectually as a necessary foil to the emotional reactions the place elicits. A civic hall—a place typical of community gatherings in Russian villages—has been created inside one of the structures to provide a safe forum for this conversation.

Hard work is already paying off. The Perm Regional Government has publicly acknowledged its belief that the presence of the museum and its educational programs in the area have positively influenced the democratic process in the region. More and more teachers want to bring their classes to the site, and the demand for traveling exhibits on the gulag system has steadily increased. The museum is now working with the regional government to amend school curricula to include the repressive history of Soviet Russia and the introduction of liberal democratic values in the nation.

The museum is now collaborating with a number of NPS sites to create an exhibit to be hosted by American historic sites, including Martin Luther King, Jr., National Historic Site, Manzanar, Boston National Historical Park, and Ellis Island. The exhibit will incorporate civic engagement principles in its organization—stating questions and encouraging the audience to enter the dialogue. Introductory panels at each host site will link contemporary issues of human rights, immigration, and repression to the historic themes of the gulag and the host site. Formal interpretive opportunities and educational programs will accompany the exhibit to ensure that all visitors have an opportunity to engage the material. Through this international partnership, NPS sites will benefit from the Gulag Museum's extensive experience with civic engagement, and will build mechanisms to continue this work in their everyday programming.

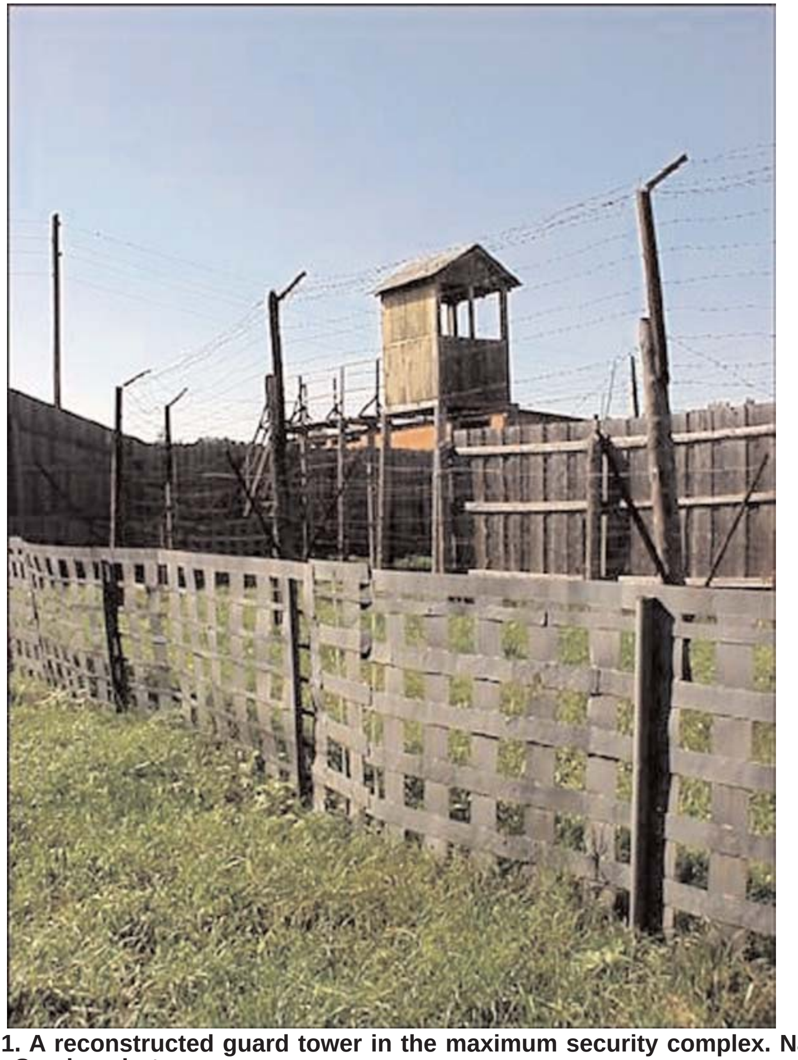

Figure 1. A reconstructed guard tower in the maximum security complex. National Park Service photo.

Endnote

1. This visitation figure was quoted by Shmyrov several times while visiting the United States in November 2002. Visitation projections at the museum suggest that this number may quadruple in the next five years.

Synthesis as a Law Enforcement Tool at Shenandoah National Park: A Synthesis Regional Support Center Case Study

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Synthesis is an information management tool for efficiently organizing, integrating, and disseminating data and information. Synthesis presents users with an easy-to-use graphical user interface that functions as a gateway to information that may be stored on local computers, networks, intranets, as well as the internet. From this single gateway, a user may view and integrate many types of information, including text-based documents, photographic libraries, databases, spreadsheets, presentation graphics, GIS (geographic information systems), bibliographies, internet-based information, and decision-support systems. The Synthesis Regional Support Center (SRSC) at James Madison University (JMU) in Harrisonburg, Virginia, was established in late 2001 to support national parks in their use of Synthesis for information management. The SRSC's first customer, Shenandoah National Park, provided documents and guidance for the development of ginseng (discussed herein) and bear gall databases intended to support special park agents and criminal investigators with both research and law enforcement for threatened natural resources.

Synthesis began life as a "hard-wired" air-quality information management system. Its capabilities were gradually expanded and enhanced to accept all types of information from any subject area. Eventually, because of the broader nature of the system, it was decided that the system should be moved to the National Park Service (NPS) Natural Resource Information Division (NRID), which happened in March 2000.

The NRID is part of the Natural Resource Program Center, administered by the NPS associate director for natural resource stewardship and science. It maintains offices in Fort Collins and Denver, Colorado, and Washington, D.C., and consists of three branches.

The *Inventory and Monitoring Branch* documents the status and trends of natural resources in America's national parks. It oversees inventory and monitoring programs throughout NPS. It assists parks, regions, and other NPS offices in the acquisition of natural resource inventory and monitoring information and in the application of this information to management decision-making and resource protection.

The *Systems Management Branch* provides and administers servicewide databases to meet the needs of natural resource program managers. It also develops and maintains data processing tools and procedures to help park staffs manage natural resource information consistently.

The *Information Services Branch* develops and communicates information for the preservation, management, and understanding of park natural resources. Informational materials and services are geared to reach the public, park staffs, and NPS partners, and include education, interpretation, and public outreach programs.

The Office of the Division Chief, through the natural resource web manager, coordinates and manages NPS natural resource web activities. This includes overall coordination of NatureNet and the Natural Resources Intranet, leading the interdisciplinary Natural Resource Web Team, and coordinating guidance and policy recommendations on natural resource web publishing.

Law enforcement and compliance actions in NPS are managed by park superintendents. Specially trained rangers provide emergency services and uniformed resource protection. A small cadre of criminal investigators focuses on long-term resource crimes or those which require extensive investigation to halt the resource harm and to restore the resource. Planning and prioritization of enforcement and compliance actions is conducted at the park level, in conjunction with resources specialists. Superintendents and chief rangers from Great Smoky Mountains National Park, Blue Ridge Parkway, and Shenandoah National Park have determined to engage in shared evaluation, response planning, and active protection when resources held in common are threatened.

In 2000, the three parks engaged in a cooperative project to identify, quantify, and mitigate the risks to ginseng *(Panax quinquefolius),* galax *(Galax rotundifolia),* and three other medicinal herbs. The resource risks are a result of large and escalating international markets.

Early in the project, rangers and agents identified the absence of an extensive, shared data set among resource-serving agencies. A common data set, shared among agencies with common missions, would serve as a conservation tool in itself. It would also facilitate the development of additional protective methodologies. Preliminary data gathering showed that a large body of information resided in several federal and state agencies; however, the information was paper-based and lacked continuity. No common links of information were found between the several agencies charged with making decisions on the protection of these species.

Having determined that a common data set was a primary protection tool, law enforcement planners, with the support of the NRID, selected Synthesis as the information management tool. Documents were sent from Shenandoah, Great Smoky Mountains, and Blue Ridge to the SRSC at JMU to be introduced into the database. NPS special agents provided NPS supervision of the project. The ginseng database developed for Shenandoah in response to this need is now a collection of well-organized, easily accessible, and searchable electronic documents containing information on ginseng and other protected or endangered plant species. Ginseng topics include, but are not limited to, biology, population surveys, import/export data, conservation programs, and regulations. A limited number of documents on endangered plants other than ginseng has been included.

Several evolutions of data organization were modeled for the end user. Eventually, a structure that mirrors the thought process of conservation enforcement professionals was constructed. The primary divisions are *Species Status*, *Threats to Resource*, and *Protection Tools*.

Species Status is first on the outline because it is the first thing that a conservation law enforcement officer will seek to determine. If resources are stable, further investigation is unlikely. By looking at the habitat requirements of the ginseng, the surveys documenting its locations in the park, how humans have used ginseng in the past, and ginseng population dynamics, the officer, in consultation with resource scientists, will be able to quickly assess whether enforcement action and/or other conservation tools are required.

Once a preliminary determination of resource risk is made, the next logical step to take is to assess and quantify threats to the resource. Hence, part two of the outline: *Threats to Resource*. Under guidance from law enforcement personnel at Shenandoah, several topics were discussed for inclusion in the outline. International trade reports, local and foreign price lists, import/export data, prior criminal cases, and documents on hunting, finding, and digging medicinal herbs were found to be top priorities. These provide important conservation information on exploitative methods and motivators, and insight into complex derogation patterns.

Reports on international trade can identify locations in the park from which foreign markets are receiving medicinal herbs. Price lists of ginseng in local markets can help identify where these herbs are bought for the highest cost, thus poached the most. Import/export data can help law enforcement officers locate areas around parks where the most herbs are being sold. Prior criminal cases will store information on past poachers, so if an officer crosses paths with someone on the list, closer attention can be paid to that individual. Many companies are in the medicinal herb business. Some of these companies wish to educate citizens about how to attain specific herbs such as ginseng by giving workshops, holding meetings, or even distributing brochures. The last portion of the outline stores information on these topics.

The third and final portion of the outline, *Protection Tools,* provides law enforcement officials the toolkit needed to design and implement interdisciplinary protection plans. Listed first are conservation programs that have been created to protect medicinal herbs and other resources. The next section offers a collection of laws and regulations from across the country that focus on policies regarding the protection of these resources. Last on the list is what may be the most important part of all the documents: public education. These documents are used to educate the public on every aspect of the medicinal herb trade. There is a wide range of conservation tools, laws and regulations that may be improved. Current ideas include marking techniques involving tracing technology and replanting techniques to further enforce restrictions.

For electronic conversion and data conditioning, each paper document was scanned in conjunction with OCR (optical character recognition) technology, then indexed for metadata and keywords. In the process of scanning, each document is converted to a JPEG (.jpg) image. OCR is used to correct scanning errors, to repair damaged documents, and to transform documents into keyword-searchable files. As each document is successfully converted and conditioned, it is added into an organized tree index of relevant categories. Documents are easily accessed through the tree, or identified through keyword searches of files and metadata. Currently, the ginseng database contains approximately 280 documents.

Each document has its own metadata file that can be accessed to allow evaluation without opening the actual file. Metadata are pieces of information about the file that include author, date, title, publisher, and a description—basically all information that is essential if the file is to be useful as a reference. The metadata for Synthesis are based on Dublin Core, an international metadata standard.

Keyword searching is done either with a full-text algorithm or by using pre-assigned keywords. Assigning keywords, which requires careful reading of each document, is a time-consuming task for Synthesis specialists. The full-text search function was recently implemented in Synthesis and saves a great deal of time in database development; however, manual keyword indexing can still be advantageous in law enforcement and can be done at the prerogative of the customer. The ginseng documents have all been manually indexed. Full-text capability is an option in either case.

The outline of the Shenandoah ginseng database is shown in Table 1, with the number of documents for each category in parentheses. When clicked, a category reveals additional cascading categories and the actual document titles. The documents in each category have been qualitatively assessed and sorted by order of importance/relevance. More important documents are placed at the top of the list under each category.

Shenandoah's ginseng database is a work in progress. It is expected to be implemented by the park's special agents in 2003. The SRSC at JMU will provide on-going support

Table 1. Outline of the Shenandoah National Park ginseng database

Species Status (71)	*Laws and Regulations*
Ginseng	International (0)
Biology and Habitat Requirements (10)	National (10)
Population Surveys (18)	*State*
Historic Human Uses (15)	Arkansas (2)
Scientific Studies (12)	Georgia (3)
Other Protected/Endangered Plant Species (16)	Iowa (2)
Threats to Resource (57 total)	Kentucky (3)
TRAFFIC Report on International Trade (2)	Maryland (3)
Price Lists	New York (2)
Foreign (0)	North Carolina (5)
Local Markets (18)	Ohio (2)
Import/Export Data (16)	Tennessee (2)
Prior Criminal Cases (0)	Virginia (3)
Hunting/Finding/Digging Ginseng (21)	Wisconsin (2)
Protection Tools (142)	Others (4)
Ginseng Conservation Programs	Cases and Rulings (10)
International (3)	Plant Marking Techniques (1)
National (19)	Plant Replication Techniques (11)
State	Public Education (18)
Indiana (3)	Miscellaneous Documents (10)
Kentucky (2)	
North Carolina (6)	
Tennessee (2)	
Virginia (9)	
West Virginia (3)	
Others (12)	

and management as more information is revealed. The capabilities of the Synthesis Information Management System will allow for continued expansion of the ginseng database. In addition to new documents, the database will handle GIS information, which may contain different data types ranging from photographic libraries to spreadsheets to internet-based information.

The SRSC at JMU also functions as a conduit between users and program designers. The full-text search engine referred to earlier, as well as improvements to metadata functionality, were constructed in response to needs identified by the agents and rangers, communicated by SRSC specialists to Synthesis system designers and programmers. Other functions of the SRSC include training park personnel to create, maintain, and use their own databases; providing support for such efforts; and, most recently, developing multimedia interpretive VIEWS of the national parks. Parks served to date, in addition to Shenandoah, are Fort Sumter National Monument and New River Gorge National River. The New River Gorge work will support future general management planning. The newest partnership, with Lava Beds National Monument (Klamath Network), is scheduled to begin summer 2003.

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Using GIS to Focus Field Inventories of Rare and Endemic Plants at Badlands National Park, South Dakota

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Background

In southwest South Dakota there is a unique landscape known as the "Big Badlands" (Gries 1996) or the "White River Badlands" (O'Harra 1920) that is characterized by the presence of barren erosional features, known as "badlands," interspersed with mixed-grass prairie. These features form a dynamic land surface prone to landslides and rapid erosion, creating new land surfaces in the form of outwash plains at the base of buttes and scoured gullies, with each geologic formation lending unique soil chemistry and texture to its deposition (O'Harra 1920; USDA–Soil Conservation Service 1971, 1986, 1996).

Deeper soils mantling the buttes, hills, and alluvial valleys support relatively dense and diverse plant communities, typically grasslands. Soils on and adjacent to badland exposures and in drainage channels are rapidly deposited, and support a sparse plant community (Von Loh et al. 1999). These processes have shaped a variety of habitats for plants that are able to cope with rapidly changing substrate, variable moisture, and short-term competition. As these plants exist within a typical Northern Great Plains environment, they are also influenced by landscape processes of frequent fire, herbivory, and drought (Wright and Bailey 1980).

There are several rare plant species that are known to live in the barren badlands habitat, including some species that are considered endemic to the Northern Great Plains, a region generally considered depauperate of endemic flora (Great Plains Flora Association 1986). The interspersed grassland provides habitat for other species that are rare due to their local occurrence at the edge of their range.

Established in 1939, Badlands National Park is located in the Big Badlands landscape and preserves one of the nation's largest mixed-grass prairies. Yet the National Park Service (NPS) lacks information on rare plant inventory and distribution throughout the park's 244,000 acres. Nine state-listed rare species, including four endemics, have been confirmed within the park incidentally during the course of other studies, or they are known from similar habitats near the park. In 2003, the park initiated a two-year study to document the location and distribution of these nine rare plant species based on potential habitat at the park.

Project Objectives

The study's objectives are to:

- Use a geographic information system (GIS) to define potential habitat of the nine state-listed rare plant species, based on spatially explicit habitat parameters found in the literature, from known sites, and on voucher labels.
- Inspect probable habitat for the presence of the nine state-listed rare plant species.
- Document the presence or absence of each species in each polygon searched. Verify habitat characteristics, map distribution, and describe the population. Collect voucher specimen for species not previously vouchered in the park.
- Formalize documentation of presence (or absence) by recording observations and vouchers in various NPS databases and the South Dakota Natural Heritage Database.
- Make baseline data available for subsequent studies beyond the scope of this project.

Methods

An attempt was made to use GIS to focus field inventory efforts in order to maximize efficiency and provide the most information for proactive protection of the rare plant populations and their habitat, whether occupied or unoccupied. The distribution and abundance of many plants are influenced by the spatial arrangement of suitable habitats across landscapes (Ritters et al. 1997), and the quantification of such species–environment relationships represents the core of predictive geographical modeling in ecology (Guisan and Zimmerman 2000). Knowledge of which habitat parameters most accurately predict the occurrence of a rare plant species, and the likelihood that the species will occur given specific site conditions, is fundamental to effective management of rare species (Simberloff 1988; Brussard 1991; Falk and Olwell 1992; Wiser et al. 1998).

Three different approaches are being used to document the distribution and abundance of these nine species (see Table 1). The approach chosen reflects the information available for each species, its life history and habitat characteristics, and its relative importance to management.

Preliminary Results

The most intensively investigated species is *Astragalus barrii*, a long-lived perennial endemic species that is rare throughout its entire range. This species is known from several locations in and near the park, although it has never been systematically inventoried in the park. It exhibits consistent and precise habitat correlations that can be analyzed using GIS and existing geospatial data, making it feasible to accurately predict its occurrence based on habitat. Using ESRI ArcGIS 8.2 software, four categories of habitat characteristics (geology, soils, vegetation, slope) were scored based on their association with *A. barrii*, as indicated in the literature, on existing vouchers, and from documented populations.

Each record in each layer was given a score of 0, 1, or 2, where *0* represents no association, *1* represents weak or imprecise association, and *2* represents strong association. Each habitat parameter was given equal weight. All four layers were then summed on a 200x200-m grid cell covering the entire park. The result is that the entire surface of the park is scored on a linear scale of 0 to 8, with *8* representing the best, and *0* the worst, habitat for *A. barrii* (Dingman 2003). These scored raster cells were then converted into polygons representing contiguous habitat with the same score. Sixty polygons were then haphazardly selected across the full range of habitat scores, with more samples drawn from the high-score

Table 1. Nine state-listed rare plant species will be studied to document location and distribution within Badlands National Park, South Dakota.

Family	Scientific Name	Duration	Endemism	Investigation Approach
Fabaceae	*Astragalus barrii* Barneby	Perennial, blooms Apr-Jun	endemic	Intensive search and study to create predictive habitat suitability model
Polygonaceae	*Eriogonum visheri* A. Nels.	Annual, blooms Jul-Sep	endemic	Focused corridor search to map populations along roads and trails
Asteraceae	*Thelesperma megapotamicum* Spreng.	Perennial, blooms May-Sep	edge of range	Focused corridor search to map populations along roads and trails
Boraginaceae	*Cryptantha cana* A. Nels.	Perennial, blooms May-Jul	endemic	Focused corridor search to map populations along roads and trails
Brassicaceae	*Lesquerella arenosa* (Richards.) Rydb. Var. *argillosa* Rollins & Shaw	Annual, blooms May-Jun	endemic	Opportunistic encounters to map populations
Ranunculaceae	*Clematis hirsutissima* Pursh	Perennial, blooms May-Aug	edge of range	Opportunistic encounters to map populations
Asteraceae	*Chrysothamnus parryi* A. Gray	Perennial, blooms Aug-Sep	edge of range	Opportunistic encounters to map populations
Asteraceae	*Townsendia exscapa* Richards.	Perennial, blooms Mar-May	edge of range	Opportunistic encounters to map populations
Asteraceae	*Townsendia grandiflora* Nutt.	Biennial, blooms May-Jul	edge of range	Opportunistic encounters to map populations

polygons and fewer from the low-score polygons.

These sites will be inspected during the flowering season in 2003 for the purpose of recording presence and absence of *A. barrii* and other habitat and population information. These data will then be used to refine a predictive habitat suitability model that will then be validated on the adjacent Buffalo Gap National Grasslands. Such a model could then be used to anticipate the location of existing populations as well as unoccupied but suitable habitat for future populations. This information will assist park managers in proactively preserving the species and its habitat (Table 2).

Table 2. The habitat parameters of geology, soils, vegetation, and slope have been scored based on their association with *Astragalus barrii*, as indicated in the literature, on existing vouchers, and from documented populations. The result is that the entire surface of the park is scored on a linear scale of 0 to 8, with *8* representing the best, and *0* the worst, habitat for *A. barrii*. This preliminary habitat suitability model will be refined and validated during spring 2003 by searching a sample of polygons in each score to verify the habitat parameters and confirm presence or absence of the species.

Score	Number of Polygons	Min area (m^2)	Max area (m^2)	Mean area (m^2)	Total area (ha)	# Polygons to survey
0	414	25541	3284042	89542	3707	5
1	858	25541	2003028	78861	6766	5
2	1115	25541	38867515	234373	26133	5
3	1492	25541	13959491	101380	15126	5
4	1600	25541	5582687	82147	13144	5
5	1172	25541	9050160	155899	18271	5
6	1101	25541	1473910	81211	8941	10
7	485	25541	689177	63564	3083	10
8	247	25541	1504397	97173	2400	10
Total	8484	-	-	-	97571	60

Eriogonum visheri, *Thelesperma megapotamicum*, and *Cryptantha cana* have habitat specificity that can be analyzed using GIS and existing geospatial data. However, the available habitat information is too imprecise or the species are too ubiquitous in their distribution to make predictive habitat suitability modeling feasible. Probable habitat, as defined using GIS, will be searched with the highest-priority search areas located within 700 m of improved roads and 100 m of designated trails. Because visitor use and management activities are concentrated along road and trail corridors, this approach maximizes search efficiency and also provides the information most needed by managers to avoid and minimize impacts to the plants and their habitats. As populations of these species are identified and mapped, it may be possible to better define their habitat preference and then use GIS to develop habitat suitability models for these species (Table 3).

Probable habitat for five other species could not be defined using GIS due to the lack of habitat specificity demonstrated by the species and/or the resolution of existing spatial data. Some of these species tend to be microsite-specific, such as “thin” areas of prairie that are not discernable based on the resolution of existing geospatial data, thus making it impossible to pick out microsite habitats. These species will not be subjected to a focused inventory effort. Park field employees and cooperators will be trained to recognize these species and report sightings. Species occurrences will be documented as populations are opportunistically encountered and verified. If enough populations are found, it may be feasible to better define their habitat characteristics and use GIS to define probable habitats for future inventory efforts.

In summary, GIS was used to the extent possible to focus field inventory efforts for the short flowering season of each species, thus increasing the efficiency and efficacy of this inventory project. The effort to document

Table 3. Probable habitat maps for *Cryptantha cana*, *Thelesperma megapotamicum*, and *Eriogonum visheri* were created based on the habitat parameters of geology, soils, vegetation, and slope. The 2003–04 inventory work will focus on those habitats, and possibly populations, that are within 700 m of improved and 100 m of designated trails. From this information, we hope to gain the information needed to create a habitat suitability model that will focus future inventory efforts more effectively.

species	Total # of polygons in park	Area (m^2) of probable habitat in park	# of polygons in corridor	Area (m^2) of probable habitat in corridor
Cryptantha cana	164	2529	75	117
Thelesperma megapotamicum	968	1,532,873	326	46,578
Eriogonum visheri	86,026	539,744	20,834	223,092

location and distribution of these species will provide the information needed for more meaningful environmental analyses and proactive preservation of these species and their habitats.

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GIS, GPS, Cultural Resource Database Information, and the FMSS Program at Kalaupapa National Historical Park

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Kalaupapa National Historical Park, established in 1980, contains the physical setting for two tragedies in Hawaiian history. The first was the forced removal of indigenous people in 1865 and 1895 from an area where they had lived for over 900 years on the island of Molokai. This resulted in the cutting of cultural ties and the association of generations of Hawaiians with the *aina* (land). The second tragedy was the forced relocation of thousands of Hawaiians, sick with leprosy, to this isolated settlement starting in 1866 and continuing until 1969. The establishment of the isolation settlement, first at Kalawao and then at Kalaupapa, was the government's response to the growing fear of the disease.

The community of Kalaupapa, on the leeward side of the Kalaupapa Peninsula, is still home for many surviving Hansen's Disease patients. Many of the structures that support this community still exist today. There are distinctive neighborhoods that support many activities of daily life. Since 1980, when the park was established, the National Park Service (NPS), in cooperation with the Hawaii Department of Health and the Department of Hawaiian Home Lands has begun a process of transfer of historic structures over to NPS's care. This process includes a careful analysis of the historic value of the structure as well as of the steps necessary for future care of the building. With over 400 buildings in the settlement, it was necessary to prioritize buildings with the goal of preserving the cultural landscape of the neighborhoods. Over 200 buildings were identified as a high priority for preservation.

Even before the establishment of the national park, the Kalaupapa Leprosy Settlement was designated a national historic landmark in 1976. Many individual structures are now listed by NPS on the List of Classified Structures (LCS). The LCS database contains important information concerning each building. An important part of the on-going management of the historic structures by NPS is the use of a geographic information system (GIS) to map the LCS database. A detailed map was produced from digitized utility and survey maps showing the location of each structure. From these digitized maps, ArcView building shape files were developed with key data fields listing the LCS number for each building. The LCS data are joined with the map data to produce an interactive map with both building locations and detailed information about each building from the database.

The next step in the preservation of the historic buildings took place in 2002 with the implementation of the NPS Facility Management Software System (FMSS). Each of the buildings in the settlement is entered as an asset into FMSS. Each of the structures is given an asset priority index (API), which assigns an importance value to the building. The next process is to define the current replacement value (CRV) for each of the structures. This number will be used to determine the condition relative to other structures. A condition assessment is completed on each structure and "work orders" are entered describing work to be completed on each structure. The total cost for the work orders is compared with the CRV and the API to produce an asset condition index (ACI). The ACI indicates the condition of each structure, from "poor" to "good" condition. The information is entered for each structure in FMSS, then combined with the LCS data in the interactive ArcView map. The database for FMSS is stored in a central server in Washington, D.C., but the data are accessible through reports. The reports can be assembled so as to be compatible with GIS. The Kalaupapa building shape files also note the individual FMSS asset number, so the two databases can be joined. The database for each building now lists the FMSS data. As new data are added to FMSS, the joined database is also updated.

The use of ArcView GIS and the ability to join other databases with the GIS data have become important tools for park managers to preserve historic resources at Kalaupapa.

Non-invasive Mountain Lion Sampling in Seven Southwestern National Parks

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Elusive, mysterious hunters lurk in the shadows. Most of us will never see them; some do. Hundreds of mountain lion sightings are reported across the western United States and Canada each year. The majority of mountain lion and human encounters are of a benign nature. Research shows that only 66 attacks—resulting in 15 human fatalities—have been recorded in the past century. While this averages out to fewer than one mountain lion attack per year over the past 100 years, the alarming reality is that over three-quarters of these attacks have occurred since 1970. The distinct increase in attacks over the past few decades provokes increased concern among managers about risks to people recreating or residing in an environment with mountain lions.

While recreationists in wilderness areas face inherent risks, resource managers can take measures to reduce those risks, including those posed by predators. Useful indicators of lion activity in proximity to humans may provide early warnings, enabling managers to minimize potential for harmful situations. Knowing how and when mountain lions use habitat, especially areas frequented by humans, may contribute to reducing the potential for dangerous incidents involving mountain lions and humans. Data collected regarding lion populations and movement patterns enable managers to protect mountain lions, people, and ecosystems. A multiyear project at Grand Canyon National Park is providing a framework for other parks to obtain valuable information about their mountain lion populations.

Historically, mountain lions occupied almost every identifiable biogeographic zone throughout North and South America. The lion had the widest distribution of any mammal in the Western Hemisphere, testimony to its ability to adapt to ecosystems and the multitude of species inherent within them. The cat's greatest adaptive challenge has been eradication campaigns in the United States. The lion's superb predatory abilities and elusive nature made it hated and feared among the settlers. Since then, the lion has disappeared from nearly two-thirds of its previous range.

Natural systems require viable populations of predators in order to maintain complete and sustainable ecosystems. Predators are often referred to as keystone species whose presence indicates a healthy ecosystem, as they require substantial amounts of habitat and diverse prey bases. With large carnivore populations declining worldwide, the mountain lion fills an integral ecological niche as the last remaining predator throughout much of its historical range.

Large carnivore populations across the West are facing increasingly shrinking and fragmented habitat as human development clambers farther into wild ecosystems. Large tracts of undeveloped land, which often occur in national parks, provide some of the only remaining habitat where populations of large predators can thrive. National parks often serve as safe havens for large carnivores where they are not hunted and can successfully reproduce. Resource managers in national parks are faced with the complex mandate of maintaining critical predator populations while providing for visitor safety.

The situation facing parks today is underscored by an insufficient understanding of park ecosystems and threats. According to research in California, most attacks on people and pets occur along the "urban fringe," where human development and recreation in mountain lion habitat is highest. Visitor services and residential areas located within parks create a wildland–urban interface, similar to urban fringe, where the risk of attacks is increased.

Currently, many parks only have information on the presence of mountain lions, in part because of the notorious difficulties obtaining information about populations of large terrestrial mammals with low densities. Practical and accurate methods of estimating population numbers and monitoring trends are scarce and tend to be very costly and time-intensive. Invasive sampling techniques are often impossible for small parks due to financial and practical constraints. Recent developments in non-invasive, genetic sampling techniques provide a practical alternative. Non-invasive sampling can be used successfully to monitor elusive carnivores that often inhabit remote, inaccessible areas. These techniques are often cost-effective, require less intensive field work than invasive methods, and do not interfere with the natural behavior of the animals.

In an effort to initiate a project among multiple parks to gather information on mountain lion populations, resource managers from six national park and monument units joined forces in 2001. A protocol using non-invasive sampling techniques was developed and implemented, first at Grand Canyon National Park, then expanded to include Mesa Verde, Saguaro, Carlsbad Caverns, Guadalupe Mountains, Zion, and Flagstaff-area national parks and monuments. The non-invasive methods include track surveys, scat collection, hair sampling, and use of remote infrared camera systems. Two years of field surveying at each park was initiated in fall 2001. Staff and volunteers trained in 2001 are assisting in data collection and coordinating lab analysis in support of the project.

This study is providing a standardized process for conducting extensive mountain lion surveys. The protocol is intended to assist other national park and forest units in monitoring lion populations and movement patterns. This project will expand non-invasive sampling to focus on mountain lion response to varying human population densities within parks. The primary objectives of this study are to document movement patterns of mountain lions, focusing on the areas of high human activity, and to relate temporal and spatial use patterns of mountain lions to areas of the park. Information obtained from this research will have direct applicability to development of management alternatives in each park. This research will allow the National Park Service to refine its management strategies to protect mountain lions, people, and ecosystems.

The National Park Foundation, Grand Canyon National Park Foundation, and Colorado Plateau Cooperative Ecosystem Study Unit Research Office funded the project and also paid for a shared seasonal technician experienced in non-invasive sampling. Matching Cooperative Ecosystem Study Unit funding allows for multi-lab analysis at the University of Idaho, Virginia Tech, and the University of Arizona, to ensure accuracy of DNA fingerprinting and consistency in analysis, and to allow for several years of data collection.

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A Comparison of Grid Sampling Designs with Stratified/Nonuniform Probability Sampling Designs for National Park Monitoring (Summary)

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Summary of Full Paper

Grid sampling with a random start is an excellent general-purpose design that assures that all areas of the park are fairly represented. The grid can be intensified in areas of particular interest. Issues and objectives certainly will change over time, but the sampling grid will remain constant and provide a good sample for all questions. Stratified/nonuniform probability sampling designs provide the opportunity for optimization, considering habitat differences, travel time to the plots, administrative requirements and other issues. Stratified designs will provide more precise estimates for important variables, are more flexible and can more easily target rare habitats, but grid designs are simpler and may be better for other variables. Plots can be easily added to stratified designs, but strata changes require the more complex nonuniform probability sampling approach. A grid design can be easily intensified to add plots, but the number of plots is restricted to fit the grid. The full paper is available from the authors or on-line at: www.pwrc.usgs.gov/brd/sampledesignsgw.htm.

We discuss the strengths and weaknesses of each approach and the situations where each would be appropriate, considering the park's objectives. Simple worked examples are provided to illustrate each approach.

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An Interactive Educational Tool for Understanding Cultural and Natural Resource Preservation at Petersburg National Battlefield

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Introduction

The interpretive rangers at Petersburg National Battlefield and members of James Madison University's Department of Integrated Science and Technology have been working together to develop a virtual experience that highlights the historical significance of Petersburg National Battlefield and the challenges of preserving this battlefield landscape. The National Park Service's Natural Resource Information Division provided the technological foundation for displaying the content and creating an informative, exciting, interactive tool that can be used by students, teachers, visitors, and virtual travelers to more fully explore this historic park. The Petersburg *Views* project is accessible online, along with *Views* of other parks at www.nature.nps.gov/synthesis/views.

Cultural Resources

Petersburg National Battlefield preserves an important piece of Civil War history. Located just 25 miles south of Richmond, Virginia, Petersburg became an important supply center to the Confederate capital during the Civil War. With five railroad lines and key roads, both Grant and Lee knew that if these transportation lines could be cut off then Petersburg could no longer supply Richmond with much-needed food and supplies. Without this, Lee would be forced to leave both cities.

Grant was not able to capture Petersburg, and so the siege began in June 1864. Both sides constructed earthen fortifications and dug trenches to protect and shelter the troops. Nine and a half months later, the war ended when Lee evacuated Petersburg and surrendered at Appomattox a week later.

The lives lost at Petersburg, the unique fortifications, the extended siege, and the bravery and determination of many individuals that fought at this site make it a valuable cultural resource. Poplar Grove National Cemetery with its 6,148 Union graves and Grant's Headquarters at City Point are part of the Petersburg story as well.

Natural Resources

Preserving the cultural resources at Petersburg and managing the visitor experience at the park requires many natural resource management decisions. Some of the most important natural resource issues facing Petersburg National Battlefield include the maintenance of earthworks, management of invasive species, preservation of open space and vistas in the battlefield, erosion of the monuments and markers in Poplar Grove National Cemetery, and riparian restoration along the shores of the James and Appomattox rivers at City Point.

Features of the Project

Views of Petersburg National Battlefield explores both the stories of the past and the natural resource issues of the present. The battlefield can be explored through the eyes of a war general, a plantation owner, a soldier, a surgeon, an engineer, or a civilian to learn about the cultural resources at the park. To explore the current challenges in maintaining this historic landscape, the natural resources are viewed through the eyes of an interpreter, a biologist, a protection ranger, and a superintendent.

Petersburg National Battlefield contains 2,659 acres and is made up of five major units; Grant's Headquarters at City Point, the Eastern Front, the Western Front, Five Forks Battlefield, and Poplar Grove National Cemetery. A closer look at each unit within the park, whether in the historical context or the natural resource context, provides the viewer an understanding of the war and its causes, impacts, and legacies to all Americans.

The virtual experience was designed to teach people about the park using a variety of tools, at a level appropriate for upper elementary and middle school audiences. Video, interactive maps, virtual views, historic photographs and documents, interactive games, and primary-source scenarios provide access to the rich historical background of the park. Photos, diagrams, animations, and explanations layered for casual interest and deeper curiosity about the natural resource management issues and the scientific basis of the issues provide accurate information about management concerns and the technology of possible solutions.

Teacher Resources

The teacher guide will provide teachers with curriculum-based activities and lesson plans that can be used in the classroom and in the field. These teaching tools will include both history and science-based lessons on Civil War-related themes and battlefield preservation that can be printed or viewed on the computer.

A unique feature of the *Views* project and teacher resources is a series of scenarios (in development) that present information about resource management problems from a variety of viewpoints. The scenarios provide the background information and the viewpoints of the interpreter, biologist, protection ranger, and any others that are needed to explain the situation. Viewers (students) are asked to wear the superintendent's hat to make decisions about what they would do. Engaging viewers in the decision-making process emphasizes the challenges of maintaining and preserving resources in the national parks. Teachers' resources will include further information about the ultimate resolution of some of the scenarios, such as the decision to replace rather than restore eroding monuments in Poplar Grove National Cemetery.

Partners in the Project

As this project has evolved, many people and groups contributed to its development. The 2001 Natural Resource Management class (ISAT 424) at James Madison University developed case studies for the project, and came up with the idea of "The Superintendent's Hat." In their example, users explore resource management issues from several viewpoints and then make decisions as the "virtual superintendent." The final product incorporates this idea, allowing the user to study the challenges of preservation at the battlefield through the eyes of an interpreter, a biologist, a protection ranger, and a superintendent. The dialogue between students and classes at James Madison University and the interpretive staff at Petersburg gave the project the added excitement of partners explaining new ideas to each other.

Acknowledgments

Thanks go to Dana Wiggins, Heather Edmondson, Janet Sobel, and the James Madison University ISAT 424 class, fall 2001 (for natural resource management content); the cultural heritage and interpretive staff at Petersburg National Battlefield; Dave Krueger for CD-ROM development and programming; and Bruce Nash of the National Park Service Natural Resource Information Division for support and overall project advice.

Soil Compaction as Indicated by Penetration Resistance: A Comparison of Two Types of Penetrometers

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Introduction

One of the most common ecological changes induced by recreational use is soil compaction, a process in which individual soil particles within the soil matrix are forced to rearrange themselves into closer proximity (Liddle 1997). Some common forces of soil compaction in recreation settings include trampling by foot and vehicular traffic on recreation sites and trails, though soil compaction can also occur from natural causes such as drying and wetting. Soil compaction typically results in reduced amount and size of pore space and total soil volume, which in turn lead to decreased infiltration capacity and increased surface runoff, standing water, and erosion (Brady and Weil 2002). These changes represent site degradation and may have a detrimental effect on vegetation and soil resources.

The objective of this paper was to apply two common types of soil compaction measuring tools in Boston Harbor Islands National Recreation Area to evaluate their utility and data variability.

Measuring Soil Compaction

Four approaches have been developed in agriculture and related disciplines to measure soil compaction: penetrometry, bulk density, conductivity/permeability, and radiation (Freitag 1971). *Penetrometry,* or soil strength, measures the resistance of soil surface to vertical force by poking a rod or penetrometer into the soil. *Bulk density* is determined by the weight of oven-dried solid per unit volume. This approach requires collection of soil samples and oven-drying in a laboratory (Lowery and Morrison 2002). *Conductivity/permeability* evaluates the rate at which water or air permeates through soil. A common technique in this category is infiltration capacity, which requires the availability of field time and distilled water. Finally, *radiation* methods, such as surface nuclear gauges, measure soil density instantly based on penetration of gamma rays or neutrons. This approach requires expensive equipment and licensed users.

Penetrometry and bulk density are the most common compaction measures in visitor impact studies (Liddle 1997). This study adopted penetrometry as the soil compaction measure due to its requiring a minimum of ground disturbance, as mandated by park regulations, and its efficiency in island settings. In a campsite impact study, Marion and Cole (1996) documented a 460% relative change in penetration resistance between the campsites and the control areas as measured by pocket penetrometer. The mean penetration resistance on 29 campsites was 2.8 kg/cm^2, while the undisturbed control sites averaged 0.5 kg/cm^2 (Marion and Cole 1996).

Methods

Study area. This study is part of a larger Visitor Experience and Resource Protection (VERP) research project in Boston Harbor Islands. Soil compaction was evaluated as a potential resource indicator. Boston Harbor Islands consists of 34 islands and peninsulas in Boston Harbor, and is 650 ha in total size. Due to its proximity to population centers, this new park receives an ever-increasing visitation, with 262,000 recreational visits recorded in 2002 (Boston Harbor Islands National Recreation Area 2003). The park is managed by a 13-member partnership that includes the National Park Service, federal, state, and municipal agencies, and non-profit organizations. This paper focuses only on two public-use islands, where soil compaction measurements were performed. Georges Island is a heavily used island with Udorthents (Ud) loamy soil as the dominant soil type. Grape Island possesses a more natural setting with less visitor use. Newport silt loam (NpC) and Pittstown silt loam (PtB) soils dominate Grape Island. They are reported herein as a combined soil type (NpC/PtB).

Penetrometers selected. Two different types of portable penetrometers were chosen to measure penetration resistance as an indicator of soil compaction. The pocket penetrometer (SOILTEST, Inc.) is a spring-loaded instrument 15.2 cm in length and 1.9 cm in diameter. The instrument measures penetration resistance when its 6.4-mm-diameter round tip is pressed 6.4 mm into the soil. When pushed into the ground, a metal ring is pushed up the scale, marking the penetration resistance value in kg/cm^2. The soil compaction tester (DICKEY-john Co.) is a portable cone penetrometer 93 cm in total length with a dial on top to immediately read the soil compaction value (pounds per in^2). An angled cone attachment of 12.7 mm or 19.1 mm is screwed onto the other end of the 70-cm rod that is pushed into the ground. The rod is marked every 7.6 cm to enable measurement of soil compaction at 7.6-cm increments (up to 45.7 cm).

Field procedures. In June 2002, a total of 12 circular plots (6-m radius) were established on Georges and Grape islands. On each island, two plots were randomly located within high-use zones (close to a pier), while another two were randomly located in low-use zones. Within each plot, 12 quadrats (25 cm x 25 cm) were randomly located along six radial transects that are 60° apart. In each quadrat, four penetration resistance (PR) readings were taken using the pocket penetrometer (PP), and four pairs of PR measurements were taken using the soil compaction tester (SCT) at a depth of 7.6 cm and 15.2 cm. Hence, the maximum numbers of PP and SCT readings for each plot were 48 and 96, respectively. Only the SCT readings at the 7.6-cm level are compared with PP readings. Due to rocks, roots, and compaction, not all SCT measurements could be taken at their intended depths, resulting in reduced number of SCT readings in some cases. Eight background PR measurements were taken with two penetrometers, respectively, at adjacent, environmentally similar control areas outside each plot. All measurements of a single plot were completed on the same day.

The same plots and quadrats were relocated and remeasured in August and October 2002 to evaluate temporal changes. The August data were collected during a severe drought, resulting in extremely high PR readings under unusual soil moisture regimes. For comparability purposes, only data from June and October 2002, representing the beginning and end of the visitor-use season, are presented. PR readings from two plots representing the same use level were combined. Relative PR change of each plot was calculated by the difference between mean plot and control PR values divided by the control mean PR value. Relative changes are valid for comparison among sites with varied background PR levels. Data variability was evaluated by the coefficient of variation (CV; standard deviation as the percentage of the mean). The percentage of successful SCT penetration to each depth level in each plot was reported as penetration depth. All SCT and PR readings were converted to kg/cm^2 for analysis and reporting.

Results

Beginning of visitor-use season. High-use plots started with higher PR values on both islands in June. On Georges Island (Ud soil), the mean PP–PR was 3.0 kg/cm^2 for high-use plots and 2.1 kg/cm^2 for low-use plots (Table 1). The relative PR change based on PP was 54.3% for high-use plots and 53.0% for low-use plots (Table 2). On the other hand, the mean SCT–PR was 31.6 kg/cm^2 for high-use plots and 18.8 kg/cm^2 for low-use plots. The relative PR change based on SCT readings was 66.4% for the high-use area and –0.05% for the low-use area, indicating essentially the same PR level between use and control sites in the latter case (Table 2).

PR values as measured by both penetrometers were lower on Grape Island (NpC/PtB

Table 1. Penetration resistance measurements on Georges Island (Ud soil) using two types of penetrometer.

Penetrometer/ Use Level		June 2002				October 2002			
		Mean (kg/cm^2)	Std. Dev. (kg/cm^2)	Coeff. of Var. (%)	n	Mean (kg/cm^2)	Std. Dev. (kg/cm^2)	Coeff. of Var. (%)	n
Pocket Penetrometer									
	High Use	3.0	0.8	25.8	96	2.3	0.9	37.9	96
	Low Use	2.1	0.8	37.1	96	1.5	0.8	51.7	96
Soil Compaction Tester (7.6 cm)									
	High Use	31.6	7.3	23.1	80*	23.7	6.2	26.0	47*
	Low Use	18.8	5.2	27.8	92*	24.5	7.2	29.5	60*

* Some readings were unable to be obtained due to failure of the equipment to penetrate to the required depth.

Table 2. Relative percentage changes in penetration resistance on George Island (Ud soil).

Penetrometer/ Use Level		June 2002	October 2002
Pocket Penetrometer			
	High Use	54.3*	35.4
	Low Use	53.0	60.9
Soil Compaction Tester (7.6 cm)			
	High Use	66.4	21.3
	Low Use	-0.1	25.9

soil). For example, the mean PP–PR was 2.0 kg/cm^2 for high-use plots and 1.5 kg/cm^2 for low-use plots. According to the relative PR difference, use sites on Grape Island actually had more substantial compaction change as compared with their off-site controls. For example, relative PR changes for PP were 85.9% and 143.5% for high- and low-use plots respectively, while those for SCT were 111.7% and 53.5% (Table 4).

With respect to variability of PR measurements, results were comparable between the two soil types, with CV values ranging from 23.1% to 37.1% on Georges Island (Ud) and 31.2% to 42.1% on Grape Island (NpC/PtB) (Tables 1 and 3). The measurements on high-use Ud plots showed less variability, while the NpC/PtB plots exhibited a reverse pattern. Pocket penetrometer readings appeared to have a higher variability than SCT readings in

Table 3. Penetration resistance measures on Grape Island (NpC/PtB soil) using two types of penetrometer.

Penetrometer/ Use Level		June 2002				October 2002			
		Mean (kg/cm^2)	Std. Dev. (kg/cm^2)	Coeff. of Var. (%)	N	Mean (kg/cm^2)	Std. Dev. (kg/cm^2)	Coeff. of Var. (%)	n
Pocket Penetrometer									
	High Use	2.0	0.9	42.1	96	2.4	0.8	35.9	46*
	Low Use	1.5	0.6	37.2	96	1.8	0.4	22.2	48*
Soil Compaction Tester (7.6 cm)									
	High Use	16.6	5.9	35.2	96	22.5	4.6	20.6	38*
	Low Use	10.4	3.2	31.2	96	12.9	2.3	17.5	47*

* Only one plot was measured for each use level in October due to logistical constraints. Some readings were unable to be obtained due to failure of the equipment to penetrate to the required depth.

Table 4. Relative percentage changes in penetration resistance on Grape Island (NpC/PtB soil).

Penetrometer/ Use Level		June 2002	October 2002
Pocket Penetrometer			
	High Use	85.9*	34.8
	Low Use	143.5	42.7
Soil Compaction Tester (7.6 cm)			
	High Use	111.7	37.8
	Low Use	53.5	25.7

most cases, particularly on Grape Island (Tables 1 and 3).

End of visitor-use season. All Georges Island plots were reassessed in October 2002. Due to inclement weather conditions, only one high-use plot and one low-use plot were remeasured on Grape Island, resulting in fewer readings. Consistent with June data, high PR values were recorded on high-use sites using both penetrometers. On Georges Island (Ud), the PP mean was 2.3 kg/cm^2 for high-use plots and 1.6 kg/cm^2 for low-use plots, both of which were lower than at the beginning of the visitor-use season (Table 1).

The relative PR changes based on PP were 35.4% and 60.9% for high- and low-use plots, respectively (Table 2). The SCT–PR mean for the high-use plot was 23.7 kg/cm^2 and 24.5 kg/cm^2 for the low-use plot. The relative PR changes were 21.3% and 25.9% for high- and low-use plots (Table 2).

On Grape Island (NpC/PtB), the PP–PR mean was 2.4 kg/cm^2 for the high-use plot and 1.8 kg/cm^2 for the low-use plot. These values were higher than the June values (Table 3). The relative PR changes based on PP were 34.8% and 42.7% for the high- and low-use plots, respectively; these were lower than the June values (Table 4). The SCT results showed similar patterns on this island.

Both soil types exhibited a higher variability of PR measurements at the end of the visitor-use season, with CV values ranging from 26% to 51.7% for George Island (Ud) and 17.5% to 35.9% for Grape Island (NpC/PtB) (Tables 1 and 3). In the Ud soil type there was the same pattern in which high-use sites exhibited less variability, while in the NpC/PtB soil type there was less variability on low-use sites. Quite consistently, PP showed a higher degree of variability than SCT in both soil types.

Penetration depths. These measurements were applicable to only SCT. The results suggest that soil was generally less penetrable on high-use sites and on Georges Island (Ud), on which most of the SCT measurements were not able to reach the depth of 15.6 cm. At the 7.6-cm level, there was a decreasing trend in penetration depth from the beginning of the visitor-use season (83.3–95.8%) to its end (68.8–79.2%). Soil was more penetrable on Grape Island (NpC/PtB soil). Twenty-four percent to 46% of SCT measurements reached the penetration depth of 15.6 cm. The soil was less penetrable at the 7.6-cm level in October, with the percentage penetrated decreasing from 100% to 85% on the high-use site.

Discussion and Implications

It should be noted that the PR values of two penetrometers cannot be directly compared due to differences in their measurement depth and mechanism. However, they may be evaluated based on their utility and data variability. The PP is less expensive (about $60) and is very efficient to operate with one person. The ring attached to the penetrometer holds the PR reading until it is reset. Pocket penetrometer measurements also create less ground disturbance. In contrast, the SCT is more expensive (about $250), is harder to carry, and requires two persons to operate effectively. One person must be dedicated to taking the dial reading, as it changes constantly. Another person must keep track of rod markings to ensure that a reading is taken at each desirable penetration depth. As a result, the inter-rater variability could be higher. This aspect of measurement error, however, was not assessed in this study. Furthermore, the two sizes of cone tip and corresponding scales on the dial gauge could create confusion.

On the other hand, the PP readings contain a higher degree of variability based on CV. This may be due to the short penetration depth of this equipment. Irregularities of soil surface, such as rocks, stones, plant litter, and tree or grass roots, are more likely to interfere with the PP readings. Since SCT measures compaction at a deeper level, it is less influenced by surface conditions. The SCT is also capable of measuring compaction at various depths.

There are several other observations from this study. First, the relative PR changes in this study were much lower than those reported in Marion and Cole (1996). This may be related to generally higher PR levels on both use and control areas in Boston Harbor Islands as compared with campsites in Delaware Water Gap National Recreation Area (Marion and Cole 1996). Second, the PR level of Georges Island was generally higher than that of Grape Island. A number of factors, such as soil type and amount of use (higher visitation on Georges Island), may have contributed to this variation. Third, the high-use plots on Georges Island (Ud soil) showed less data variability for both penetrometers, whereas less data variability were found on the low-use areas on Grape Island (NpC/PtB soil). In other words, data variability of PR readings appeared to increase with decreasing PR level. A possible explanation is that soil strength could become more uniform in compacted soil. Finally, the relative PR changes were found to decrease in most cases from June to October, indicating the closing gap of PR between use and control areas. Both decreasing on-site PR values and/or increasing control PR values may have caused this effect.

Concluding Remarks

There are a number of limitations in this study. Only two islands and two penetrometer types were involved. Bulk density and soil moisture were unavailable to provide a more comprehensive comparison. The control areas are not entirely free of human influence and may be subject to limited foot traffic. This data set is being further examined to understand spatial and temporal patterns and to correlate with vegetative ground cover.

While soil compaction has been excluded from the final list of resource indicators for implementation of VERP at Boston Harbor Islands, this study has provided the park with baseline PR data on three different islands (data on Peddocks Island were not presented here). It seems useful to conduct similar measurements on selected sites that show signs of growing degradation. The PR data can inform management of the need for visitor and/or site management actions to reduce soil compaction and increase soil quality of recreation sites.

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Using Global Positioning Systems to Monitor Elkhorn Coral, *Acropora palmata*, at Buck Island Reef National Monument, U.S. Virgin Islands

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Introduction

Elkhorn coral, *Acropora palmata*, is a major reef-building species that is found mostly in water depths of less than 10 m. Up to the 1970s, elkhorn coral was the dominant coral in wave-exposed and high-surge reef zones throughout the Caribbean (Adey 1978; Gladfelter et al. 1977). In 1973, white band disease was recorded for the first time at Buck Island Reef National Monument (Robinson 1973). This disease affected Acroporids throughout the Caribbean, and within two decades killed over 80% of the elkhorn coral at the park. Hurricanes, such as Hurricane Hugo in 1989 and Marilyn in 1995, further damaged those reefs (Bythell et al. 2000; Hubbard et al. 1991; Rogers 1992). The wide-scale decline of elkhorn coral led to its being added in 1999 to the candidate species list of the Endangered Species Act.

Some areas in the park have experienced elkhorn coral recruitment and growth within the last decade. The growth rate of elkhorn coral can reach 10 cm/year, and the species is one of the fastest-growing among stony corals (Gladfelter et al. 1978). However, problems have occurred when applying conventional coral-monitoring methods to this species. The chain transect method may result in the accidental breakage of some of the fragile branches, especially in high-surge zones, while two-dimensional quadrant methods may poorly quantify its complex three-dimensional structure.

The objectives of this study were to (1) develop a non-invasive method to monitor distribution, abundance, and size of elkhorn coral within large areas of linear reef, and (2) collect baseline information for damage assessment after hurricanes, disease outbreaks, and ship groundings.

Methods

Buck Island Reef National Monument (N 17°47'/ W 64°37') encompasses a 176-acre island and 18,839 acres of submerged lands. Buck Island is located 1.5 miles to the northeast of St. Croix, U.S. Virgin Islands. The eastern part of the island is surrounded by a barrier reef system with a protected lagoon and a wave-exposed fore-reef. Our study area was an 18.4-acre section of this fore-reef, where large elkhorn thickets previously dominated.

We defined the elkhorn colony size as its maximal dimension and grouped the colonies into size classes: small, measuring 1–49 cm; medium, 50–99 cm; large, 100–199 cm; extra-large, 200–399 cm, and so forth. Two researchers using snorkels recorded the location of every colony using handheld global positioning system (GPS) units that were put into waterproof bags. One GPS was designated for each size class. We used 1-m PVC (polyvinylchloride plastic) poles demarcated at 0.5-m increments to verify colony sizes. A pilot study determined that, for small colonies, the surveyor error was greater than 25%; thus, we did not survey them. A section of the reef was surveyed repeatedly to calculate errors of the remaining size classes.

We downloaded the location of every colony and time of data collection to a computer and then differentially corrected the locations. The corrected locations were then plotted on a georectified aerial photo provided by the National Oceanic and Atmospheric Administration (NOAA) Biogeography Program using the GIS (geographic information system) software ArcView 3.2a. We used ArcView's spatial analyst extension to calculate elkhorn density. The density was defined as the number of elkhorn colonies within a 100-m^2 circle.

Results

Surveyor error for the medium, large, and extra-large classes were 3%, 2%, and <1%, respectively. Two researchers using snorkels surveyed, on average, 1 acre/hour. We recorded 1,808 elkhorn colonies greater than 50 cm. Of those, 57% were medium, 39% large, and 4% extra-large. Maximal density was 61–70 colonies per 100 m^2. Thirty-four percent of the study area had no colonies, 56% had a density of 1–10 colonies/100 m^2, 8% a density of 11–20 colonies/100 m^2, and 2% a density greater than 21 colonies/100 m^2.

Discussion

Elkhorn coral distribution, abundance, and size may change rapidly compared with other hard corals due to its fast growth rate and the ability to establish new colonies from broken fragments. However, conventional coral-monitoring protocols have proven difficult for this fragile, branching, shallow-water species. This new method provides a non-invasive and rapid way to monitor large areas of linear reef with relatively small surveyor error (<5%). It thus can detect a 5% change in the number of colonies within a study area or even within sections of a study area. Changes in the number of colonies will also be reflected in density changes. Furthermore, changes in the amount of area with no colonies are a sign of recruitment or mortality. A further benefit is the ability to detect shifts in the size class distribution that can occur if diseases or hurricanes are selective for certain size classes. This method is ideal for linear reefs, where the data collectors can orient themselves and avoid double-marking of colonies. However, this method can be modified; for example, by laying out reference lines prior to data collection. In the future, this method may even be possible using Scuba.

At the park, data collection by this method will be done on an annual basis. Additional surveys will be conducted after hurricanes, disease outbreaks, and ship groundings. Supplemented by data gathered from long-term monitoring sites, recruitment sites, and random survey plots on non-linear reefs, these data will provide the basis for future population trend-analysis.

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Current Topics in Natural History Collecting and Collections

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Though natural history specimens represent only 6% of the objects and specimens in National Park Service (NPS) collections, their number is increasing rapidly. The recent advent of the natural resource inventory and monitoring (I&M) initiative has stimulated acquisition of specimens. Accompanying this growth are calls for revisions to policies and procedures and innovative solutions to arising issues. Several speakers addressed these topics at the George Wright Society/Cultural Resources 2003 Joint Conference and have made their papers available. The assembled invited or contributed papers in this section of the proceedings are complementary and shed light on current trends in NPS natural history collecting and collections management.

Papers associated with three case studies at Acadia, Death Valley, and Channel Islands national parks illustrate current practices at parks and non-NPS repositories in managing park collections. Several of these papers review the procedures for obtaining a permit to collect and the responsibilities of the permit applicant to consult with the park curator about management strategies for specimens that are permanently retained. They consider the collector's responsibilities in preparing and documenting the specimens and associated records and in recommending a repository for the specimens. One paper reviews the options that the parks have in choosing a NPS or non-NPS repository for collected specimens and data and the need for parks to have a well-conceived strategy to guide that choice. Taken together, the case study papers emphasize the need to ensure that park permit coordinators, park curators, permitted researchers, and designated repositories work together to document, preserve, and facilitate access to the specimens to further science and park resource management. They touch on problems with the process from the viewpoint of the park, researcher, and repository; adjustments that can be made to accommodate legitimate needs; and steps that are taken when abuse occurs.

One contributed paper describes a rich legacy of park-related specimens that are in non-NPS museums and the difficulty in accessing the specimens and their associated data. With a view to expanding knowledge of biodiversity, the authors surveyed nearly 300 museums and other entities seeking information on collections related to 14 northeastern U.S. parks and presented the results. They point out the problems of finding park-related specimens, since many non-NPS repositories lack automated records, and offer advice on structuring manual searches.

Another author describes concerns with handling contaminated collections from the past and emphasizes the importance of using current preservation methods that do not contaminate the collections.

Additional presentations open windows on the issues of ownership and the reluctance, or refusal, of some non-NPS repositories to accept park collections on loan; on the importance of having collections and being able to retrieve them in the future for the purpose of confirming or reassessing findings from the past; and on why metadata and quality assurance efforts are important parts of collections.

The compilation of topics discussed at an NPS workshop on managing park natural history collections indicates that park curators and research coordinators are focused on such issues as improvement to communication and information access among park, permittee, and repository personnel through software changes to existing systems and development of software-based training; the need for network, region, and Washington offices to increase technical support for natural history collections management and facilitate coordination with partners and multi-park research efforts; the need for new or revised guidance on specimen and associated records acquisition and management; and the ability to ensure that projects and initiatives that generate collections support the required collections management functions. The discussion elicited suggestions for actions that NPS might consider to enhance automated permitting, inventory, and collections management systems; address NPS staffing needs; improve partnership arrangements; clarify NPS collecting and collections management requirements for parks and partners; and accommodate recent taxonomic changes and new collecting technology in NPS natural history collections management systems.

These papers highlight the kinds of concerns that park collections managers address no matter where and how they choose to manage park collections. They also reveal circumstances that users of collections and associated data (whether park scientists, resource managers, or non-park researchers) experience in trying to bring together information collected over many years and from many sources.

Options for Managing Park Natural History Collecting and Collections: Overview

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National Park Service (NPS) units have two options for long-term management of natural history specimens collected within park boundaries. Parks can manage collections in a NPS repository or lend them to a non-NPS repository. Park staff considers factors such as geographic proximity, available taxonomic expertise, potential for future use in research and park resource management, and storage requirements when deciding where to place collections. Most parks have management strategies that use both options to varying degrees. Within the parameters of established requirements, parks design unique management strategies that meet their individual needs, as illustrated by three case studies from Acadia, Death Valley, and Channel Islands national parks, which follow this paper.

With the advent of the NPS inventory and monitoring (I&M) initiative in 2001, collecting and specimen collections have increased dramatically. Forty-five percent of the current NPS natural history collections were added in the last five years. This rapid growth is pressuring parks to re-evaluate options and strategies for managing natural history collections.

Requirements

Permits to collect specimens that will be preserved, rather than consumed in analysis, designate an approved repository for those specimens. Both the permit applicant and the park staff participate in the process of identifying the repository. Each permit applicant should consult with the park curator to discuss the proposed collecting and a management strategy for specimens that will be permanently retained in a museum collection.[1] Based on that discussion, the applicant proposes management in a NPS repository or a non-NPS repository. If the applicant recommends a non-NPS repository, the repository must concur with the recommendation. The applicant must ensure that an official of the repository completes and signs a section of the application indicating the institution's willingness to accept the collected specimens on loan from the park, subject to the general permit conditions and restrictions and terms of NPS loan agreements.

Researchers seeking permits complete applications and repository agreements using the web-based NPS Research Permit and Reporting System (RPRS). Reading and following the accompanying guidance is important to ensuring that the application is complete and will not be delayed by missing information.

During initial consultation, the curator explains requirements for preparing, identifying, cataloguing, and submitting specimens and associated records or copies. Associated records include such items as field notes, maps, photographs, and analytical data. Parks often post basic requirements on the park web site; however, requirements for each project may vary. Researchers can access NPS museum management policies and procedures on the web as follows:

- Director's Order #24, NPS Museum Collections Management: www.nps.gov/policy/DOrders/DOrder24.html
- NPS Museum Handbook: www.cr.nps.gov/museum/publications/handbook.html
- NPS museum loan form and conditions in "thumbnail" (pages 19–23): www.cr.nps.gov/museum/publications/MHII/mh2ch5.pdf
- NPS Automated National Catalog System User Manual: www.cr.nps.gov/museum/publications/ancs.html

Once the park issues a permit, designating the repository, the permittee must meet submission requirements for specimens and associated data, and use RPRS to complete the required investigator's annual report, providing information on specimens collected.

NPS Repository Option

A decision to place specimens in an NPS repository offers several alternatives. The park staff may choose to manage collections in:

- The park where the specimens were collected;
- An adjacent park that manages park collections for the immediate geographic area; or
- A central repository that serves a large geographic area.

Under the alternative to manage collections in the park where they were collected, the specimens and associated data are a readily available reference for park staff making resource management decisions on an ongoing basis. Park staff may include botanists or zoologists who specialize in species found in the park. The collections are critical to their long-term scientific activities. In addition, non-NPS researchers have access to the collections during their own fieldwork in the park. They can use specimen vouchers, maps, and field notes to compare identifications and findings while their work is in progress. Though park-based management has many advantages, parks often do not have the essential expertise or the capability to serve as a research center, which is critical to responsible management of collections. In addition, park storage areas sometimes lack space and cannot accommodate a rapid growth in collections, such as the I&M initiative generates, without expansion.

Geographically clustered parks often will pool some of their resources. They may share such functions as purchasing, law enforcement, or resource management. When one park provides museum collections management functions for its neighbors, each park generally has its own exhibits and interpretive functions on site, but record-keeping, storage, and other management functions occur at the lead park. Each park, however, maintains a distinct catalogue of its collection, and specimens carry a label specific to the park where they were collected. Generally, only the lead park has full-time museum management staff and resource management specialists, such as biologists. This alternative is especially appealing to small parks that do not have sufficient natural resource research activity to warrant an independent museum management operation for natural resource collections.

The concept of a centralized NPS repository for a wide geographic area is well established for NPS archeological resources, but only nascent for natural resource collections. The I&M initiative has formed 32 networks based on biogeographic commonalities. Increasingly, network offices are taking on the responsibility of developing a network-wide strategy to manage collections resulting from I&M activities. The network offices generally have an interest in making the collections centrally available. This option is especially appealing when a single study project or permit involves multiple parks. When developing multi-park strategies, the network staff must consult park research coordinators and curators to ensure that each park's specific needs are met by the centralized strategy.

NPS archeological centers serve as excellent models for providing centralized resource management, fieldwork, and collections management services for parks. These models can be extended to natural resource management functions and organization. Centers, such as the Western Archeological and Conservation Center in Tucson, offer parks archeological and collections management services. Park superintendents, who have responsibility for archeological sites and museum collections, have the option of asking a center to provide management services for these resources. This option appeals to parks that do not need a full-time archeologist, curator, or archivist. Centralization of these functions enables NPS to hire specialists rather than generalists, thereby applying the most appropriate expertise to each situation. Centers employ archeologists with knowledge of sites in the region, curators and conservators specializing in archeological artifacts, and archivists with experience in managing archeological records. Center staff do project work, advise parks on on-going management of archeological sites, and provide long-term management of the archeological collections. These facilities are centers of excellence, attracting researchers and setting trends in archeological resources management.

Following this model, natural resource centers could provide a battery of biologists, paleontologists, and geologists to do project work and on-going resource management consultation in parks. In addition, centers could hire specialized curators, conservators, and archivists to manage the specimens and associated records. Though such an NPS center does not exist, the option is viable. To date, most networks seeking a centralized alternative to museum collections management for natural history collections have turned to a non-NPS repository option.

Non-NPS Repository Option

Non-NPS researchers often propose that the institution with which they are affiliated serve as the repository for specimens that they collect. Generally, these institutions are natural history museums or research centers, operated by non-profit organizations or state governments, or university museums. In 2001, 71% of NPS permits that authorized collection and retention of specimens designated non-NPS repositories. That year, permittees proposed that over 250 different repositories be used to manage their specimens.

Permit applicants propose repositories that will facilitate their on-going research. Often these repositories are centers for certain taxa and attract specialists who use the collections and associated documentation in their research. These specialists annotate the specimens and cite them in publications, thereby increasing their value to science and the park. When these facilities are near the park where the specimens originated, the park has all the benefits of easy access. When these facilities are distant, the benefit of easy access is lost. Many proposed repositories are in the mainstream of taxonomic research, but not all are. Some are unwilling to accept long-term NPS loans. Parks must consider these factors when approving repositories.

Evaluating proposed repositories serially, in isolation, with each permit application, can result in dispersed park collections and an unmanageable number of repository loans. Most parks develop a relationship with certain repositories and designate those repositories when issuing permits. For example, the Santa Barbara Botanic Garden is the repository for the Channel Islands National Park herbarium.

Some I&M network offices have established agreements with non-NPS repositories. The South Florida/Caribbean Network has a contract with the Fairchild Tropical Garden to serve as the repository for botanical collections made under network auspices. The garden is cataloguing specimens and will make images and label data available, as appropriate, in its virtual herbarium on the web (www.virtualherbarium.org/). The network pays for these services.

The NPS chief curator has drafted a generic repository agreement that can be adapted for use at the national, regional, network, or park level to establish long-term relationships with non-NPS repositories. An agreement is helpful in detailing responsibilities and expectations of each party and in streamlining NPS management requirements, such as annual inventories and new loans to the repository with each addition of specimens. An umbrella agreement is essential to ensure consistency when more than one park has collections on loan to a single repository. Such agreements, when approved by contracting authorities, facilitate payment to the non-NPS institution for services. In addition, NPS can provide partner institutions with supplies and equipment to support maintenance of NPS collections. In establishing an agreement, all affected parties, including each park covered, must approve core features of the agreement, but parks can negotiate with the repository to append park-specific requirements as needed.

The NPS is one of many federal partners that has joined recently established Cooperative Ecosystem Studies Units (CESUs) in biogeographic regions throughout the country. These CESUs involve multiple federal and non-federal partners that work together to address natural and cultural resources research, technical assistance, and education needs in an ecosystem without regard to administrative boundaries. Many CESU partners are logical and appropriate institutions to serve as collections repositories for parks. Though not yet used for this purpose, the CESU partnership can be a foundation for development of a repository agreement to serve parks in a biogeographic area.

Developing a Strategy for Park Natural History Collections Management

A well-crafted strategy that evaluates needs and options is essential to effective management of a park's natural history collection. All parks have a scope of collection statement listing laws, regulations, and policies that affect collection of natural history specimens in the park. It also states areas of emphasis and gaps in the collection. The management section names the repositories where natural history (and other) collections will be managed if outside the park. Parks typically develop strategies for managing natural history collections that involve more than one option or alternative. For example, a park with a botanist on staff may manage its own herbarium, while loaning zoological and paleontological collections to the state museum.

The park's collection management plan describes arrangements with each repository and identifies needed adjustments to management strategies. Repository agreements and information accompanying loan forms inform the repository of its rights and responsibilities in managing NPS collections. A selected repository generally meets or exceeds NPS preservation and protection standards. The repository agrees to comply with NPS documentation and reporting requirements, such as cataloguing, labeling, and annual inventories. At the same time, the park conveys various kinds of authority to the repository, such as making third-party loans or approving destructive sampling, that facilitate research and effective management in the repository. When a repository serves more than one park, the parks, region, network, or Washington office should jointly develop a single agreement with the repository to achieve efficiency and consistency.

Three Case Studies

Because all parks are different, their strategies for managing natural history collections will be unique (within the parameters of NPS regulations and policies). Nevertheless, sharing commonalities, best practices, and experiences benefits parks, NPS and non-NPS repositories, and researchers. All involved in natural history collecting and collections management need to have a good working knowledge of NPS requirements and options for managing natural history collections. Acadia National Park, Death Valley National Park, and Channel Islands National Park apply NPS requirements through different approaches, yet have much in common.

Acadia National Park has 272,000 natural history specimens in its collections, which are managed by a curator, a museum technician, and many volunteers. The park curator and a botanist in the Department of Botany at the College of the Atlantic jointly manage the park's herbarium, which is stored at the college. The park directly manages its other natural history collections and, in addition, serves as the official repository for natural history materials collected under the auspices of the Northeast Temperate Network. In 2002, the park issued 13 permits to collect specimens that would be permanently retained. For the benefit of permitted researchers, the park posts its collections management requirements on the web.

Death Valley National Park manages most of its nearly 18,000 natural history specimens and their associated records in park facilities, though some are in non-NPS repositories. Researchers actively use the collection. The park's herbarium is listed in the Index Herbariorum, a worldwide index of public herbaria. The park has a curator, intermittent project-based assistants, and volunteers who manage the natural history specimens and associated resource management records. Researchers must follow park-specific conditions when collecting, preparing, and documenting specimens before submitting them to the park. In 2002, the park issued 50 permits to collect specimens that would be permanently retained.

Channel Islands National Park maintains only a few of its natural history specimens on site, with most being curated at other institutions. The chief of cultural resources has oversight for the park's museum collection. The Santa Barbara Botanic Garden curates the park herbarium as part of its extensive collection of plant materials from the California central coast bioregion and the California islands. The Santa Barbara Museum of Natural History maintains the park's paleontological collections, including pygmy mammoth remains, and a number of other natural history specimens. In curating natural history specimens, partners first catalogue items using their own cataloguing system, and then the park assigns NPS catalogue numbers and imports the data into the NPS catalogue database. The park has provided storage cabinets and curatorial supplies to support its partners; the partners provide researcher access to the collections. In 2002, the park issued 11 permits to collect specimens that would be permanently retained and housed at partner institutions.

In the papers that follow, a park research coordinator, two park curators, and a representative of a park partner institution share their experiences and practices in managing the natural history collections of Acadia, Death Valley, and Channel Islands national parks. Though every park is unique, the authors hope that other parks, partners, and researchers will benefit from and improve upon the best practices presented herein.

Endnote

1. The Code of Federal Regulations (36 CFR 2.5g) requires that (1) specimens placed in displays or collections bear official NPS museum labels and be catalogued in the NPS catalogue system; and (2) specimens and data derived from consumed specimens be available to the public and reports and publications resulting from a research specimen collection permit be filed with the superintendent.

Options for Managing Park Natural History Collecting and Collections: Case Study—Acadia National Park

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Acadia National Park has established a collections management program that is multi-disciplinary, collaborative, and flexible to ensure that all relevant information and specimens associated with a study are protected and available for future park managers and the scientific community.

The program resides in the resource management division with responsibilities for natural and cultural resource management, research, environmental compliance, lands, and recreation management. Curation of specimens and their associated data is closely linked with the management of other information, such as the park bibliography, spatial data (GIS), and other natural and cultural resource databases.

The curatorial program and museum curator are considered on par with other natural and cultural resource programs and managers in the resource management division.

Scientific research and collecting at the park requires close collaboration with the curatorial program as well as with other disciplines in the resource management division. When a research proposal is submitted, it is reviewed by the division chief (permit coordinator) and resource management staff with expertise in the discipline and others who could evaluate potential impacts of the proposed work. The proposals are evaluated to determine if proposed research and/or collecting activities will affect park resources, the visitor experience, and/or park operations. The proposals are also reviewed to see if the cost of curation is included in the proposed study budget.

If a proposal includes collecting activities, after it is reviewed the researcher is required to meet with the park curator prior to the issuance of a research permit, if the specimens collected will not be consumed during analysis. The meeting can occur in person, over the phone, or via e-mail. During the meeting, the park-specific collecting conditions are discussed, including preparation of the specimens for deposit into the collections, description of associated data, and the park-specific specimen data. Researchers may also be required to meet with the park's data manager and the park GIS specialist to discuss the park requirements for both spatial and tabular data prior to receiving a permit.

Acadia's park-specific conditions are available to research applicants on the park's web site (nps.gov/acad/rm/research.htm). This information is reiterated by the division chief and the resource management staff scientist who is assigned to oversee the logistical coordination and oversight of the research project once it is permitted.

The park requires two copies of all final reports generated from research conducted within the park. One copy is deposited into the park archives, the other into the park library. Two copies of all electronic data, such as charts and graphs, are requested, as well as two hard (paper) copies of all electronic data. Specimens collected must be properly housed (for example, wet specimens must be in flint glass jars with vapor-barrier screw caps) and labeled by the researcher. All associated data, such as field journals, photographs, and drawings, whether they are on a cocktail napkin or nicely typed, are requested.

Acadia requires that all federally funded projects submit the originals of their associated data. We request that non-federally funded projects submit good, clear copies of their associated data and consider Acadia as a repository for their originals if and when they decide to deposit them in an institution.

Investigators who receive federal funds are responsible for cataloging the specimens and associated data from their study into the

National Park Service's Automated National Catalog System (ANCS+). The park will catalogue specimens collected by non-federally funded researchers who collect fewer than 50 specimens. If more than 50 specimens are collected, then we require the non-federally funded researchers to catalogue the specimens into ANCS+.

Acadia is not getting 100% compliance on our requirements, but we have seen a significant improvement in the products that we are receiving. We go out of our way to ensure that researchers have every opportunity to meet the requirements. We will provide them the software, training, and computers (if catalogued at the park) to ensure that the specimens and data are catalogued into ANCS+. The park provides acid-free paper and/or copy machines for researchers to copy their associated data. We will also provide diskettes for the electronic data. We will accept prepared specimens even if they don't meet our requirements. For example, if a researcher remembered to place her wet specimens in 70% ethanol in a vial and labeled the specimen, but forgot to use a vapor-barrier screw cap, we will still accept the specimen as ready for deposit into the collections and we will replace the cap.

Researchers submit an update annually on the status of their projects and the collections of specimens and associated data. The primary investigator fills out this information in the investigator's annual report. These reports are filed by the permit coordinator in the resource management files until the project is completed; then they are transferred to the archives.

Acadia has two natural history collections: scientific and educational. The scientific collection is composed of voucher specimens and associated data that were systematically collected as part of a study proposal. The scientific collection is accessioned into the museum collection and retained in perpetuity; access to the collection is provided to the scientific community and park staff. The scientific collection is not used for exhibitions unless the exhibition is about scientific research in the park. Scientific proposals to conduct destructive analysis on a specimen in the scientific collection are reviewed by the resource management division chief, park curator, and resource management staff with expertise in the discipline.

The educational collection comprises specimens that were collected especially for interpretive programs and exhibits. Because these specimens were not systematically collected as part of a scientific study, they have no associated data. These specimens are accessioned into the collection with a notation that they will be deaccessioned once the interpretive program or exhibit is over or upon deterioration/loss due to handling.

Acadia has two repositories where specimens and associated data are stored. The William Otis Sawtelle Collections and Research Center, the central repository, is located at park headquarters. Plant specimens are deposited at the College of the Atlantic's herbarium. The college is located in Bar Harbor, three miles from park headquarters. The specimens at the college are on loan to the college. The loan agreement permits the college botanist to collect specimens in the park and use the specimens for teaching botany (each class is taught how to properly handle the specimens). The specimens cannot be loaned by the college to another institution without first contacting the park curator. In exchange, the college catalogues the specimens into a database that is converted into ANCS+, annotates them, and provides access to the scientific community (each researcher signs into a logbook). Should the college's herbarium ever be disbanded, the park's specimens will be returned.

Changes have begun that will contribute to the future vision of the program. Acadia National Park is a member of the Northeast Temperate Network of the inventory and monitoring (I&M) program and has been designated as the repository for the specimens and associated data collected as part of the I&M program. We are working closely with the program coordinator to establish a collecting and curation policy for the I&M program, fielding questions from curators and scientists in the Northeast Temperate Network and within the Northeast Region, and reviewing specific needs for the care and preservation of existing collections.

In addition, the park has established a learning center at a former naval base. The Schoodic Education and Research Center (SERC) will provide key infrastructure (housing, offices, and labs) to support research conducted in the park. Plans call for the park to move its natural history collection to SERC so that the scientific community can have ready access and so that it is available to be used as a teaching tool in scientific workshops.

Acadia's curatorial program faces many challenges, including the need for a budget that increases with the growing size of the collection, the need to update the taxonomy of the historical collection, improving on-going communication between resource management staff and researchers on collecting issues, achieving adequate staffing levels and expertise, and interpreting the code of federal regulations.

Acadia's curatorial program works because it ensures that the specimens and associated data that are collected as part of the park's research program are preserved for future park managers, yet are accessible to current park managers and the scientific community.

Options for Managing Park Natural History Collecting and Collections: Case Study—Death Valley National Park, Collecting and Permits

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Death Valley National Park is a large desert wilderness park in eastern California and southeast Nevada. It receives about 50 research permit applications annually, over half of which are for geology studies involving the collection of rock or soil specimens. The environmental specialist is the collateral-duty research permits coordinator responsible for review and processing of the research proposals and applications.

Prospective investigators apply on-line through the Research Permits and Reporting System (RPRS; on-line at http://science.nature.nps.gov/research) program of the National Park Service (NPS) and usually include their research proposals as an attached file. The RPRS program notifies the park research coordinator via email when a new application is entered into the system.

The objectives in administering the park's research permit program are to protect park resources for future generations and to promote the use of the park for research purposes. Death Valley's enabling legislation includes congressional direction to "retain and enhance opportunities for scientific research in undisturbed ecosystems" (California Desert Protection Act of 1994).

Research proposals are put to several tests during their review. The first is for scientific rigor. Most applications are from academic researchers from recognized universities with National Science Foundation or university grants, so additional peer review for scientific quality is usually not needed. The park does not require investigations to be applied towards park management needs such as those identified in park planning documents.

Another test is institutional affiliation. By regulation, collection permits may be issued only to an official representative of a reputable scientific or educational institution or a state or federal agency (36 Code of Federal Regulations 2.5). Some applications are received from people who lack institutional affiliation. These applications are denied unless a park staff member feels strongly about supporting the particular researcher and research project and signs on the researcher as a park volunteer. Park volunteers have institutional affiliation with the park itself and work under a staff supervisor and a written position description. Field technicians collecting for multiple researchers and multiple studies cannot be accommodated on one permit. Each study, under a qualified researcher, must be permitted separately.

One applicant identified himself as a professor and corresponded on college letterhead but had actually been fired from his teaching position. His former college did not support this affiliation for his research project and his department was unaware he was using letterhead or posing as a professor. His application was rejected due to lack of institutional affiliation.

The applications and research proposals are circulated to park staff and sometimes to other subject-matter experts. The park archeologist reviews all applications involving ground disturbance (including the removal of soil samples or rock samples). The park wilderness coordinator reviews all applications in wilderness areas of the park (95% of the 3.4 million-acre park). Other park staff specialists are often involved in the review (e.g., wildlife biologist, botanist, curator, mining engineer, hydrologist, landscape architect, internet technology specialist, GIS specialist, etc.). Their review comments and recommended or required mitigation measures are relayed to the park's research coordinator, who usually calls or e-mails the principal investigator to discuss the project and any park issues. If the investigator agrees to the recommended changes and conditions, then the permit is issued. Sometimes these negotiations continue for several rounds and several weeks.

Most research permits are approved easily and at the lowest level of environmental compliance: a categorical exclusion (CE). The CE for "non-destructive data collection" is usually used. There has been some debate about the use of this CE for research involving collecting, especially that of non-renewable geologic specimens that is by its very nature destructive of park resources. However, if placed in context, such collecting is deemed to be insignificant. Geologic collecting typically involves a few dozen rocks or soil samples from common formations. Collecting requests are typically rejected for vertebrate fossils, macro-invertebrate fossils such as trilobites, uncommon crystal formations, uncommon strata, or strata of limited extent. The burden is on the researcher to demonstrate that the sample type he or she is requesting is common, and that the permanent removal of the specimen would not impair the research opportunities of future generations of investigators.

One Swiss geologist on his third year of a research project was cited by a park ranger for collecting specimens well over the permitted weight limit. The ranger confiscated two boxes of overweight specimens and later discovered that some of the rocks were not part of the research study but were valuable crystal formations apparently taken for personal collection or rock show sale. The investigator was fined for violation of permit conditions and his permit was cancelled. The park does not expect to issue another permit for this investigator.

For all research collecting permits the park curator assigns a park accession number to the study. The accession number is entered near the top of the permit. The accession file initially includes the research proposal, application, and a copy of the permit. The investigator's annual reports and publication records are added to the accession file even prior to specimen records. Often it takes several years of tracking a study before all the specimen records are finally sent to the park's curator. Projects are tracked by keeping the permits active while waiting for the specimen information.

During park review of a proposal, the purpose of the study is rarely challenged, but the methods of the study often receive scrutiny and changes are suggested. Researchers are encouraged (or required) to use the existing study collection at the park or at other institutions before collecting new specimens. Researchers are encouraged to contact other investigators conducting similar or related work in the park. Often the park research permit coordinator serves as a liaison introducing investigators to one another. Often the researcher is asked to reduce the number, size, and type of specimens collected; for example, paleomagnetic coring is not allowed.

The default situation is for specimens to be returned to the park's study collection, but often researchers ask to keep the specimens in a non-NPS repository such as their home university. The park strives to use repositories where the specimens would be most useful to science. The researchers are usually the subject-matter experts who help the park to determine where to keep the specimens. The curators of the non-NPS repositories must accept an NPS loan agreement because the NPS retains permanent ownership of the specimens. The non-NPS repositories must be available to the public. Death Valley has had some problems with what appear to be private collections. The non-NPS repositories, above all, must be able to care for the specimens and their associated data. The park also has had some problems with smaller local museums requesting the specimens but not being able to curate the collections.

Many prospective researchers resent NPS collection policies. They feel it impedes their work. Ideally the scientific research gives added value to the park. It should be to both the park's and the National Park Service's advantage to host the research and accept the impacts of collecting. Death Valley, unlike most parks, issues lots of multi-year research permits. This has been at the request of the researchers and is one of the few things we could do to reduce their aggravation. Rarely have we had to cancel an approved multi-year project because investigators' annual reports were not received or for some other problem.

The park conducts little or no monitoring of researchers' field activities. Park resources are protected by the permit conditions and the good faith of the researchers in following them. The park requires notification prior to each trip in order to track researchers' activities, inform interpretive and patrol rangers, and watch out for the safety of the researchers.

Decisions on whether to approve collecting permits are based on the value of the research to science, the value of the specimen to nature and the ecosystem if left in situ, the value of the project to the park, the quality of the associated data (publications, annual reports, labels, catalogue data), and the value of the properly curated specimens.

If parks are made available for science, then science will benefit the parks with knowledge for protection and interpretation.

Options for Managing Park Natural History Collecting and Collections: Case Study—Death Valley National Park, Collections Management

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Death Valley National Park's museum collection began soon after 1933 when park naturalists collected samples of the rich geologic record that is Death Valley. Soon thereafter plant and animal specimens and paleontological specimens were also collected. Since those early days of collecting, the park has accumulated nearly 18,000 natural history specimens, including 357 paleontology, 2,678 geology, and 14,943 biological specimens, as well as their associated records and reports. These numbers do not reflect the specimens collected before 1933 by early expeditions, or even after 1933 when research permits were not issued or enforced; these collections are located in national museums or regional universities and colleges.

Since the 1980s, park museum staff have attempted, though not always successfully, to monitor permitted collecting activities, including specimen collections and generated data. About three years ago, thanks first to the technological improvements of the National Park Service (NPS) Research and Permit Reporting System (RPRS) and the investigator's annual report (IAR), then with the advent of the NPS inventory and monitoring (I&M) program, the park has been able to standardize and streamline its research permit program. These advances have allowed the park's curator and research permit coordinator to better track research activities and specimen collecting and processing.

The park's first step was to add specimen collecting conditions to the park-specific conditions for research and collecting permits. Thankfully, Yellowstone National Park had already created an excellent example that could be easily adapted for Death Valley. As a side note, these same conditions were added to our Mojave Network I&M study and data management plans and are utilized by contractors who work in Death Valley National Park, Joshua Tree National Park, Mojave National Preserve, Manzanar National Historic Site, Lake Mead National Recreation Area, and Great Basin National Park. In March 2003, the park's curator and permit coordinator drafted another version of these conditions and updated the curatorial conditions as well. These updated conditions will soon be posted on the park's web site where researchers access the NPS RPRS web site to apply for permits. The following illustrates the park's process for keeping track of research and specimen collecting.

The process begins when a researcher contacts the park's permit coordinator to request a permit. If collections will be generated, the permit coordinator discusses the research request with the park's curator. At times, the curator and permit coordinator negotiate the quantity or methodology of the specimen collecting. For instance, does the researcher really need to collect five lizards when one or two vouchers will suffice and tissue samples can be collected instead? The permit coordinator also makes sure the researcher has carefully read and understands the park-specific conditions; sometimes the curator clarifies the museum conditions for the researcher.

Park-specific conditions for specimen collecting include citation of 36 Code of Federal Regulations 2.5(g) to emphasize that the collected specimens and their associated data must be accessioned and catalogued into the NPS Automated National Catalog System (ANCS+) and must bear NPS museum labels.

Conditions for the long-term curation of specimens outside Death Valley National Park include that the researcher must secure park approval of the designated non-NPS repository in writing, and that the designated repository must certify in writing that it will care for the collections in accordance with standards that are consistent with NPS policy for managing museum collections. Both approvals must be obtained before collecting begins and must be referenced in the permit. Repository agreements and/or NPS's outgoing loan agreement (which is available on the park's web site) must be prepared before collections are deposited in the non-NPS repository. The park prefers that specimens are deposited at the park or in repositories that already have Death Valley collections (e.g., herbarium samples at the University of Nevada–Las Vegas and Rancho Santa Ana Botanical Garden; animal specimens at the California Academy of Sciences, etc.).

All collected specimens are to be accessioned, catalogued, and labeled. The park curator assigns accession and catalogue numbers as well as cataloguing and label preparation instructions. The accession number must be referenced in the permit and used on all reports, field records, correspondence, and permit(s) relating to the collection, as well as on the label of each specimen or material that will be permanently retained. Catalogue numbers must be referenced in the final report or publication when individual specimens are cited. The permittee or cataloguer may submit data in either Microsoft Excel or Access format; however, the catalogue fields (numeric and text formats and size) and their sequence must match the field attributes and sequence of the ANCS+ record. Specific catalogue data include:

- Catalogue number;
- Accession number;
- Classification;
- Specimen name (scientific and common name);
- Quantity or item count;
- Collection site;
- Township/range/section, UTM (Universal Transverse Mercator), or latitude/longitude coordinates (the datum should be included if Global Positioning System {GPS} technology is used);
- Name of collector;
- Collection number;
- Collection date;
- Collection method (chisel, shovel, net, hand, etc.);
- Name of person who identifies the specimen and date identification is made;
- Formation (for geology specimens);
- Period/system (for geology and paleontology specimens);
- Condition;
- Type (if designated);
- Specimen description; and
- Preservative and/or preparation method.

The most difficult research activities for the park to track are the required deadlines associated with the permit. Our park-specific conditions have been modified to help alleviate this problem. Within one year of the final date of collecting, the permittee must submit to the park curator:

- All specimens that are to be permanently retained in the park museum collection, their associated labels, and catalogue documentation (catalogue worksheets and/or electronic data);
- Associated catalogue documentation (catalogue worksheets and/or electronic data) for all specimens that are to be permanently retained in non-NPS repositories;
- Copies of all field records (notes, maps, recordings, reports, etc.), printed or copied onto archival or acid-free quality paper; and
- Copies of final reports or publications.

The permittee is required to contact the curator to make other arrangements if he or she is unable meet the one-year submission deadline (e.g., for specimens that require long-term analyses). The permittee is responsible for reporting the status of the collection analysis and/or cataloguing in the IAR. Research and collecting projects are considered complete when most, if not all, of the above conditions are fully met. The park plans to use the IAR to track outstanding curatorial processing of specimens, including the completion and submission of associated specimen data and records.

It is hoped the above-mentioned park-specific conditions will enable the park to better track collected specimens; monitor specimen collecting, preparation methods, and cataloguing; and direct the efforts of the researcher to secure appropriate storage repositories. The park wants researchers to have a clear understanding of their role and responsibility for conducting appropriate and professional research activities.

Death Valley's process of tracking research activities and holding researchers accountable for their collecting activities continues to evolve, especially when there are not enough staff or funds to adequately track their collections. For instance, the park continues to discuss the possibility of adding an additional condition to the permit that would require the permittee to contact all known repositories for specific vouchers to determine if those extant collections can be utilized for research and analysis in lieu of collecting and preparing additional specimens. At this time, the permit coordinator asks researchers if this is an option, but the park should standardize or require this as a condition of the permit.

To conclude, no matter how many conditions the park establishes, the most important condition is that the curator and the permit coordinator establish an on-going dialogue with the researcher to convey the importance of appropriate curatorial processing of collected specimens. This is because the ultimate goal for the park is to make the specimen information and the researcher's data and final reports accessible to the scientific community and the public.

Options for Managing Park Natural History Collecting and Collections: Case Study— Channel Islands National Park, Plant Collections

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The Santa Barbara Botanic Garden herbarium currently houses approximately 140,000 specimens, composed of 120,000 vascular plants, 20,000 lichens, and 1,000 mosses. Thirty-five thousand specimens are from the eight California Channel Islands, including about 23,000 from what is now Channel Islands National Park. The Channel Islands have been of considerable interest to botanists for over 120 years; their collections have been deposited at such institutions as the Smithsonian Institution, the California Academy of Sciences, the University of California at Berkeley, Rancho Santa Ana Botanic Garden, and the Santa Barbara Botanic Garden. The Santa Barbara Botanic Garden's Clifton Smith Herbarium is the primary depository for collections from Channel Islands National Park, enabled through a cooperative agreement with the park.

The nucleus of the garden's herbarium centers on the efforts of Ralph Hoffmann, who was director of the Santa Barbara Museum of Natural History in the 1930s. Hoffmann collected extensively on the northern Channel Islands from 1925 to 1932. His collections have been supplemented by the fieldwork of successive researchers, including Martin Piehl, Ralph N. Philbrick, E. R. (Jim) Blakley, and Steven Junak, the current curator. Consequently, a substantial portion of the collection was acquired prior to designation of the islands as a national park. However, these collections provide the foundation for analyzing and extending knowledge of the islands' plant diversity. Current collecting activities focus on new distributional records, especially to document rare species, invasive species, and new geographical or ecological records. All current collecting and curatorial efforts are conducted under a permit issued through a cooperative agreement between the park and the garden.

Herbarium specimens are essentially pressed plant materials, selected to represent diagnostic features of the plant that are useful for identification, systematic research, and other purposes, including even DNA extraction. Specimens are prepared using standard practices, including use of archival paper, glue, and storage cabinets (Metsger and Byers 1999; Lee et al. 1982). Pest management includes freezing specimens prior to storage in the herbarium cabinets and regular inspection of collections for potential pests. The herbarium collections are housed within a fireproof structure and have experienced a very low level of infestation from such pests as book lice and silverfish, resulting from regular inspections, prompt treatment of infected specimens, and a positive air pressure maintained by an air conditioning system. Relative humidity is maintained at less than 30% through use of a freestanding dehumidifier. Study of specimens is restricted to within the collection rooms, which minimizes exposure to potential pests.

The herbarium is actively used by professional botanists, students, researchers, and environmental consultants. Most use of the park-based collections is by garden staff, park staff, visiting researchers, and graduate students; additional use occurs in the form of requests from other institutions for loans. Loans are made under standard practices, which include only those institutions with appropriate herbarium facilities. Annotations are expected for all returning loans. We estimate that at least 400 publications, including scientific journal articles, books, and technical reports, have resulted wholly or partly from collections housed in the herbarium.

Published floras based on the collections include those for Santa Barbara Island (Philbrick 1972) and Santa Cruz Island (Junak et al. 1995). Some examples of recent scientific publications include descriptions of new species (Davis 1997; McCabe 1997) and reproductive biology (Barrett et al. 2000). The herbarium collections also include vouchers for technical reports on vegetation and rare plants, including Halvorson et al. (1992) and McEachern et al. (1997).

The garden has developed a database that currently holds 60,000 specimen-based records, of which about 40,000 records are from the Channel Islands. About 90% of the records are from the herbarium, the remainder having been obtained from other herbaria, including those of the California Academy of Sciences and the University of California at Berkeley. We estimate that a database on the California Channel Islands may approach 100,000 records, judging from conservative estimates of collections at other institutions. It is likely that as many as 40,000 records may ultimately become available for Channel Islands National Park. All of the botanic garden's island lichen collections, about 5,000, have been databased and are currently available through a web site hosted by Arizona State University (seinet.asu.edu/collections/selection.jsp). Until early this year, the garden's database on higher plants was accessible through the non-profit Calflora, which has now been temporarily suspended because of budget shortfalls. About 75% of the island collections have been databased, and we expect to complete the effort by the end of 2003.

The database uses Microsoft Access as a platform, primarily because it provides relatively easy exporting tools so that data can be shared with other agencies and institutions. The database structure essentially follows guidelines established by the International Union of Biological Sciences, Taxonomic Database Working Group (www.tdwg.org). Thirty-seven fields are employed for entries on geographic locality, collector(s), date, and plant specimen data recorded by the collector, among others. Records can be sorted in different ways, depending on research or management needs. Specimen-based records are gradually being georeferenced, using latitude and longitude in decimal degrees, which permits analysis output to a geographic information system (GIS) for mapping purposes. Data are generally provided in electronic format on request to qualified researchers. All data requests are reviewed and provided with appropriate stipulations that include giving credit to the source of information. Data have been provided to such agencies as the California Department of Fish and Game Natural History Database (Tibor 2001), USDA PLANTS, Calflora, the Biota of North America Project, and the National Park Service. Currently the Santa Barbara Museum of Natural History and the Santa Barbara Botanic Garden are pursuing development of an all-island, all-taxon database, which eventually will be available on the internet.

The garden and the park have enjoyed mutual benefits from a cooperative agreement that clearly defines responsibilities and expectations. Specimens and specimen data are available through several media, including loans of collections and data summarized by means of reports extracted from the database. The central location of specimens provides for appropriate curation and access, reducing demands on park staff and resources. The scientific community has clearly benefited through the availability of specimens for study and from database records used in various endeavors of analysis.

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Natural History Collections: Overview

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A session of contributed papers often appears to have no coherent theme or structure. Viewed as a whole, however, the papers presented to the Natural History Collections session do provide a wide-ranging and connected perspective on the topic.

The presentation by Gilbert and O'Connell opened a window on the challenges one faces in trying to find existing collections in a sea of museums, developing optimal strategies for searching and obtaining data from those collections, keeping abreast of locality and taxonomic name changes that inject sources of confusion through more than a century of collecting, and then using the resulting information for making judgments about biological diversity. An operational challenge Gilbert and O'Connell reported was coping with specimen fragility, presence of poisonous preservatives (arsenic), and the large investment of time needed while trying to use the more-accurate specimen labels as a key source of information rather than relying on the less-accurate catalogue records. These authors concluded by reporting that mathematical techniques they applied to analysis of voucher specimen data indicate that species inventory results have potential for objective evaluation of temporal change in species diversity.

The presentation by Bayless explored problems associated with not finding collections in a sea of ownerships. The author pointed out that, during the past 20 years, the National Park Service (NPS) has more strictly managed research specimens collected in parks, affecting both researchers and repositories with which researchers work. The crux of the problem appears to revolve around ownership of the specimens and the on-going debate appears to be impeding park goals to support science and consistently implement NPS guidance across the National Park System. Bayless suggested that solving the question of ownership, finding the means to support curation and storage of specimens, and improving partnership arrangements will benefit maximizing the contribution of specimens to all partners by maintaining specimens in high quality and in places where all users can access them.

Bischoff reported on recent partnership steps being taken for organizing efforts to cope with older collections that have been treated with arsenic, mercury, or other hazardous pesticides. She identified performers of a variety of actions, including research to develop testing methods for contaminants; research on use of microorganisms for decontamination of objects; creation of Material Safety Data Sheets for contaminated ethnographic/botanical objects; development of testing methods for organic pesticide residues on museum artifacts; research to develop tests for mercury; development of testing protocols for x-ray fluorescence analysis; data mining of museum records to identify pesticides used on collections; and study of museum worker exposure levels to pesticides. From this review, one can conclude that, for future collections, managers should use preservation tools that do not contaminate the collections; for contaminated collections from the past, managers should take steps to minimize the effects of the contaminants on people and on uncontaminated specimens.

The Palmer and Sappington presentation addressed a broader topic of why metadata and quality assurance efforts are important parts of natural resource data collections. These authors stressed four key concepts: data must be long-lived; data must be easily locatable and accessible; data must be of a quality and form that are usable, credible, and promoting of knowledge; and the data management system must maintain accountability. In addressing these concepts, they showed the importance of including quality assurance steps to control the data acquisition process and to determine the uncertainty in the data and whether or not the data are appropriate to support management decisions. Although their focus was broadly on data, their message can be adapted by collections managers to improve the attention paid to proper collection of specimens and data about the specimens, to improve the care given to preserving the collections together with their associated data, and to developing usable metadata about the collections.

Irrespective of where collections are stored or who owns them, a presentation titled "The Role of Plant and Animal Voucher Specimens in Natural Resource I&M Programs" by Roy Woodward (not available for inclusion in these proceedings) stressed the importance of having physical collections and being able to retrieve them in the future for the purpose of confirming or reassessing findings from the past. Woodward observed that voucher collections increase the reliability of inventory and monitoring work conducted by many people over many years because these specimens represent the actual plants and animals that were observed in the past. In addition, the voucher specimens can provide the future raw material needed for estimation of past characteristics of organism gender and health, and for chemical and genetic analyses that can reveal conditions from the past. The author observed that the keys to making voucher specimens useful in the future include collecting the correct parts of organisms now, collecting sufficient numbers of organisms to provide an adequate sample size, and storing the specimens properly to ensure long-term preservation and safety. Woodward also suggested that the process of making voucher collections needs to consider animal rights, visitor perceptions, impacts caused by the collecting, relationships to on-going studies, and adherence to standards and protocols. He also suggested that the collecting of vouchers needs to be guided through training, workshops, and other forms of sharing information.

These contributions to the Natural History Collections session revealed circumstances that users of collections and data about collections, such as park inventory and monitoring personnel, experience in trying to bring together information from many sources and collected over many years. These contributions also brought into focus the kinds of concerns that park collections managers will have to deal with no matter how they organize the location and management of their collections.

Retrieval, Compilation, and Organization of Vertebrate and Vascular Plant Voucher Specimens Originating from National Parks

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Introduction

Natural history collections are the fundamental source for understanding and interpreting biodiversity, but their value is unappreciated and poorly supported (Cotterill 1995). An important but often overlooked component of this information is the efficient retrieval and compilation of records available. Museums and herbaria have not done a good job of marketing their resources and services (Alberch 1993), and, as a result, the initial appeal and application of their data are limited. In fact, specimens in museums and herbaria are an enigma to many outside the museum environment because the information is often difficult to access. Furthermore, analyses using only partial datasets may provide results different from those obtained from a full complement of records. For example, in the use of butterfly lists to make biodiversity comparisons in Oregon, less than half of the dataset was used because only that portion was computerized (Fagan and Kareiva 1997).

Computerization of records in natural history collections is still in a long way from completion, and even when accessing collection data that are computerized, navigating the computer interfaces can be awkward without adequate guidance. Management of collections also varies greatly from site to site, often making retrieval of information a complicated process. Retrieval and access of specimen data will be necessary to objectively evaluate current inventory and monitoring efforts of our biological resources in the near future. Thus, our objectives in this study were to locate, compile, and organize specimen records originating within and around 14 national parks throughout the northeastern United States. (Table 1). We used a variety of strategies and techniques to search natural history collections for four different taxa in three vertebrate groups (mammals, birds, and reptiles and amphibians) and vascular plants. We developed procedures for assembling collection records into one of four locality categories in a manner that established a database of historical diversity for the National Park Service (NPS) at increasing scales, from within park boundaries to outside park boundaries at county and state scales.

Methods

We obtained information about vertebrate (except fish) and vascular plant natural history collections by first searching two web-accessible databases of natural history collections: the Index Herbariorum (IH; www.nybg.org/bsci/ih/ih.html) and the Directory of Research Systematics Collections (DRSC; www.nbii.gov/datainfo/syscollect/drsc/). We also sent out requests for information about collections to several e-mail listservs (TWS-L, NHCOLL-L, ORNITH-L) and obtained a list of museum contacts from John Karish (NPS, Philadelphia Support Office) from a similar project. Additional collection information was found by searching web sites of regional biology departments.

We mailed requests for data to 274 collection managers curating 299 natural history collections and 8 state natural heritage programs. We specifically requested data for specimens originating within the 14 northeastern national parks. Information about natural history collections was recorded in a Microsoft Access 2000 database. Collection

Table 1. National parks searched for vertebrate and vascular plant voucher specimens.

National Park (Code)	State(s)	Size (Ac)	Year Est.
Acadia National Park (ACAD)	ME	46,784	1916
Marsh-Billings-Rockefeller National Historical Park (MABI)	VT	555	1992
Minute Man National Historical Park (MIMA)	MA	967	1959
Morristown National Historical Park (MORR)	NJ	1,685	1933
Roosevelt-Vanderbilt National Historic Site (ROVA)[1]	NY	683	1940
Saint-Gaudens National Historic Site (SAGA)	NH	150	1964
Saugus Iron Works National Historic Site (SAIR)	MA	9	1968
Saratoga National Historical Park (SARA)	NY	3,406	1938
Weir Farm National Historic Site (WEFA)	CT	60	1990
Assateague Island National Seashore (ASIS)	MD	39,732	1965
Cape Cod National Seashore (CACO)	MA	43,604	1961
Fire Island National Seashore (FIIS)	NY	19,580	1981
Gateway National Recreation Area (GATE)	NY, NJ	26,610	1972
Sagamore Hill National Historic Site (SAHI)	NY	83	1963

[1] ROVA was consolidated from Eleanor Roosevelt National Historic Site (ELRO, est. 1977, 181 ac), Home of Franklin D.Roosevelt National Historic Site (HOFR, est. 1945, 290 ac) and, Vanderbilt Mansion National Historic Site (VAMA, est. 1940, 212 ac).

information was separated by taxa (e.g., Cornell University Museum of Vertebrates ornithology collection) where taxa-specific data were available. Information such as size of collection, percentage computerized, contact person and address, web address, and notes about the collections were recorded. We determined that much of the information provided in the two natural history collection databases were out of date; therefore, we checked contact information for all institutions through web sites or by contacting institutions directly and updated information as necessary.

To reduce search time and increase the number of responses from institutions, we broadened search criteria to county-wide locality requests. This approach also had the benefit of including locations that were misspelled or used historic names. We sent institutions a list of parks and localities by state and county. We requested that the following data fields be provided: park name, taxonomic name, common name, catalogue number, accession number, condition of specimen, collector's name, date of collection, locality information, latitude–longitude, and comments. We e-mailed follow-up requests for data to 177 collection managers who did not respond within six weeks of the initial request for data. We logged responses into the collection database as they were received. We established two databases: one in Microsoft Access for collections, and the other in Microsoft Excel for specimen records we located.

Results

We received a 70% response rate form the curators we queried and tallied information from 78 collections. We assembled 31,110 specimen records (30,833 categorized 1–4 by locality; Table 2) of which 4,745 (15%) are from within park boundaries (category 1) and an additional 4,552 (15%) may be from within park boundaries (category 2), but for which we do not have enough information to determine their exact location. We gathered the most specimen records for plants, followed by birds, mammals, and amphibians and reptiles. Within the four taxa, specimens comprised 260 families, 909 genera, and 2,055 species/species hybrids. Plant specimens represented the highest diversity of taxa with the greatest number of categories from species/species hybrids to families and genera. More than one-third of all records were from Acadia National Park, the largest and oldest park in this study. Acadia also had the most category 1 and 2 specimens (4,615) followed by Cape Cod National Seashore (2,180). We were unable to corroborate taxonomic identification due to time constraints. Most transfers of specimens to other institutions were catalogued as accessions, but in some cases disposal of specimens was not recorded.

The software EstimateS 6 (Colwell 2001) generated estimates of species richness for plant diversity at Acadia (Figure 1) using several different estimators (and functions).

Discussion

The staff of most natural history collections were unable to search records themselves because of the lack of time and resources to fulfill such requests, which understandably places the responsibility of searching upon the organization requesting the data. To conduct efficient manual searches, we offer several recommendations. Preparation is the key. Knowledge of the historic names for the localities for which you are searching will be helpful in identifying relevant specimens. In addition, lists of potential species for a region can help narrow the search field, although care must be taken not to exclude rare, extinct, and vagrant species.

Efficiency in searching is also important. We suggest searching specimen tags if the collection is divided by locality. In most large collections, specimens were divided regionally into separate folders (for plants) or trays (for vertebrates). Although size alone can make the largest collections overwhelming, they often were the easiest to search because they possessed enough specimens to be divided into smaller discrete geographic regions. Smaller collections tended to be divided into local specimens, the rest of North America, and foreign specimens, thus requiring searching most, if not all, specimens. Searching specimen tags can be tedious, but has the advantage of having updated taxonomy and the assurance that specimens are still in the collection. Tags are often very difficult to read, particularly for vertebrate specimens with small tags and old writing. Additionally, handling specimens

Table 2. The number of specimen records received in each proximity category for all parks.

Park code	Number of specimen records[1]				Total (%)[2]
	Category 1	Category 2	Category 3	Category 4	
ACAD	3,392	1,223	7,739	149	12,503 (40.6)
MABI	1	199	273	20	493 (1.6)
MIMA	72	408	1,797	78	2,355 (7.6)
MORR	0	119	905	46	1070 (3.5)
ROVA	237	4	251	485	977 (3.2)
SAGA	0	10	102	19	131 (0.4)
SAIR	0	17	722	0	739 (2.4)
SARA	180	6	115	423	724 (2.3)
WEFA	12	15	983	8	1,018 (3.3)
ASIS	471	1	197	3	672 (2.2)
CACO	186	1,994	1,806	6	3,992 (12.9)
FIIS	109	276	4,026	0	4,411 (14.3)
GATE	30	277	1,107	75	1,489 (4.8)
SAHI	55	3	201	0	259 (0.8)
Total (%)	4,745 (15.4)	4,552 (14.8)	20,224 (65.6)	1,312 (4.3)	30,833

[1] Category 1 = within park boundaries, 2 = may be within park boundaries, 3 = in county, 4 = in state.
[2] Totals are reduced by 277 specimens (0.89%), because we were unable to identify current locality based on a historic place name, there were discrepancies in the locality data, or they could not be assigned to any one park.

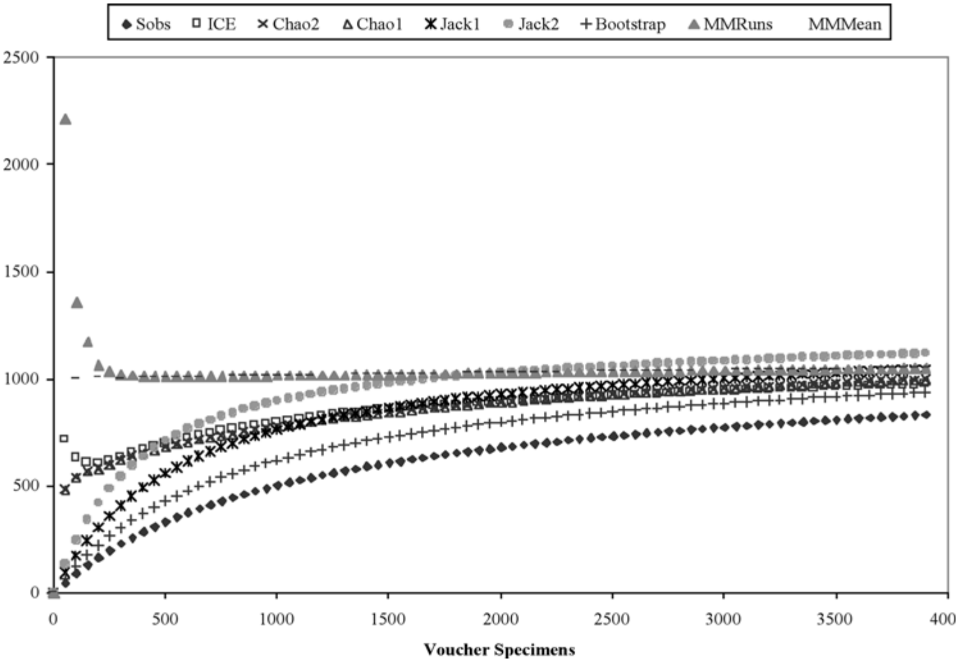

Figure 1. Plant species diversity for Acadia National Park plotting the number of voucher specimens identified (category 1 & 2) using the program EstimateS 6. Results are based on actual observations (Sobs) and eight numerical estimators. A detailed description of individual estimators is in Colwell 2001.

degrades them and may be irritating to the searcher because of harsh chemicals (i.e., arsenic) that may have been used for their preservation. Searching by catalogue is much faster, but data are less reliable and taxonomic updates are not usually made to catalogue entries. If time permits, we recommend searching catalogues, then checking and referencing those records against specimens in the collection. Ultimately, every collection is managed differently, which will affect the search strategy. Flexibility in search strategy is important for determining the best method to search for specimens at a particular site.

Natural history specimens originating from NPS lands acquired prior to 1984, and stored in a non-NPS repository, typically are not catalogued in the NPS national catalogue and are not tracked (i.e., on loan from NPS to non-NPS institutions). A 1984 regulation requires that specimens collected in parks and permanently retained in collections (even in non-NPS facilities) be catalogued into the NPS national catalogue. Although most NPS natural history catalogue records are now recorded in the NPS Automated National Catalog System (ANCS+), catalogue records created prior to 1987, when the automated system began, continue to be input into ANCS+, a project the NPS expects to complete within the next two years. Most collections we searched were in non-NPS repositories in an attempt to locate records unknown to the NPS. In a few cases, we also searched institutions considered NPS repositories as part of our overall effort to compile all available specimen records. For example, the College of the Atlantic in Maine maintains the herbarium collection from Acadia National Park and serves as an official NPS repository and, as such, has records recorded both locally and in ANCS+. The herbarium is on loan from the park.

Natural history specimens originating from NPS lands and acquired prior to 1984 typically are not catalogued in the NPS national catalogue and are not tracked (e.g., those on loan from NPS to non-NPS institutions). A 1984 regulation requires that specimens collected in parks and permanently retained in collections (even in non-NPS facilities) be catalogued into the NPS national catalogue. Although most NPS natural history catalogue records are now recorded in the ANCS+, data acquired prior to 1984 continue to be input into ANCS+, a project that NPS expects to complete within the next two years. Most collections we searched were in non-NPS repositories in an attempt to locate records unknown to NPS. In a few cases, we also searched institutions considered to be NPS repositories as part of our overall effort to compile all available specimen records. For example, the College of the Atlantic in Maine maintains the herbarium collection from Acadia National Park and serves as an official NPS repository and, as such, has records recorded both locally and in ANCS+.

Given the volume of information, we did not error-check data, assuming correct identification of specimens with accurate supporting information. Given that taxonomic revisions occur frequently, verification of identity may be necessary. Furthermore, data such as locality or date can lack specific information or be missing, particularly for older specimens. Locality names can change over time and historic names need to be checked to ensure compatibility between the past and current locations. Despite these limitations, these data are useful as a set of tools for exploring changes in biodiversity, especially when records date back over a century or more.

Estimation of species richness has become an important topic in community ecology and monitoring (Cam et al. 2002) and is an important component of evaluating biodiversity (Colwell and Coddington 1994). Species accumulation curves (Soberon and Llorente 1993) have been used to estimate species diversity, but the use of phenomenological models to plot species accumulation data has been criticized because there is no mechanistic basis to correct for sampling effort (Fagan and Kareiva 1997; Cam et al 2002). The EstimateS 6 program is vulnerable to the criticisms posed above. However, plotting the relationship of the number of voucher specimen records against the number of species identified in these records can be a useful exploratory tool to view the "thoroughness" of sampling conducted in an area and compare sampling across regions (Fagan and Kareiva 1997) or, in this case, park units.

For parks such as Acadia with intensive sampling over several decades, voucher specimens records may provide species richness estimates that are nearly asymptotic for true species diversity. Recent statistical procedures, such as the information-theoretic approach (Burnham and Andersen 1998), can provide further objectivity in selecting a particular estimator (and function) to determine the accuracy of species accumulation data, assuming a reasonable a priori model set (Cam et al. 2002). Additionally, techniques for estimating species richness that are preferred over the function-fitting approach employed by EstimateS 6 (Cam et al. 2002) can also be used. The lognormal distribution of species abundances (Fagan and Kareiva 1997), models of detection probability (Cam et al. 2002), and others based on capture–recapture theory are preferred by some authors (see Nichols and Conroy 1996; Boulinier et al. 1998). These models can estimate the size of species assemblages—an important consideration in the design of biological inventories and monitoring programs. We recommend further exploration of how to use these techniques with voucher specimen data so that species inventory results can be objectively evaluated in the context of temporal change in species diversity.

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Ownership of Natural Resource Specimens as a Pitfall in Effective Research

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The issue discussed here is straightforward: Who can own scientific specimens collected from U.S. national parks under research permits? Must all specimens and samples remain the sole property of the U.S. government or can they become the property of another museum or institution? This question has been addressed by various National Park Service (NPS) guidance documents[1] that clearly answer "yes," they must remain federal property. But this answer is not simple to implement and has never been definitively asserted in law or court rulings. This paper explores the effects of requiring ownership on the management of scientific specimens. The opinions expressed herein are strictly those of the author, and do not necessarily reflect official NPS policy or opinions.

What is the current NPS approach to specimen ownership? During the last 20 years, NPS has developed increasingly strict policy interpretations that ownership of specimens collected under scientific permit and permanently retained in collections or displays must remain the property of the NPS.[2] This policy is based upon one sentence in the regulations[3] that control the issuance of research permits and has caused extensive disagreement among NPS staff, scientists, and museum professionals. The uncertain meaning and intent of the regulation appears inadequate to base a far-reaching and precedent-setting policy upon: that scientific collections must remain inalienable federal property!

NPS has not always had this policy interpretation on ownership. In the first half of the 20th century, NPS was pleased to be the recipient of scientific research in remote parks where little funding existed to purchase the efforts of scientists.[4] Permission to collect specimens was granted in a letter, and many repositories throughout the United States have numerous specimens from these early years of discovery. In 1942, a solicitor's opinion on a new directive dealing with permits ruled that only employees of NPS could collect wildlife in parks.[5] This ruling caused disruption of many research projects. It would take some 34 years to finally correct this problem with the publication of new regulations in 1976.[6] Throughout this period specimens were transferred to outside repositories.[7] In 1982, the permit regulations were opened for revision, and staff of the natural science division of the Washington Office (including the author) recommended revised language based on efforts to upgrade NPS scientific curation.[8] This draft language was greatly reduced from a paragraph that described the desire to track specimens and their data to a single sentence—one that is open to a wide range of interpretation.

Is there a problem? The lack of resolution on this issue has caused controversy between parks and other scientific partners, professional societies, and repositories, and its variable implementation across NPS interferes with the effective use of science to increase our knowledge of park ecology. Numerous complaints have been received[9] about how the policy of specimen ownership is burdensome and counter-productive. The policy clearly creates difficulties in fulfilling goals in NPS's self-proclaimed "new era of 'parks for science' and 'science for parks'" in which the agency says "it welcomes researchers to explore the national parks as unparalleled living laboratories."[10] NPS stands alone in its approach (within the United States, at least) that all natural resource specimens must, in effect, remain inalienable federal property, and this stance runs headlong into standard practices of other state and federal agencies.

Why is there a need for a new policy analysis? The continued uncertainty and increasingly highly visible conflicts created by this issue suggests that sooner or later it will become embroiled in a court case or legislative action. Even without a legal challenge, we are open to being charged for the cost of storage and preservation of NPS collections in outside repositories. Once money is needed up front, fewer collections will be preserved to save on limited funds. We need to define what outcomes are in the best interests of the parks, science, and the public. By understanding how we want research specimens managed, we improve the chances that the outcome will better meet our needs and be consistent with the NPS mission. If we analyze the costs and benefits of various approaches, we can maximize best management practices through effective policies and procedures.

NPS Collections

NPS maintains natural resource collections as part of its national catalogue of museum property.[11] These museum specimens are preserved in perpetuity, whether housed within a national park or loaned to an outside repository for storage and use. When NPS insists that all collections remain government property, it runs the risk that it is discouraging specimens from being permanently retained. If specimens are loaned as NPS property, outside repositories may require that we pay storage and processing fees, currently in the neighborhood of $50 to $500 per cubic foot. These costs, once invoked, will result in some collections being transferred to cheaper alternatives (frequently, substandard storage).

NPS currently has very limited in-house capacity to store and curate natural resource collections, very few scientifically trained curators, and little infrastructure to support specialized collection needs. While our capabilities have greatly improved over the years, and additional improvements can be expected, it will be many decades (at best) before NPS has substantial capacity to care for large numbers of natural resource collections. Large and complex specimens, such as the blue whale from Golden Gate National Recreation Area seen in Figure 1, have been lost to science due to limited staff expertise. There is virtually no capability to store specialized collections such as frozen collections, specialized wet fluid, and living collections. Without the cooperation and partnership of universities, museums, and repositories, NPS will be obligated to pay for the storage and curation of these important materials, or they will increasingly not be collected and preserved at all. Recently, major natural history repositories such as the University of Nebraska Museum, the Museum of Northern Arizona, and the San Diego Natural History Museum have closed or curtailed operations due to budget cuts and staff storages.[12] The ability of NPS to find high-quality storage at little or no cost to the agency may be rapidly disappearing.

Quid Pro Quo[13]

A long-standing practice has been for scientists to obtain permits from federal and state authorities to research and collect specimens, along with any necessary landowner permission. Upon completion of the project, materials collected may be consumed during research, discarded, or preserved. If specimens or samples are preserved, they are deposited in a museum or university where they become the property of that institution. The services of the repository in documenting and storing the specimens far outweigh, in real dollars, the average value of the specimen itself. This “quid pro quo” reflects an exchange of value between the two parties without any direct payments being required. In some instances, scientists transfer specimens to other specialists to enlist their aid in describing or further studying the specimens, and in exchange allow the consulting scientist to retain specimens for his or her institution as a form of compensation for his or her time, but even more as a way to diversify and strengthen the holdings of other repositories. The scientific data and analysis associated with collections are as important, and often more important, than the specimens themselves. Access to the information gained is the primary benefit most land management agencies seek. As long as the specimens are well preserved and available for public access, the agencies gain a sub-

Figure 1. Author in underground World War II bunker with vertebrae from blue whale *(Balaenoptera musculus)* washed ashore in 1988 and buried for five years on the beach. The lack of monitoring of its buried condition and its subsequent cleaning led to a loss of bone stability and a crumbling specimen.

stantial benefit through repository ownership. These practices are the standard practices that other federal and state agencies, including those in the Department of the Interior, use to encourage and regulate scientific collecting.[14]

Ownership Explored

The resources within NPS lands, where owned by the federal government, are federal property of the United States, held in trust for the people. The living communities and non-living elements—rocks, soil, air, water, and so on—that make up parks are in a state of dynamic flux. Nevertheless, ownership of this property resides with the landowner, the National Park Service.

What is ownership? To own something is to have legal title or right to something. Mere possession is not ownership, and ownership is said to be a "legal title coupled with exclusive legal right to possession."[15] This discussion centers on the ownership of property, which is a concept that is inseparable from laws and the legal system:

> Property is commonly thought of as a thing which belongs to someone and over which a person has total control.

> But, legally, it is more properly defined as a collection of legal rights over a thing. These rights are usually total and fully enforceable by the state or the owner against others. It has been said that 'property and law were born and die together.' Before laws were made there was no property. Take away laws and property ceases. Before laws were written and enforced, property had no relevance. Possession was all that mattered.[16]

For moveable property, such as scientific specimens, the collection of legal rights include possession; the ability to decide on the location and storage conditions; the right to determine uses, both private and commercial (assuming, of course, that these uses are within the law); the ability to alter, disassemble, add to, and even destroy all or part of the property; and finally, the right to convey title through gift or sale. There are many other rights and abilities that come with ownership, and many forms of use that do not convey ownership, such as rentals, leases, and loan agreements. The process of conducting scientific research under permit in national parks involves granting scientists some, although not all, of the rights of ownership. A set of rights are granted that makes the ownership question not an "all or nothing" proposition. This implies that a functional co-ownership relationship exists that current policy does not address.

Specimen Collecting in Parks

Specimens and samples are collections made from the living and non-living materials that make up the natural resources of our national parks. Plants, mammals, rocks, water, insects—all these and more are the basic materials that parks are established (in part) to protect and preserve. Permission to collect scientific specimens is granted to qualified institutions and individuals after they apply using a standard application.[17] A thorough review and evaluation of the proposed work must find the proposal to be consistent with the park's mission, a benefit to science and society, and within acceptable limits of any negative impacts or effects before a permit is issued.

During the process of conducting scientific research, a series of activities occur that affects the possession, treatment, and disposition of specimens. When a scientific permit is issued that involves collecting, the permit grants researchers permission to conduct activities not authorized for the general public. The permit review process assesses the effect of the collecting on the environment and the species, and evaluates any potential effects against the benefit to NPS and science. The same is also true for non-living materials, although geological systems require a different set of considerations than do living biota. Once removed from the park, the specimens are no longer part of the natural resource base of the park. NPS defines the natural resource specimens as museum property managed under its cultural resource program.

Collecting activities may generate specimens far in excess of needs for the research (e.g., the use of insect traps or fish nets). These excess specimens may be discarded on site or in the laboratory. Specimens may be brought to laboratories and subjected to methods of analysis, such as dissection or chemical analysis, that may destroy the specimen. Specimens may also not fit the protocols established for permanently retained specimens and may be discarded after analysis. If the specimen is intended for permanent preservation, it will be processed, labeled, and documented. It is at this point that NPS policies currently state that the specimen must remain federal property.

The process of collecting and research has a direct link with the rights of ownership of the specimens. The ability to collect and/or kill the specimen is one that is granted by the scientific permit. The right is given to possess the specimen and transport it to a location outside the park. The researcher is allowed to alter, divide, and chemically treat the specimen during the research, and even allowed to destroy the specimen (even if we request that we be contacted first). After this long series of activities and decisions involved with property rights occur, then, and only then, and only in cases where the specimen is preserved, does current policy require ownership of this property. The scientific research and collecting process involves a shared set of rights of ownership and property, and their complexity suggests that legal analysis is required beyond the abilities of the natural and cultural staff that have developed these policy interpretations so far. Without legal clarification, the current policy interpretation—that we have no right to convey ownership—creates restrictions on our ability to pursue the best management practices that encourage the development and preservation of the largest number of high-quality scientific specimens from our national parks.

Inalienable Property

There are certainly some benefits that accrue to the people of the United States by following the policy of making all scientific specimens into inalienable federal property. The full rights of ownership are retained, allowing for their use to benefit science and the management of national parks in such ways and at such times as determined by the people's representative government. At the same time, there are a number of reasons for not pursuing such a policy interpretation as being in our best interest.

Specimens taken for scientific research are not the only way that natural resources are moved, altered, or collected in national parks, and are not even the way the majority of park resources are altered or moved. Parks are visited by millions of people who have legal fair use of the parks when they hike, swim, move surface rocks and soils, and, where permitted, fish, hunt, collect firewood, berries, seashells, and conduct many activities that affect natural resources. Parks also maintain and develop roads, power line clearances, drainage ditches, rock wall riprap, bridges, and numerous other ground-affecting activities.

Of course, not all natural resources are permanently located within a park: there also is the effect of their dynamic ecosystem properties. Water and sediments flow into and out of parks, animals migrate, birds travel long distances, and even some plants and especially their seeds can be mobile. And of course living individuals die and are replaced on regular cycles. Natural resources are a form of dynamic property, quite unlike real or personal property (such as land, buildings, equipment) that are carefully tracked and accounted for as government property. The conclusion is that a policy of inalienable property would be in effect only for those natural resources turned into museum property—a category of property resulting from actions that are a tiny minority of the activities that affect natural resource property, creating a split in our view of natural resources. Such a dichotomy would stand in strong contrast to other inalienable property, namely archeological artifacts, which represent a consistent approach of preservation and ownership in perpetuity.[18] If natural resource specimens are to remain inalienable property, much work remains to clarify why natural resource specimens must remain federal property while similar organisms and geological resources are managed separately and with much greater flexibility.

A Vision for the Future

Within a legal framework, we need to define goals that maximize the contribution of scientific specimens to the protection of resources, the gaining of knowledge that benefits society, and the mission of the National Park Service. Any policy direction should be analyzed against a vision that would include maximizing the geographical, spatial, and taxonomic representation of specimens from national parks that are collected with scientific rigor, have the highest-quality data, and are well curated and preserved. There will be great costs associated with achieving such a vision, and there are almost limitless biological and geological resources under our care. Any policy that creates obstacles to these goals needs to ensure that the benefits outweigh the costs.

I've seen many instances where scientific partners and institutions refuse to accept specimens on loan in lieu of ownership. After more than 20 years, I'm still waiting to see a case where ownership allowed us to recover, study, or otherwise benefit in ways that nonownership would not allow. This paper concludes with a call for action that would bring together scientists, partners, curators, and legal and policy experts to address the issues raised here and in numerous other documents and forums.

Endnotes

1. The NPS Museum Handbook, Part II, states: "The NPS must accession specimens collected under 36 CFR [Code of Federal Regulations] 2.5g." "Accessioning is the process of officially accepting items into National Park Service (NPS) museum collections. Accessioning establishes legal custody and ownership." In the NPS Research Permit and Reporting System, the general conditions for all permits state: "Collected specimens that are not consumed in analysis or discarded after scientific analysis remain federal property. The NPS reserves the right to designate the repositories of all specimens removed from the park and to approve or restrict reassignment of specimens from one repository to another. Because specimens are Federal property, they shall not be destroyed or discarded without prior NPS authorization."
2. The Museum Handbook, Part II, states that "the NPS must accession specimens collected under 36 CFR 2.5g. The collector must give you information for accessioning the specimens. You must assign an accession number to the collection, and give the number to the collector. Assign one accession number to each project, and accession the specimens as a field collection."
3. 36 CFR 2.5 Section (g)(1) reads: "Specimens placed in displays or permanent collections will bear official National Park Service museum labels and their catalog numbers will be registered in the National Park Service catalog."
4. R. Sellars, *Preserving Nature in the National Parks: A History* (New Haven, Conn.: Yale University Press, 1997).
5. J. Bayless, "Regulating National Park Service research and collecting: a fifty-year search for a legal, flexible, and standardized approach," pp. 418–422 in *On the Frontiers of Conservation: Proceedings of the 10th Conference on Research and Resource Management in Parks and on Public Lands*, ed. by D. Harmon (Hancock, Mich.: The George Wright Society).
6. 36 CFR 2.25.
7. "Take, for example, a park's study series of insects ... the park needs to know about them, and this knowledge can only come from thorough, well documented collections. However, the staff may need to keep at hand ... only those insects which are conspicuous enough to excite visitors questions.... All the rest might be more useful in the entomological collections of a nearby university museum. Obviously, this arrangement would save curatorial time and money for the park. All concerned would benefit whether the specimens were on loan from the park or were collected under permit and belonged to an outside museum." R.H. Lewis, *Manual for Museums* (Washington, D.C. : National Park Service, 1976). Quote from p. 8.
8. R. Lewis, "Museum Curatorship in the National Park Service: 1904–1982." See page 205.
9. Examples include "An open letter to Superintendent Martin" signed by 14 geologists, April 1999; numerous verbal complaints made to the author at the Society for the Preservation of Natural History Collections meeting in San Francisco, June 2001; e-mail letter from The Ornithological Council, May 2002.
10. "Parks for science: The National Park Service welcomes researchers"; on-line at www.nature.nps.gov/challenge/brochures/ParksforScience.pdf.
11. Under the authority of the Museum Act of 1955, as revised.
12. L. Krishtalka, "Forum: At natural history museums, the ox is gored." *Museum News*, July–August 2003.

13. Latin for "Something for something," or giving one thing and receiving something in return, often without any formal contract or agreement to do so; that is, with an implicit understanding or tradition.
14. See the U.S. Fish and Wildlife Service's permitting system, on-line at www.fws.gov/. Note that neither permits nor their instructions and regulations discuss ownership of collections, and make no provisions for USFWS ownership.
15. Quote from the legal dictionary on-line at http://dictionary.law.com/.
16. Quote from the legal dictionary on-line at www.duhaime.org/dictionary/dict-p.htm.
17. In 2001, NPS implemented a new on-line permit system called the "Research Permit and Reporting System." Approved by the Office of Management and Budget, this research application process has provisions for the disposition and tracking of any permanent specimens collected under permit. See J. Bayless and N. Henderson, "Research and permit reporting system: the on-line launch is up." *Park Science* 21:1, 39–40 (2001).
18. The Archeological Resources Protection Act states: "[T]he archaeological resources which are excavated or removed from public lands will remain the property of the United States" (Title 16, Chapter 1B, Section 407cc(b)(3)).

Leadership of NPS in Dealing with Contaminated Natural History and Cultural Collections

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Background

At a spring 1999 meeting of the Museum Management Program Council (MMPC), one of the members, Virginia Salazar-Halfmoon, regional curator from the Intermountain Region of the National Park Service (NPS), asked if the Harpers Ferry Center tested NPS museum collections for contaminants. As head of the scientific research and analytical support laboratory at the Harpers Ferry Center, the question was addressed specifically to me. My answer was "no." In fact, at that time my lab had only been in existence for less than a year and our analytical capabilities were very limited. Indeed, I had only been vaguely aware that a problem even existed. I was soon to learn that many museum collections had been treated with arsenic, mercury, and/or organic pesticides in order to preserve them against insect infestation. It became evident in discussions with my conservator colleagues that the issues surrounding contaminated collections, motivated in part by the Native American Graves Protection and Repatriation Act (NAGPRA), were complex, hot topics, and ones in need of much discussion. Unfortunately, the pesticide literature is scattered and relatively inaccessible to professionals dealing with treatment or handling of contaminated collections.

The Symposium—Contaminated Collections: Preservation, Access, and Use

It was imperative that something be done to solve the problems related to contaminated collections. To that end, I authored—with help from Scott Carroll, curator at the Alaska State Museum; Catharine Hawks, a conservator in private practice; Jim Pepper Henry, NAGPRA manager at the National Museum of the American Indian (NMAI), Smithsonian Institution; Jessica Johnson, senior conservator in the NPS Museum Management Program (MMP); and Stephen Williams, assistant professor of museum studies, Baylor University—a successful grant proposal under the auspices of the Society for the Preservation of Natural History Collections (SPNHC) to organize a symposium to discuss the issues. The National Center for Preservation Technology and Training (NCPTT) funded the project, and I, in collaboration with the aforementioned colleagues, coordinated the symposium. We brought together about thirty conservators, scientists, attorneys, public health/safety officials, Native Americans, and other preservation professionals to discuss current scholarship and to map future plans of action related to these issues.

The specific goals of this symposium were to:

- Identify current scholarship on collection surveys, development of testing methods, risk assessment, and treatment of contaminated collections;
- Determine research and training needs for safe use of collections;
- Help develop conservation strategies for the safe handling, storage, and treatment of contaminated objects;
- Encourage communication among various stakeholders;
- Create working groups to carry out the plans; and
- Disseminate information.

The symposium was held in April 2001 at the U.S. Fish and Wildlife Service's National Conservation Training Center in Shepherdstown, West Virginia. In addition to funding from NCPTT, it was supported by SPNHC, NPS, and NMAI, with additional support from the American Institute for Conservation of Historic and Artistic Works and its Objects Specialty Group and Research and Technical Studies Group, and from the Repatriation Office, of the Department of Anthropology, National Museum of Natural History, Smithsonian Institution.

The format of the symposium was a retreat with facilitated sessions. The primary focus of the symposium was on repatriation of museum objects to tribal communities, and because of this focus, more than half of the invited participants were Native Americans. Although many natural history collections may also be contaminated with hazardous materials such as arsenic, mercury, and/or organic pesticides, we felt that if we addressed the more complex issues of collections being repatriated, we would also be addressing those issues pertaining to collections care managers and the care of natural history collections.

In honoring the traditions of and respecting our Native American participants, the meeting commenced with an opening blessing by G. Peter Jemison (Seneca), NAGPRA representative of the Seneca Nation of Indians, and a keynote address by James D. Nason (Comanche), professor/curator of American and Pacific ethnology at the Thomas Burke Memorial Washington State Museum, University of Washington. Each set of speakers presented an overview of current knowledge on the following topics:

- Sampling and testing;
- Communication and training;
- Legal, ethical, and regulatory issues;
- Exposure and risk assessment; and
- Mitigation and decontamination.

Six groups, representing a variety of interests and expertise, discussed the presentations and cross-cutting themes were identified. Based on these, an action plan was developed that included cost and funds procurement, policy and planning, historical perspectives and basic principles, technical communication and training, testing protocols/research and development, and legal and ethical issues.

With respect for our tribal participants, the symposium concluded with a closing blessing by Billy Cypress, executive director, Ah-Tah-Thi-Ki Museum, Seminole Tribe of Florida.

Post-Symposium Activities

Products from the meeting to date include several publications: (1) a compilation of the papers presented at the Shepherdstown symposium, the executive summary, and the list of participants (SPNHC 2001); (2) three Conserve O Grams (NPS 2001a, 2001b, 2002); (3) an article for ICOM–Ethnographic Conservation Newsletter (Johnson 2001); and (4) an article in the ICOM-CC–Ethnographic Group Preprints and Triennial Conference (Johnson and Henry 2002). In addition to the publications, there have been numerous presentations at professional meetings, including a panel discussion at the 2001 annual meeting of the AIC, a presentation at the 2001 annual meeting of SPNHC, and several presentations at the annual meeting of the Society for Environmental and Occupational Health.

The remarkable level of consensus among the participants on ways to address the problems associated with contaminated collections led to several important outcomes in addition to the publications, including a firm commitment to carry out the action plan. As with many meetings and symposia of this type, participants often profess commitment to an action plan, but when faced with day-to-day job responsibilities and other realities, momentum is lost and the problems stagnate. This has not been the case with this group.

This symposium led to the creation of a core network of people familiar with the issues associated with contaminated collections. This network has eagerly assisted others less familiar with preservation, access, and use of contaminated collections. Since the April 2001 symposium, a number of individuals and groups both nationally and internationally have been working diligently to expand our knowledge and resources in the area of contaminated collections. Examples of these efforts include:

- P. Jane Sirois, conservation scientist, Canadian Conservation Institute: continuation of research to develop testing methods for contaminants;
- Timberley Roane (Lumbee/Cherokee), assistant professor of microbiology,

University of Colorado at Denver, Department of Biology: initiation of research on the use of microorganisms for the decontamination of objects;
- SPNHC: creation of Material Safety Data Sheets for contaminated ethnographic/ botanical objects;
- Museum of New Mexico's Museum of International Folk Art: development of testing methods for organic pesticide residues on museum artifacts;
- Catherine Hawks, private conservator, and Kathryn Makos, senior industrial hygienist, Smithsonian Institution, Office of Environmental Management and Safety: continuation of research to develop tests for mercury;
- Nancy Odegaard, conservator/associate professor, Arizona State Museum/ University of Arizona: development of testing protocols for x-ray fluorescence analysis;
- Several museums: mining of their records to identify pesticides used on their collections; and
- National Institute of Occupational Safety and Health and Occupational Safety and Health Administration: study of exposure levels on museum workers.

Leadership Role of DOI and NPS

In addition to the above efforts, the Department of the Interior (DOI) and NPS have taken a broad leadership role in a variety of ways. For example, the MMPC asked Ann Hitchcock, NPS chief curator, to meet with John Robbins, NPS assistant director for cultural resources stewardship and partnerships, and Ronald C. Wilson, museum policy manager for the DOI, about coordinating a department-wide effort to address contaminated collections issues. MMP Senior Conservator Sara Wolf also participated in the discussion. As a result, Wilson established the Contaminated Collections Working Group (CCW) and serves as its chair. During its monthly meetings, the group has developed a draft disclosure statement for anyone who might be handling contaminated objects in DOI or NPS collections, including researchers, conservators, curators, collections care managers, and/or tribal representatives. More recently, the group has developed a set of FAQs (frequently asked questions) that will be posted on the DOI and NPS intranets, as well as appropriate internet sites.

Ann Hitchcock is also a member of the CCW. She has actively solicited authors for Conserve O Grams related to contaminated collections. As a result of her efforts and those of Sara Wolf, there are now three new ones devoted to contaminated collections issues (NPS 2001a, 2001b, 2002).

Through the efforts of Paula Molloy, head of the national NAGPRA grant program, the program has expanded its grant topics to include those related to testing of collections. Molloy, who is also a member of the CCW, will host the contaminated collections web site, which is currently under construction.

I too have been very involved in a wide array of projects related to contaminated collections. As a member of the CCW, I have been involved in all of the group's activities. More recently, I have been actively involved in helping to develop the FAQs and write answers to some of the questions. On my own, I designed and created the contaminated collections web pages, which will soon be hosted by Molloy at the NAGPRA web site.

To raise the awareness and keep the issues alive, I was on the AIC's contaminated collections panel where we presented a synopsis of the symposium to our professional colleagues. Along with Hawks and David Goldsmith, associate research professor, Department of Environmental and Occupational Health, The George Washington University, I was one of the presenters at a session on pesticides and indigenous peoples at the annual meeting of the Society of Occupational and Environmental Health. I also serve as a technical advisor to Peter Reuben (Tonawanda Band of Senecas), a young chemist from the Seneca Nation of Indians who is the research coordinator on a NAGPRA grant.

Perhaps the person to whom we at NPS are most indebted is Virginia Salazar-Halfmoon, curator at the NPS Santa Fe Support Office. Salazar-Halfmoon had long recognized the need for DOI and NPS to take a leadership role in tackling the issues of contaminated collections and it was she who initiated this long and complex process with her ostensibly simple question to the Harpers Ferry Center about testing of collections. Her continued commitment in this arena led to a job hazard analysis and safety audits of the collections at her site and region. Based on these assessments, she has developed a safety plan for dealing with hazards in her collections.

Through the contaminated collections symposium and the efforts of other knowledgeable individuals and institutions, DOI and NPS have identified a number of resources for anyone dealing with contaminated collections, whether they be objects for repatriation or natural history collections:

- Conserve O Grams: www.cr.nps.gov/museum/publications/conserveogram/cons_toc.html
- Society for the Preservation of Natural History Collections: www.spnhc.org/documents/CF17-1_2.htm
- Environmental Protection Agency: www.epa.gov/pesticides/
- Center for Disease Control/National Institute for Occupational Safety and Health: www.cdc.gov/niosh/pestsurv/default.html

The Future

DOI and NPS will continue their efforts to provide accurate and relevant resources for use by persons both within and outside of the federal government. The contaminated collections web site will soon be available. As part of an assignment from the CCW, Molloy and I will be creating an annotated bibliography, or literature review of all relevant literature, and make this available through the web site. Once the FAQs have been reviewed, they too will be added to the growing body of valuable resources available to federal employees working with contaminated collections, non-federal museum workers, and tribal groups.

The CCW plans to seek funding to develop training for people who must deal with contaminated collections. As one of only a few conservation scientists in the entire NPS, perhaps the most exciting developments for me personally and professionally are two projects: (1) the development of a research project on a new method for non-invasive analysis of organic pesticide residues, and (2) organizing an all-day session on object contamination testing methods and health exposure monitoring for the 2004 Eastern Analytical Symposium, the second-largest analytical chemistry conference in the United States.

The problems are critical and complex and will require long-term commitment on the part of many institutions and individuals in order to find creative solutions. DOI and NPS have accepted the challenge to ensure that the preservation of, access to, and use of cultural and natural history collections can be done safely and in a manner agreeable to tribal communities to whom collections are being repatriated, and to researchers, museum workers, and collection care managers. The continued involvement of DOI and NPS in furthering the efforts on behalf of contaminated collections is a demonstration of their leadership in this arena.

Acknowledgments

I would like to thank the symposium presenters, participants, organizers, and facilitators for sharing their knowledge at the symposium. Their hard work and commitment have laid the foundation for the current efforts to deal with issues of contaminated collections. DOI and NPS would not have come as far as we have but for foresight of Virginia Salazar-Halfmoon and Catharine Hawks; the unflagging efforts of Ron Wilson, museum policy manager, and his CCW; and Ann Hitchcock, chief curator, NPS. None of this would have been possible without the financial support of the National Center for Preservation Technology and Training, the Society for the Preservation of Natural History Collections, the American Institute for Conservation of Historic and Artistic Works, and the Smithsonian Institution's National Museum of Natural History and National Museum of the American Indian.

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Information Management and Quality Assurance for Resource Management Data Collection Efforts

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Development of an Improved Data Management System at Lake Mead National Recreation Area

Good data management is achieved, in practice, when data that have been collected and archived are recognized for their high quality, are readily accessible, and contribute to the intended purpose of the project, such as resource management decisions, regulatory processes, scientific research, or interpretive and educational needs. Good data management also fosters recognition by the scientific community that translates into increased research funding and scientific credibility.

In October 1999, Lake Mead National Recreation Area began working with the Harry Reid Center for Environmental Studies at the University of Nevada–Las Vegas to improve the organization and use of Lake Mead's resource management data and information. The first phase in this multi-phase project was an assessment of the current status at Lake Mead and development of a framework for data management. During this initial phase, four specific objectives were identified for any new data management system:

1. The data must be persistent, or long lived.
2. The data must be easy to locate and readily accessible.
3. The data must be of a quality and in a form that is usable, credible, and promotes knowledge to a variety of users both within and outside Lake Mead.
4. The system must accommodate resource managers' requirements for accountability.

The second phase of the project was development of a data management system to address these four objectives. Rather than beginning after data have been collected or a project has been completed, the new system starts with the conception and design of a research or monitoring project and continues until the desired end information product (data, report, map, etc.) is made available to the intended audience. This approach involves six distinct steps from project initiation to distribution of the project's findings: data design, collection, manipulation, analysis, archiving, and access.

Data design. Many potential difficulties in data collection, analysis, archiving, and distribution can be avoided when sufficient thought and effort are given to the data design and management process prior to data collection. With this in mind, the data design process begins with a project proposal detailing the purpose, methodologies, budget, references, and other aspects of the proposed project. This proposal is reviewed by two to three inhouse scientists or managers and may be sent out for independent review if appropriate. After it is reviewed, the proposal must be approved by the chief of resource management at Lake Mead before work can proceed. This step addresses the data management objectives of data quality and accountability.

Data collection. In addition to actually collecting data, several practices must be followed during the data collection process. As data are collected, any changes to protocols detailed in the original proposal need to be documented. One of the most important aspects of data collection is ensuring that the data collected are of known and high quality. Consequently, data quality and assurance procedures must be followed during data collection. These procedures are detailed later in this paper. In addition, data should be backed up as they are collected to avoid loss, and FGDC-compliant metadata (i.e., conforming to the content standard set by the Federal Geographic Data Committee) should be created for the data sets from details in the project proposal. This step addresses the data management objectives of data persistence, accessibility, and quality.

Data manipulation. After data have been collected, they often need to be manipulated before they can be analyzed. This process can include conversion to a different data format, standardization of data fields, organization into databases, and linking to other data. Numerous computer software tools can be used to accomplish these tasks, including databases, spreadsheets, and geographic information systems. This step addresses the data management objectives of data quality and usability.

Data analysis. During data analysis, data are summarized and formatted for delivery to their intended audience. Final products may include maps, reports, data summaries, raw data sets, and databases, among others. In addition, data analysis and product delivery should take place in a timely manner. This step addresses the data management objectives of data accessibility, usability, and resource manager accountability.

Data archiving. Archiving, or proper storage, of data allows potential data users the ability to access data and provides security against loss. Part of the data management procedures is to archive data both locally for internal users and externally for outside users and to ensure data security. Internally, data will be archived on the resource management data server for access by Lake Mead employees. Data on this server are protected onboard with a fault-tolerant hard drive system (i.e., RAID array), and data that frequently change are backed up on a daily basis using a high-capacity tape drive. Data that do not frequently change, such as images, are also archived on current-technology optical discs (e.g., DVD+RW). Externally, data will be archived in web-based databases (when appropriate, such as for non-sensitive GIS data), and tapes and disks will be stored in secure off-site storage. This step addresses the data management objectives of data persistence and accessibility.

Data access. The ability to easily locate data is as important as proper storage of data. For internal users at Lake Mead, data and metadata will be accessible through professional information management software, such as Synthesis. External users will be able to locate metadata for data sets by searching on-line metadata databases, such as those operated by the National Park Service (www3.nature.nps.gov/im/metadata/quick-search.cfm) and the U.S. Geological Survey (mercury.ornl.gov/nbii/). Using the metadata, external users would then be able to determine if data would be useful to them and be able to request the data. This step addresses the data management objectives of data persistence and accessibility.

Integration with NPS data management tools. To ensure persistence and accessibility of data collected, the new data management system being implemented by Lake Mead is designed to integrate with existing NPS data management tools, such as Dataset Catalog, NPBib, NPSpecies, Database Template, and the GIS Theme Manager.

Legacy data. Since the new data management system is designed to be integrated with all current and new data collection projects, legacy data will have to go through a process of inventorying, prioritizing, re-formatting, cataloguing, and re-archiving to make them compatible with this new system. This process will ensure the persistence and accessibility of legacy data.

The third phase of the project involves implementing the new data management system by conducting and evaluating a pilot test of the system. Currently, pilot test projects are being conducted for project planning and data quality and assurance within each program area at Lake Mead. These projects include desert tortoise monitoring, *Rana onca* habitat studies, aquatic plant surveys, exotic plant management, arid land restoration, and bat monitoring within abandoned mines.

Elements of the Lake Mead National Recreation Area Quality Assurance System

To help achieve the goal of credible, persistent, assessable, and useful natural resource information, a quality assurance (QA) system is being developed for the resource management staff at the Lake Mead. The purpose of this section is to provide some background on the approach we are using in the development of this QA system.

Natural resource management agencies such as NPS often have limited experience with the establishment and implementation of formalized QA programs (Figure 1; Palmer 2003). In contrast, federal regulatory agencies such as the Environmental Protection Agency and the Department of Energy have very detailed and structured QA programs that must be implemented by their staff whenever they collect data. The experience of these agencies has been that QA not only assists in making their data more defensible in court, but also improves the likelihood of high-quality data that have been adequately documented so as to be persistent and assessable.

QA is an overall system of management activities designed to assure the quality of data and information that are generated by a project or program. The two principal components of QA are quality control and quality assessment. Quality control includes those operational techniques and activities that are used to control the data acquisition process. Quality assessment or evaluation includes the application of statistical tools to determine the uncertainty in the data and whether or not they are appropriate to support management decisions. For example, the precision and bias of measurements can be estimated to identify if measurements should be considered quantitative, semi-quantitative, or qualitative.

The approach used to develop the QA system for Lake Mead was to follow the American National Standard (ANSI 1994), which provides specifications and guidelines for quality systems for environmental data collection programs. The value of selecting this approach is that it is based on the extensive experience of a large group of QA professionals and is currently used as the common standard for the development of QA programs by many agencies. This standard requires that a QA program be developed in two main parts. The first part is to specify the quality management elements for the overall program. This is documented in a quality system management plan. The second part is to specify QA ele-

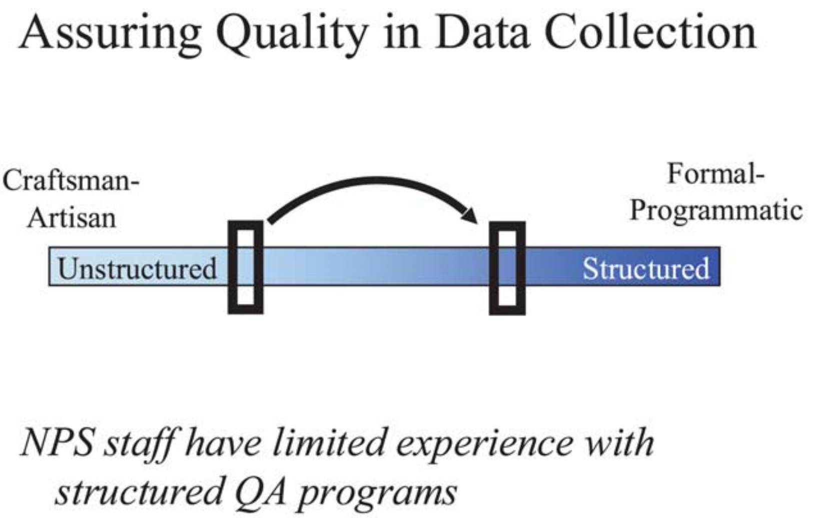

Figure 1. Quality assurance in data collection requires moving from unstructured to structured programs.

ments that should be included in any data collection effort. These QA elements should be included as part of the planning for data collection in any given project.

The development of the QA program for Lake Mead began with the preparation of a draft quality system management plan (Palmer and Landis 2002) for consideration by park staff. In accordance with the guidelines from the American National Standard, ten topics were addressed in this plan: management and organization, quality system description, personnel qualification and training, procurement of items and services, documents and records, computer hardware and software, planning, implementation of work processes, assessment and response, and quality improvement.

The Lake Mead quality system management plan details a QA system to be implemented whenever natural resource information is collected. This QA system is detailed in Table 1. The table is divided into QA activities that should be undertaken during the planning, data collection, assessment, and continual improvement phases of each project. Each of these topics will be considered in more detail in the following paragraphs.

Planning. The primary project planning tool for the quality system is the resource management project plan (RMPP). During the process of preparing a RMPP, a project leader answers a specific list of questions. A unique property of this RMPP is that it includes all the information needed to complete a fully compliant FGDC metadata record.

An important component of the RMPP is the identification of each of the measurements that will be undertaken during the project study period. For each of the measurements, the project leader is asked to specify a measurement quality objective (MQO). For example, an MQO might be set for the measurement of the width of a tortoise shell, frequency of correct identification of plant species, range in acceptable condition codes, or the concentration of a chemical in a water sample. The development of MQOs is a critical QA step as it serves as the basis for evaluating and improving the quality of data over time.

Data collection. Data collection in projects should follow written protocols called *standard operating procedures.* Field crew members should be trained in these proce-

Table 1. Quality assurance activities, tools, and responsibilities for the Lake Mead Resource Management Division quality system

Project Phase	Activity	Tools	Responsibility
Planning	Develop a project plan with a QA section	Resource Management Project Plan (RMPP)	Prepare: Project Leader Review: QA Team
	Select measurement quality objectives (MQOs)	RMPP	Prepare: Project Leader Review: QA Team
Data Collection	Develop detailed methods and data quality objectives	Standard operating procedures (SOPs)	Prepare: Project Leader Review: QA Team
	Conduct training and certification of trainees	Training guide and certification forms	Prepare: Project Leader Review: QA Team
	Collect, record, and control data	Scientific notebooks, field forms, data recorders	Prepare: Project Leader Review: QA Team
	Collect and control samples (if required)	Sample labels and sample handling procedures	Prepare: Project Leader Review: QA Team
	Calibrate and maintain field and laboratory equipment	SOPs	Prepare: Project Leader Review: QA Team
Assessment and Response	Conduct audits	Field audit form	Prepare: Project Leader Review: QA Team
	Remeasurements	Field data collection forms, remeasurement schedule	Prepare: QA Manager Conduct: Auditors, QA remeasurement crew
	Data review, verification, and validation	Data entry checks, illegal data filters, outlier detection, internal consistency checks	Prepare: Project Leader Program: Data Manager Conduct: Project Team
	Assess quality of data	Quality assessment section in project reports	Prepare: Project Leader Review: QA Manager
Continual improvement	Conduct annual reviews of project	Debriefing reports, client interviews; system audits	Prepare: Project Leader Review: QA team

dures and then tested as to their ability to perform them within the limits specified in the MQOs. Data collection should proceed using standardized field data collection forms or portable data recorders with built-in data collection programs. The advantage of using portable data recorders is that they minimize field data collection errors, such as missed fields or the entry of invalid codes. During data collection, all field equipment should be calibrated and maintained frequently.

Assessment and response. During the first few weeks of data collection, audits should be conducted of field crew members to ensure that they are following established protocols and to answer questions that might not have been adequately covered in training sessions. The purpose of conducting the audits early in the field season is to prevent the collection of erroneous or questionable data. During an audit or in a subsequent visit, independent remeasurements need to be taken of a subset of the data being collected by the field crews. When these data are collected during a field audit, they can be used to help identify problems the field crew might be having with the interpretation of field protocols. When they are collected at a different time without knowing the values obtained by the original crew, these remeasurement data can be used to calculate the precision and (in certain situations) bias in the data.

All data that are collected should be reviewed. The first step is to verify whether or not the numbers placed on the field data sheets have been correctly transferred to the project database during computer data entry. This step is called *data verification.* The next step is to evaluate whether or not the data are internally consistent and scientifically sound. This step is called *data validation* and includes evaluation for outliers and comparisons between parameters (Edwards 2000).

Continual improvement. An important component of any quality system is to have in place a process to improve the system over time. The approach recommended in the Lake Mead quality system management plan is to focus on debriefing of field crews at the end of the field season and to conduct annual reviews of on-going projects. The overall quality system management plan should also be reviewed on an annual basis.

Approach to implementation. The approach we have used to implement the quality system at Lake Mead has been to gradually implement the program through training and pilot studies. A day-long training session was used to introduce the staff to quality concepts and the overall approach. Each project leader was asked to select one of his or her projects to act as a pilot for QA during the coming year. Assistance has been provided to the project leaders to help them with the implementation of the quality system components, such as the preparation of RMPPs, the selection of MQOs, and the identification of opportunities for the collection of independent remeasurement data.

Summary

It is our belief that the formal planning of QA and information management systems will improve the likelihood that credible, persistent, accessible, and useful data will be collected by resource management staff in our national parks. This planning should begin with the preparation of a data management plan and a quality system management plan.

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Workshop Report: Discussion Among NPS Research Coordinators and Curators of Ways to Improve Cooperation in Specimen Collecting and Curation

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In this workshop, approximately 20 National Park Service (NPS) research coordinators and curators engaged in a wide-ranging discussion of steps NPS could consider taking to improve management of natural resource collecting in parks and care of the resulting specimens. The desired outcome was to develop suggestions for best practices that could be applied to (1) improving the coordination within NPS of purposes, strategies, and activities for administering the collection and curation of natural history specimens; and (2) communicating these purposes, strategies, and activities to permit applicants and partner repositories. This workshop report provides a written compilation of the discussions.

The workshop leaders encouraged the group to identify:

- Key points in administration of collecting and curation of specimens where coordination among park curator, permit coordinator, permittee, and non-NPS repository is critical;
- Best practices where this coordination works well;
- Possible new practices to improve coordination;
- Follow-up tasks to promote best practices and to develop new practices for servicewide review; and
- Needs that are beyond what individual permit coordinators, permittees, curators, and repositories can do either separately or together, such as changes to statutory, regulatory, policy, or procedural guidance, and servicewide training programs.

The discussion produced the following suggestions.

Improve communication and information access through software changes:

- Facilitate export and import of data between the Automated National Catalog System (ANCS+) and NPSpecies, the NPS flora and fauna database. Consider inclusion of ANCS+ data in the NPS database-organizing program Synthesis. Note: ANCS+ data, exported to NPSpecies, was some of the first data to populate NPSpecies in its early stages. NPSpecies developers are working on a routine to export NPSpecies data into ANCS+.
- Include additional data fields in the NPS Web Catalog to increase its usefulness to researchers. Note: Current natural history data fields in the Web Catalog are *taxonomic classification, scientific name, common name, collection date, collector, catalogue number, eminent figure and organization,* and *state.* The Web Catalog provides images of specimens, but does not include locality data, which parks must protect and release on a case-by-case basis. Additional data fields are under consideration.
- Improve coordination between the park curator and permit coordinator by identifying the curator in the Research Permit and Reporting System (RPRS) and having RPRS send an automated message to the curator when an applicant proposes to collect specimens that will be retained. Note: A RPRS work group also recommended this modification. The recommendation is being implemented; the software now displays the park curator's e-mail address on the park research coordinator's home

page, includes the curator's e-mail address in park information provided to research applicants, and triggers an automated message to the park curator when an investigator submits an application proposing a non-NPS repository for collected specimens.
- Modify RPRS to allow identification of all project personnel, including those who collect specimens. Note: Currently, RPRS allows identification of one principal investigator and unlimited numbers of co-investigators. The system does not allow multiple principal investigators for two reasons: NPS needs to identify a single responsible research official, and the principal investigator is a key link to other fields in the database.
- Improve guidance on the researcher's collections management responsibilities. Develop an instructional CD-ROM to explain the step-by-step process for researchers to meet collections management requirements, including working with the park curator and research coordinator, completing repository agreements and other requirements in RPRS, preparing specimens, and exporting or entering ANCS+ data. Modify RPRS to prompt permit applicants to supply required collections-related information. In order to facilitate tracking of specimens, consider assigning an accession number to each permit for specimens to be retained. Note: Modifications to include researcher prompts in the online RPRS process have been made and the suggestion regarding the accession number is under consideration. A distance-learning program is also under consideration.

Increase communication among key players in permitting and collections management:
- Involve park curators at the earliest stages in processing applications that involve collecting specimens for permanent retention.
- Ask NPS regional and support office curators to provide park curators and research coordinators with increased technical support and facilitate coordination with non-NPS partners in the museum community.

Augment central NPS staffing to guide NPS natural history collections management:
- Provide curatorial support at the inventory and monitoring network level.
- Establish a servicewide curator in natural history. Note: The museum management and inventory and monitoring programs jointly have established a position to be filled in 2003.

Facilitate partnership arrangements:
- Establish a generic cooperative agreement for parks, networks, regions, and Washington to use in establishing relationships with one or more non-NPS repositories. Note: A draft is under review.
- Seek recurring funding to support non-NPS repositories managing park collections.
- Place NPS curators at partner repositories.

Clarify, update, and disseminate guidance for NPS specimen acquisition and management:
- Consider whether the significance of a specimen should factor into a park's decision to acquire it.
- Update the NPS Museum Handbook, Appendix H, Natural History, to include new or revised guidance on managing DNA and tissue samples, tracking consumption of specimens, and researcher submission of resource management records or archival copies. Note: These updates will occur after the museum management program fills the natural history curator position (see above).
- Respond to repository requests for NPS to convey ownership of specimens.
- Update the taxonomic classification system (hierarchical classification outline) in ANCS+. Note: This update will occur after the museum management program fills the natural history curator position.

Make quality improvements to management:

- Consider establishing a servicewide annual report on repository loans and agreements by collecting this information from parks.
- Consider adopting protocols for peer review of permit applications and study proposals.
- Consider developing databases equivalent to NPSpecies for geological and paleontological resources.
- Provide centralized reference to park-specific and project-specific permit conditions.
- Provide training to park and network staff on collecting and collections management procedures. Note: The programs that manage RPRS and ANCS+ provide training throughout NPS when introducing new systems or modifications. A distance-learning program on permitting and collecting natural history specimens is under consideration.
- Identify funding within the inventory and monitoring program to compensate permittees who provide collecting and collections management services to parks in conjunction with their own independent research.

Workshop members offered a wealth of ideas for parks, networks, and servicewide programs to consider. Many of the recommendations pertain to enhancements to servicewide automated systems and guidance coordinated by the museum management program and inventory and monitoring program of the Natural Resource Information Division. The programs have these recommendations for consideration, as appropriate, in planning.

What's in the Pipeline for Natural History Collecting and Collections?

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A sea change is occurring in National Park Service (NPS) natural history collecting and collections management. The recent advent of the Natural Resource Challenge initiative has already stimulated changes in the permitting process. Several new developments are in the pipeline and more will come in the future.

The web-based Research Permit and Reporting System has revolutionized the scientific research and collecting permitting process. It standardized permitting across all parks and is helping park research coordinators, park curators, researchers, and repositories to improve their coordination of permitting, collecting, and collections management activities. Drawing from experiences gained during the two years in which the system has been in operation, an advisory group of users has identified a number of desirable changes, such as automated messaging to notify a curator of a new permit application to collect and retain specimens, software prompts reminding applicants to get a signed agreement from a proposed repository, and expanding the software to allow applicants to propose multiple repositories for collections made under a single permit. The Natural Resource Information Division expects to issue these enhancements in 2003.

The wealth of existing and anticipated future collections, the dispersed distribution of those collections throughout the world, the need to improve our knowledge of the information represented by those collections, and the importance of improving the retrievability and conservation of those collections call for creating partnerships and cooperative funding arrangements, for no one entity can do it all. New tools to facilitate coordination with non-NPS repositories managing park collections are, or soon will be, available. A model generic agreement will be issued for parks, networks, and the Washington office to consider using when coordinating the management of multiple park collections at non-NPS partner repositories. NPS use of this generic agreement could facilitate efforts to compensate and assist cooperating repositories when they provide collections management services. Consolidation of park collections into regionally focused repositories can facilitate scientific research, collections management, access for resource management purposes, and administrative coordination. Streamlined and automated inventory procedures, such as those available to NPS centers that manage multiple park collections, are now also available to non-NPS repositories with similar functions.

Researchers must enter plant and animal species data for the inventory and monitoring initiative in the NPSpecies database. To streamline the cataloguing of inventory and monitoring specimens and avoid duplicate data entry, the NPSpecies developers are designing a function to readily export data from NPSpecies to the Automated National Catalog System (ANCS+) database. This new function will complement existing ANCS+ capabilities to export data to NPSpecies and to import data from Microsoft Access or Excel files into ANCS+ when the Access or Excel files are arranged according to simple protocols, such as making the catalogue number field the first field in the database and ensuring the researcher's field names exactly match the import/export format that the park curator uses.

Using the NPS Web Catalog, introduced in 2002, the parks can make recently collected and catalogued specimen data and images immediately available for public use. Researchers in a network can use the Web Catalog to inform colleagues of specimens collected. The data then are available for other web-based union catalogues to access and use. For an example, see the John Day Fossil Beds National Monument collections on the Web Catalog at www.museum.nps.gov/joda/page.htm. Although over 50 parks have committed to post data on the Web Catalog, only 13 have made their data available thus far. As more parks take advantage of this opportunity, the electronic accessibility and benefit of NPS collections to science and the public will increase.

Needed revisions to the NPS Museum Handbook, Part II, Appendix H, Natural History, including the taxonomic classification system and the hierarchical classification outline, will follow once the partnership of the museum management program and the inventory and monitoring program fulfills its goal to hire a natural history curator in 2003.

These new developments, in the pipeline for 2003 and beyond, are some of the steps being taken to meet the needs of scientific, museum, and park communities in managing and accessing NPS specimens and their associated data for research and education. The National Park Service and partner organization experiences reported in the case studies and contributed papers offer a number of different models for park collections management. The NPS workshop report highlights the kinds of changes that park research coordinators and curators think could improve the collecting, use, and management of park scientific specimens. Our goal is to use the information from these case studies and papers and the workshop discussion to encourage all partners to adopt best practices that are effective in managing park collections while optimizing their benefit to science and society.