PARK SCIENCE
Integrating Research and Resource Management

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Butterflies and Moths of National Parks, State Parks, and National Wildlife Refuges

A Survey Reflects a Growing Interest in Managing for Lepidoptera

Photo by Don Riepe

Figure 1. Instantly recognizable, the tiger swallowtail nectars *at orange milkweed (butterfly weed), a prairie perennial that attracts many lepidoptera.*

By Don Riepe and Barbara Toborg

THE RECENT proliferation of butterfly field guides and gardening books, butterfly farms and observatories, and the formation of the North American Butterfly Association, attests to an increasing public interest in the study and enjoyment of *lepidoptera* (butterflies and moths). Because they can live in relatively small habitats, butterflies and moths make ideal subjects for "watchable wildlife" and other environmental education programs–even in heavily urbanized areas. Butterflies add color and movement to the landscape and have an aesthetic appeal to many visitors. Some, such as the monarch butterfly, migrate by the millions across the lower 48 states on their annual journey to southern California, Texas, and Mexico. A group entitled "Friends of the Monarchs" monitors the monarchs as they winter at Pacific Grove, California. Last winter (1995-96), upwards of 50,000 monarchs delighted visitors from all over California, nearby states and Hawaii, including tourists from France and Switzerland.

As plant pollinators (figure 1), lepidoptera play an important role in natural ecosystems. Many species serve as indicator species or environmental "barometers" whose presence or absence tells us something about the state of an environment. As components of food chains and webs, lepidoptera (especially caterpillars) provide sustenance for small mammals and many species of birds, especially during nesting and migration periods when food demand is high. Among the million plus insects presently described, butterflies and moths are perhaps the most well known and best loved. Therefore, from a public agency perspective, lepidoptera make ideal subjects to consider in resource management and landscaping plans and for interpretive programs.

Natural Areas Surveyed

In order to get some general overview of the current status of interest and management concern regarding lepidoptera in park systems in the United States, we developed

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The editor encourages submissions from all readers and would especially like to stimulate resource managers to write for the Highlights column. Please refer to guidelines published in volume **16(3)**:5-6 and online, or contact the editor:

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IN THE NEXT ISSUE. . .

In winter, we will take a look at snowmobile emissions research at Grand Teton National Park. Also, Lake Mead Wildlife Biologist Mike Boyles will share his perspective on desert tortoise research, protection, and recovery in the Mojave Desert parks. Other articles are planned, including a report on deer reductions at Gettysburg National Military Park and a brief account of the establishment of the Biological Resources Division within the U.S. Geological Survey, but plenty of space is available. Please contact the editor if you have a story you would like to contribute.

Evolution as Process

Like the organisms many of us study or the organization we work for, our work in resource management and science evolves. Always short on time, staff, and money, we persevere, focusing on what is important–making progress and bringing about results. However slow or gradual the evolution process and however many setbacks we experience along the way, we always seem to march forward making new discoveries, seeing new connections, improving on the way we manage our respective areas of responsibility. This process, this evolution of building on knowledge, applying tools in new ways, of making refinements in what we do is demonstrated throughout this issue.

Two articles discuss different aspects of the survey or questionnaire as a tool to gather information and make advances. In our cover story, Don Riepe and Barbara Toborg report on their use of a survey to investigate the status of management of butterflies and moths in many northeastern U.S. parks. In their case, the survey served as a catalyst for many parks to begin considering these insects in their resource management plans and activities. Information from the questionnaire has also turned into a resource in itself, giving parks access to a network of resource managers with experience in lepidoptera management. Surveys also help us judge the impact of our work on others as the *Park Science* reader survey summary explains. In providing feedback, this survey has created a foundation for making future improvements.

Conferences are a part of this evolution, too. For example, discussions about the NPS "natural process" wildlife management policy at the Ecological Society of America meeting facilitated feedback from supporters and critics as we consider possible refinements of this management approach over the next couple of years. The Tall Timbers gathering in Idaho last spring pulled together an exciting collection of ideas and experiences with prescribed natural fire and may help to further the successful use of this ecologically important management tool in parks.

In her article on natural resources and park construction, Abby Miller explains a refinement in the process to evaluate construction project proposals. Now, the process takes into account multiple benefits to a park, including those related to preserving natural resources. This administrative change represents another significant development in the evolution of carrying out natural resource management work in the parks.

To venture to the next step for each of us certainly requires desire, courage, perspective, and time. As Ralph Waldo Emerson said, "The years teach us much the days never knew." Stay focused, keep pushing, be creative, take chances. The next step may be just within reach.

Jeff

News & Views

Erratum

Keith Langdon, the inventory and long-term monitoring coordinator for the last 3 years at Great Smoky Mountains National Park, wrote to say that he enjoyed the cover story about the Natural Resource Trainee Program last issue. He also pointed out an error; he is not a plant ecologist as listed in the key to the photograph on page 17. Rather, his title is Supervisory Biologist. As he put it, "I do work with plants, but also just about every other form of life here."

Changes

Several minor changes related to *Park Science* (online) are afoot. First, it has a new World Wide Web address and can be found at http://www/aqd/nps.gov/natnet/nrid/parksci. An online, integrated infobase of this year's issues (volume 16) is now up and running and, for some readers, may be easier to use than downloading the PDF (portable document format) files that have been the only choice so far. You can reach the infobase from the *Park Science* home page. Likewise, text files of the articles are also available from the web site and the editor is considering a method to distribute them to interested parties via NPS cc:Mail. Also, *Park Science* (online) has been assigned an international standard serial number (ISSN 1090-9966) by the Library of Congress. This official registration should help make the information easier to locate on the web and in print. By the way, the U.S. Government Printing Office maintains links to federal publications, including this one, from their home page on the web (http://www.access.gpo.gov/su_docs/dpos/btitles.html).

New E-mail Address

The George Wright Society (GWS) recently adopted a new e-mail address and unveiled a web site. You can reach them by e-mail at gws@mail.portup.com and explore their web pages at http://www.portup.com/~gws/home.html. The home page features basic GWS information, including an online membership signup form, a complete GWS publications list and order form, a George Wright Forum sampler, and information on the upcoming 1997 GWS conference (see Meetings of Interest on page 32). Abstract submission guidelines and registration forms for the conference are available. The site also sports an ever-changing list of other relevant web sites for park researchers and managers.

Conservation Directory Available

The U.S. Fish and Wildlife Service, Montana Fish and Wildlife Management Assistance Office, has compiled a national directory of Native American Conservation Departments. Each listing is of an active tribal conservation program. A resource such as this may be useful to many parks and other land managers in establishing contact with tribal liaisons regarding conservation issues and goals on adjacent federal and tribal lands. Contact Joe

Continued on page 4

Early at (406) 585-9010 in Bozeman, Montana, for a free copy.

Readers Generally Satisfied Concludes Survey

Results from last year's *Park Science* readers survey are in and the general word is that most readers are satisfied with the publication. Distributed to over 4,200 readers and returned by 16% of them, the survey asked 16 questions specific to *Park Science* including questions about the readers themselves, content, distribution methods, electronic publishing, design, and how the information is used. A summary of the findings follows.

The profile of a typical *Park Science* reader yielded few surprises. Sixty-one percent of the questionnaires were completed by NPS employees, 11% by university staff, 6% by NBS employees, 5% by other federal agency staff, and 5% from other organizations. Responses came from 50 states and territories of the United States with western states leading the pack. Eight countries responded with Canada leading this group.

Within the National Park Service, responses came from 156 different units of the national park system and at least 15 administrative units. Thirty-five per cent of readers have completed a master's degree, while 22% have earned a bachelor's degree, and 20% have a Ph.D. Fifty-eight percent indicated a resource management background, with biological sciences running a distant second at 27%. The average pay grade of a *Park Science* reader is GS-11.

Most respondents are long-time readers of this publication (55% greater than 5 years) and learned about it through the former Natural Resource Publications Office or a colleague. While seventy-eight percent are happy with receiving the publication by mail, most respondents also indicated that Internet access or other electronic distribution (such as cc:Mail) would be beneficial.

Nearly three-quarters said they read *Park Science* cover to cover, and 71% save it for future reference. The three most common uses for the information were to contribute to general knowledge of natural resource issues (90%), to keep up with NPS natural resource management and research (88%), and to learn of new activities and techniques (64%). Twenty percent use the information to make a decision about a management issue. Clearly indicating general satisfaction, over 90% consider the publication very useful or somewhat useful.

Regarding content, 81% feel that the mix between technical articles and science and resource management news is about right. The most popular sections are feature articles and case studies (88%) and the Highlights department (78%). The Editorial, Meetings of Interest, Book Review, and Information Crossfile are read by approximately half of the recipients. Least popular is the MAB Notes department (33%).

Despite general appeal, *Park Science* can be improved as 38% of recipients pointed out. While the list is too long to share in its entirety, the most common suggestions (in descending order) were to include articles on: social science research applications; geology (caves) and paleontology; exotic species; restoration ecology; coastal and marine resources; integrated pest management; GIS use in field applications; visitor impacts to natural resources and how to deal with them; the people doing the field work and discussions on the value of research in park management; fire management; various wildlife and vegetation issues; international activities; and interpretation of natural resource issues. The editor is always looking for good material and encourages anyone to consider this list of ideas, write a story, and submit it.

Layout and design was another area on readers' minds with nearly a third offering suggestions. Feedback ranged widely and often reflected opposite points of view (i.e., "make more like a newsletter," or "make more like a journal"). Some suggested that the layout should be "opened up," incorporating more white space. However, the vast majority indicated that the materials are now presented in a professional and attractive way and that the publication has improved in this respect.

One additional goal of the survey was to find out how to increase use of the publication by park managers who do not presently read it. Suggestions from the 5% of respondents who do not read it included, choosing articles of immediate interest, focusing on small park issues, increasing synergy between resource managers and other divisions, providing more articles on people and more information on potential grant sources, and distributing it by cc:Mail and over the Internet.

Finally, 31% made general comments about *Park Science,* the most common of which was that they appreciate the publication and do not want to see it lost for whatever reason. Although suggestions for improvement were many, the greatest number of repeat suggestions were for *Park Science* to continue presenting articles of the same sort and diversity as it has been doing. A broad spectrum of articles seems to appeal to readers especially if the material is related to management or real-world applications in the field. This is precisely the *Park Science* niche, for now and for the future.

What does all this effort and information mean? By coincidence or by design, many of the comments gleaned from the reader survey are already being addressed. For example, this issue features articles on butterflies, paleontology, a small park issue (the Lincoln Boyhood National Memorial reforestation story), application of GIS in the field, and a potential "grant" source (the story on construction projects and natural resources), all indicated as areas or high interest by respondents. For those who have Internet access, the publication is available online on the World Wide Web. The editor is also considering a method for distributing the publication via cc:Mail to those who want it delivered this way. In the future, *Park Science* will begin to share personal accounts of resource managers and scientists in the form of interviews, which will improve the immediacy of articles by giving firsthand reports of the application of research to park management. All in all, the survey will help *Park Science* continue to grow in a useful direction over the next several years.

WILDLIFE POLICIES IN THE U.S. NATIONAL PARKS: A KNEE-JERK RESPONSE

A Book Review by Dan Huff

IT'S BEEN JUST ABOUT 10 years since a disgruntled Yellowstone volunteer accused the National Park Service of *Playing God in Yellowstone*. Now, an arguably more credible group of self-appointed NPS critics is using Alston Chase's style to indict the NPS for too much *watching* God in Yellowstone! Could it be that the quid pro quo for "America's favorite bureaucracy," privileged with managing "America's best idea," is the infamous *dual* mission? This apparent dichotomy, "conservation (of park resources) unimpaired for the enjoyment of future generations," serves as a touchstone for some critics of national park policy. But both conservation and visitor use are absolute requisites of the national park idea. Constantly under the loupe of the preservationists and the determinists, we're damned if we do, and damned if we don't. No one said it was going to be easy and NPS Alaska Area Field Director Bob Barbee has, more than once, admonished us to apply for the U.S. Postal Service if we can't handle an honest ration of institutional ambiguity. In fact, one of his very best quotes is "the road to hell is paved with unrocked boats." In that sense, I guess we owe these boatrockers some appropriate gratuity for this contribution to our salvation.

In *Wildlife Policies in the U.S. National Parks,* Utah State University's Fred Wagner, along with Ron Foresta, Bruce Gill, Dale McCullough, Michael Pelton, William Porter, and Hal Salwasser, attempt to make mincemeat of practically everything that is "holy" in NPS natural resource policy. [Note: Salwasser is Regional Forester for the U.S. Forest Service's Northern Region.] The writers summarily discredit the historic and contemporary icons from Starker Leopold's "vignettes of primitive America," to the populist concepts of biodiversity and ecosystem integrity. In doing so, Wagner et al. provide a textbook vivisection of that ambiguity Bob Barbee was talking about a decade or so back. But more than anything else, the treatise implicitly confers why concise, simplistic natural resource management objectives do not work for the National Park Service.

Unfortunately left out is the fact that no national park system units have been established solely for the recreation of pre-Columbian ecosystem conditions or for the preservation of biodiversity–much less the utilitarian objectives of sustainable resource yield. Unlike the Bureau of Land Management and the U.S. Forest Service, the National Park Service has not been burdened by the Congress with all-encompassing, legislated, deterministic natural resource prescriptions. In fact, it has established units with a broad array of both ecumenical and unique "purposes," thereby clearly obviating the utility of a detailed, prescriptive NPS-wide natural resource liturgy. This fact is, obviously, not well understood by the authors.

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In *Policies,* the authors muddle around, sometimes rather aimlessly, in numerous conceptual discussions, citing all the appropriate scientific authorities that support their murky contentions–and most often posing little resolution. [I must admit, I read on with enthusiasm until hand cramps dampened my marginal note-making.] A KEY POINT: Though other parks are mentioned, the obvious focus of the authors' philosophical discord is Yellowstone. If only they understood that Yellowstone, not unlike other national parks, is managed for the suite of purposes explicitly determined by Congress, with NPS-wide policy guidance adopted as appropriate. National Park Service policies *reflect* park-specific policies; they do not proscribe them.

The discussions do a better job of documenting the limitations and ambiguities of contemporary wildlife science than inculpating NPS management decisions

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GREAT PLAINS

Parking Lot Runoff Traced into Wind Cave

In addition to being one of the most extensive cave systems in the world, Wind Cave is home to rare speleothems (formations) and a simple ecosystem that is only recently beginning to be studied. Perched above the cave are a number of surface developments, including roads, houses, maintenance facilities, a visitor center, and a 2.5-acre parking lot.

The parking lot funnels precipitation into just four drains, with one handling almost half of the runoff. These drains direct the flow into an adjacent dry streambed. Most locations in Wind Cave passing beneath this dry streambed are wet, suggesting that the streambed supplies water to the underlying cave. The park was interested in determining whether contaminants from parking lot runoff could be entering the cave in this manner. With funding assistance from the Geologic Resources Division of the Natural Resource Program Center, the park has initiated some special dye traces to study this possibility.

A number of wet locations in the cave were prepared for sampling. Background samples were collected prior to injecting the fluorescent dye and analyzed with a fluorometer, which measures fluorescence. Dye was injected below the largest parking lot drain on July 29,1996. One and eight-tenths liters (1.9 quarts) of Rhodamine WT, a red fluorescent dye commonly used for tracing groundwater, was injected along with 30,000 gallons of water to simulate a 1-inch rainfall.

Dye began arriving at one cave location within 6 hours of injection. Two other sites received dye within 22 hours. By mid-September, an additional two locations had received dye, one location after 16 days, the other after 22 days. Another area showed dye after 73 days.

Dye concentrations peaked at the three initial sites about 3 weeks after injection, and then began to fall off very slowly. Water entering the cave at these sites has remained visibly pink. Concentrations were still rising for the other three cave locations as of November 21. The park estimates that the dye will be entering the cave in measurable quantities for the next 2 years.

The park will be using this information to redesign the parking lot so that ordinary runoff is contained and treated prior to release. Hazardous material spills from ruptured vehicle fuel tanks and other sources could also be contained and removed, further improving water quality within Wind Cave. Commenting about the significance of the experiment in demonstrating the inarguable link between surface runoff and the cave, park Cave Management Specialist Jim Nepstad said, "seeing is believing."

COLUMBIA-CASCADES

Rare Flower Research

The Mt. Mazama collomia is one of the most beautiful and rare wildflowers in Crater Lake National Park, Oregon. Concerns over its vulnerability and long-term viability prompted the National Park Service and the U.S. Forest Service to join with scientists from the University of Idaho to gain information on the ecology of the species. Last summer, scientists worked with volunteers to locate collomia populations and track its population trends and reproductive success.

The research was supported by a generous grant from Canon U.S.A. through the "Expedition Into Parks" program of the National Park Foundation (NPF), an official nonprofit partner of the National Park Service. Dedicated to helping meet the needs of the 367 national park system units, the foundation was chartered by congress in 1967 to channel private resources into the parks. The National Park Foundation awards $2 million in grants each year to support education, visitor services, and volunteer activities that preserve and enhance the parks.

As a result of our studies, we have discovered new populations of collomia and gained new insights into its habitat requirements. We also found that populations of the wildflower in Crater Lake National Park are genetically different from those outside of the park. This means that plants found in the park contain valuable and unique genetic resources not found in other portions of its range.

Once again, Canon U.S.A. has funded continued research and restoration of Mt. Mazama collomia at Crater Lake through a NPF grant. Using the genetic information gained in our initial research, scientists from the University of Idaho will evaluate the physical and biological factors necessary to successfully restore collomia. Eventually, scientists, volunteers, and park staff will come together to establish experimental populations in areas where it once grew in the park.

Restoring Bull Trout at Crater Lake

Bull trout *(Salvelinus confluentus)* is the only native fish known to inhabit Crater Lake National Park today. Within the park, bull trout abundance has been reduced to between 100 and 300 adults; their distribution has been restricted to a 1.9-km reach along Sun Creek. Hybridization and competition with nonnative brook trout *(S. fontinalis)* threatened the Sun Creek bull trout population with extinction. Last year, a generous grant from Target Stores, through the NPF "Expedition Into the Parks" program, supported bull trout research and management, which led to improved management techniques.

From the research, the park learned that standard electroshocking techniques for brook trout removal within the bull trout zone injured bull trout and caused delayed mortality. Resource managers refined their techniques and began using snorkel divers to count bull trout and remove brook trout. The divers counted bull trout by size-age class. When they encountered brook trout, the divers immediately removed them with suction samplers or electroshockers. This technique was successful in reducing brook trout abundance and allowing bull trout to increase in number. However, the technique is not likely to result in the eradication of brook trout, due to the structural complexity of the stream channel.

In future studies, the park will continue to remove brook trout from Sun Creek using the snorkel diver electroshocking technique. They will also monitor bull trout recovery. Removal of brook trout from Lost Creek, where no native fishes are

found, will be conducted with electroshocking and treatments of Antimycin, which proved successful during early phases of the project at Sun Creek. The establishment of a bull trout population in an alternate watershed will serve as a backup in the event that the Sun Creek population becomes extinct or as a source of fish to enhance the restoration of the Sun Creek population.

PACIFIC ISLANDS

Whatever It Takes

Funding and staffing shortages coupled with the continual reorganization of research scientists have made it much more difficult for the National Park Service to accomplish natural resource management projects that protect national parks. In Hawaii, park resource managers and scientists have adopted a cooperative strategy to combine forces and expertise to get the job done in national park areas, and the whole is definitely greater than the sum of the parts. In smaller parks, such as Kalaupapa National Historical Park, developing, organizing, and completing large projects would simply not be possible, given the very small staff and logistical constraints, without the cooperative support of Hawaii Volcanoes and Haleakala National Parks, the University of Hawaii Cooperative Park Studies Unit (CPSU), the Pacific Islands System Support Office, and the Pacific West Field Area. Additional critical support has been shared by the NPS Water Resources Division and the USGS Biological Resources Division (BRD).

Good examples of this cooperative spirit come from recent and ongoing fence exclosure construction projects at Kalaupapa. With the assistance of Dr. Cliff Smith of the CPSU, Lloyd Loope, Art Medeiros, and Chuck Chimera of the Haleakala BRD field station, and the resource management staff of Hawaii Volcanoes, especially Larry Katahira and Howard Hoshide and his crew, the park constructed a fence nearly 3 miles long around a volcanic crater containing rare remnant Hawaiian dryland forest. This forest was being severely degraded by marauding nonnative pigs and a rapidly growing population of alien axis deer. Their efforts, coupled with the park maintenance staff, successfully completed this project in time to save this very special resource, one of the last remaining dryland forests of its type in existence. Newly sprouted seedlings of the native wiliwili tree are being seen in the crater for the first time in years since the exclusion of pigs and deer.

Another fence building project is underway at Kalaupapa, this one designed to protect several federally listed endangered plant species, and a fine example of native coastal strand vegetation. This area is being besieged by more than 500 axis deer nightly, and time is running out for the remaining coastal plants. Again, park partners were there to assist with the vegetation surveys, management recommendations, and administrative support to get the project developed and funded. Pacific Islands SSO and Pacific West Field Area staff, especially Jay Goldsmith and Don Tiernan, helped bring the project to life. Resource managers at Haleakala, led by Ron Nagata, enthusiastically coordinated the materials procurement and construction. The Haleakala fence building crew, led by Ted Rodrigues, are constructing nearly a mile of fencing, often drilling through solid rock to set the posts.

With this kind of cooperative spirit, Hawaiian parks will continue to strive to accomplish more with less. There is no choice–native ecosystems in Hawaiian parks are being rapidly degraded, and parks can not wait.

This illustration depicts the spread of exotic species to Hawaii and some of the resulting natural resource problems. Note the pigs and the exclosure at the far right.

GREAT LAKES

Brook Trout Restoration in Lake Superior

Isle Royale National Park, Michigan, is participating in several research and management activities aimed at the protection and restoration of native *coaster* brook trout. The coaster is a large and colorful form of lake dwelling brook trout that was once abundant in the near shore waters of Lake Superior and parts of the lower Great Lakes. In the early 1800s, the coaster provided a spectacular and cherished fishery, but overfishing and habitat loss reduced populations to the remnant stocks in isolated areas that exist today. Several small populations of coasters at Isle Royale may represent the last viable stocks in U.S. waters (a few small stocks also exist in Ontario).

Park staff have worked closely with the U.S. Fish and Wildlife Service in Ashland, Wisconsin, to develop a consortium of Great Lakes fisheries management agencies and private foundations to research and manage coaster brook trout. Cooperators include state Department of Natural Resources (DNR) agencies, Lake Superior Chippewa Tribal Natural Resource agencies, and Trout Unlimited.

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Initial projects at Isle Royale have focused on collecting data on the size of the wild populations and the biology and life cycle of the coaster brook trout. In addition, DNA analysis is being performed on tissue samples from Isle Royale and the region to determine the genetic relationship of coasters to stream resident brook trout. Preliminary results suggest that existing coaster populations are small and vulnerable and that genetic differences do exist.

Because coasters may spend part of the year in streams, Isle Royale took steps to severely restrict the harvest of brook trout in inland streams beginning in 1994. The park also requested the Michigan DNR to provide additional protection in Lake Superior waters, which led to a larger size limit beginning in 1996.

Finally, Isle Royale has provided logistical support and assistance to cooperators attempting to collect gametes from wild coasters in the park to establish a parent hatchery brood stock. This stock, to be made available to fisheries managers throughout Lake Superior, will be a key element in reintroducing and restoring coaster brook trout to much of its remaining Lake Superior habitat. For further information, contact Jack Oelfke (NPS) at 906-487-9080 or Lee Newman (USFWS) at 715-682-6185.

CHESAPEAKE-ALLEGHENY

Hemlock Ecosystem Studies

The National Park Service and the USGS Biological Resources Division (BRD) have initiated landscape-level studies of hemlock ecosystem biodiversity at Delaware Water Gap National Recreation Area, Pennsylvania and New Jersey, and Shenandoah National Park, Virginia. Previous ecological studies completed at the parks were geographically limited in scope, including only two or three hemlock stands in each park, and did not include stream ecology. In contrast, the new initiative will be geographically extensive, and include as many as 40 stream study sites at Delaware Water Gap.

The initiative has three major goals: (1) determine the extent to which hemlock-dominated forests contribute to landscape-level biodiversity; (2) identify environmental correlates of hemlock occurrence and mortality; and (3) predict and measure the effects of hemlock decline and mortality on ecosystem structure, function, and biodiversity at the two parks.

The NPS has funded a team of three Penn State University researchers to compile existing park biodiversity information and develop standardized sampling protocols for terrestrial vegetation, vertebrates, and invertebrates. The BRD is providing GIS analysis and statistical guidance to ensure effective study design, and they will also conduct stream studies of fish and macroinvertebrates. Caralyn Mahan is the project coordinator (814-863-1904; cgm2@psuvm.psu.edu).

A Different Spin on SSO Support

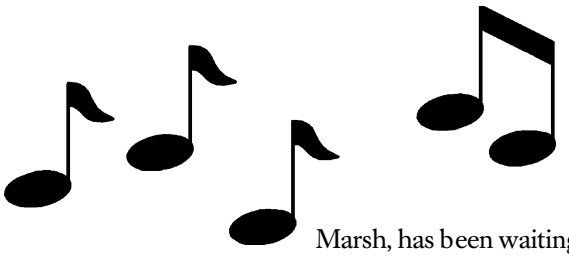
Three years ago, Chief Scientist John Karish of the Allegheny-Chesapeake System Support Office placed a 4-year term Natural Resource Specialist (wildlife biologist) at the cooperative park studies unit at Penn State. The experiment, unique in the National Park Service, has proven successful in integrating many of the vast resources of Penn State into cluster park resource management projects. The natural resource manager, Michele Batcheller, sees many pluses, along with some minuses, in this alternative arrangement for SSO resource management operations.

From her office in University Park, Pennsylvania, Batcheller first worked on writing a deer management plan-environmental impact statement (EIS) for Gettysburg National Military Park and Eisenhower National Historic Site. Penn State had played an integral role in the research associated with the EIS and had completed a case study that focused on the manner in which participation was obtained during the scoping process. The CPSU had also documented deer movements, habitat use, and park impacts related to the issue. Batcheller had easy access to the CPSU researchers, who helped provide background for the EIS. Their expertise also proved important in clarifying many of the implications of certain data when she wrote the document. Another bonus was being able to confer regularly with Karish, who is also duty stationed there, about the eastern deer issue and other topics. (Karish has effectively administered the regional science and resource management programs for 16 years from the CPSU.) By working from Penn State, she was able to focus on writing without interruptions related to routine park or regional office operations. Although it required much coordination, the EIS was signed by the regional director within 2 years, considered prompt for this kind of task.

Batcheller notes that her isolation from the parks is at times both an asset and a disadvantage. The separate duty station has helped her increase her impartiality in several projects. Even though she interviewed park staff about the deer management issue, Batcheller was able to be more objective when she wrote the EIS. This is because she was supervised by the regional office (now the system support office) rather than the park. However, isolation also challenges her to keep up with common, day-to-day, park operational problems and resource management activities. She comments that this reflects more strongly on her limited experience in the National Park Service, as opposed to the duty station itself. This is Batcheller's first NPS post and she sees the need for a comprehensive orientation to natural resource management in the National Park Service, such as the "Fundamentals" course offered last summer at the Albright Training Center. She regrets that she was unable to attend and has to rely on meetings and networking to provide her this orientation.

Since completing the EIS, Batcheller has broadened her duties. She now provides technical information and advice to cluster parks on wildlife management issues and threatened and endangered species. Surrounded by experts in sociology, forestry, fisheries, and wildlife management, she finds herself acting as a liaison in applying these resources to the best advantage of parks.

Long-billed Marsh Wren Sings Again in the Nation's Capital



By Stephen Syphax

Earlier in this century, Long-billed Marsh Wrens flourished in the emergent marshes along the tidal Anacostia River in Washington, D.C. By 1950, practically all of the Anacostia tidal marshes within the District of Columbia were dredged or filled. No doubt, the loss of the emergent marshes, the type of habitat the wren requires, is why it has not been seen or heard in the past 30-40 years in the Kenilworth Marsh (figure 1), part of the Anacostia River wetland.

In a report entitled "Birds of the Washington, D.C., Region (Proceedings of the Biological Society of Washington, March 25, 1929), May Thacher Cooke wrote that Long-billed Marsh Wrens were an "abundant summer resident in the marshes along the Potomac River and Eastern Branch [Anacostia River]". In 1944, Dr. Frances M. Uhler of the U.S. Fish and Wildlife Service authored a report examining bird life in the Anacostia Marshes. In that report, he commented, "under the golden canopy of the flowering wildrice the mid-summer air rings with cheery call of scores of marsh wrens." Most of the marsh land about which Dr. Uhler made that important observation, and many others, was destroyed when it was used as the city dump during the 1960s.

Figure 1. Absent for at least 30 years, the marsh wren staged a comeback last summer at Kenilworth Marsh, a recently restored wetland along the Anacostia River in Washington, D.C.

Restoring the Marsh

In 1992-93, National Capital Parks-East worked with the Washington, D.C. Government, the U.S. Army Corps of Engineers, the Washington Metropolitan Council of Governments, and others, on the restoration of Kenilworth Marsh in northeastern, Washington, D.C. (See the *Park Science* cover article for volume **15(1)**). During that cooperative venture, approximately 32 acres of emergent marsh land were reconstructed in a tidal lagoon that had previously been dominated by exposed mud flats at low tide. Following the reconstruction, a 5-year monitoring program (begun in 1993) was established to look at wildlife utilization, plant biodiversity, and nutrient reduction. If all goes well with the Kenilworth project, the information from the monitoring efforts will be applied toward other marsh reconstruction projects along the Anacostia River (e.g., Kingman Lake–a NPS site downriver of Kenilworth Marsh).

One of the components of the 5-year monitoring program is a breeding bird census (mapping technique for documenting breeding songbirds). Using this technique, year one, two, and three found Red-winged Blackbirds, Common Yellowthroats, and Tree Swallows breeding in the reconstructed marsh. This year (1996) marked the long-awaited return of the Long-billed Marsh Wren to the marshes of the Anacostia River-Kenilworth Marsh!

Natural Resource Specialist Dan Roddy, who has been leading wildlife utilization investigations at Kenilworth Marsh, has been waiting for this day ever since he began the monitoring efforts 4 years ago. Roddy says it has been exciting to see blackbirds, swallows, and yellowthroats attracted once again to the "new marsh", especially knowing the history of the Anacostia River and the many changes it has gone through. However, the Long-billed Marsh Wren might be the best indicator of the success of the reconstruction of Kenilworth Marsh, and real fulfillment would not occur until its return.

This past June, after 4 years of looking, listening, and mapping, Roddy finally heard his first Long-billed Marsh Wren in the Kenilworth Marsh. He observed 3 males establishing territories in sections of the reconstructed marsh. Within 2 weeks of that observation, Roddy saw his first Swamp Sparrow and Willow Flycatcher, also new to the restoration area, demonstrating territorial behavior in the rebuilt marsh.

Although the park continues to have its challenges in the reconstructed Kenilworth Marsh (i.e., exotic plant management), the return of the Long-billed Marsh Wren (and other species) is clearly a positive indicator and may indicate (from a wildlife standpoint) proceeding with current plans for reconstructing another tidal marsh at the nearby Kingman Lake in 1997.

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ECOLOGICAL SOCIETY OF AMERICA MEETING PROVIDES A FORUM FOR DISCUSSING NPS WILDLIFE POLICIES

BY MIKE BRITTEN

LAST AUGUST, I ATTENDED the 81st Annual Combined Meeting of the Ecological Society of America (ESA) in Providence, Rhode Island. ESA was joined in this meeting by the Society for Conservation Biology, the American Society of Naturalists, the Association for Tropical Biology, and the North American Chapter of the Society for Ecological Modeling. It was by far the largest professional meeting I had ever attended with nearly 3,000 registered participants and approximately 2,000 scientific presentations.

I was disappointed to see only about 10 other NPS staff in attendance. While some of the presentations reported on basic research, many described applied research and were very relevant to national park management. The theme of the meeting, "Ecologists and Biologists as Problem Solvers," focused presentation on the utility of applied research. I wonder if the lack of NPS involvement was due to the timing of the meeting and how much was because NPS managers traditionally rank attendance at professional meetings as a low priority.

NPS presentations included: "Potential impacts of recreational use on high-elevation heather populations" by R.M. Rochefort and D.L. Peterson; "An examination of annual grass control methods for use on the Lawrence Memorial Grassland Preserve" by S.T. Gibbons and B. Youtie; and my presentation (along with P.L. Kennedy and S. Ambrose) on "Migration routes and wintering areas of peregrine falcons determined by satellite telemetry." Many other presentations covered work in national parks done by outside researchers. (Also featured was an excellent poster presentation on exotic plant invasion and ecosystem features at Wind Cave National Park in South Dakota by S.M. Ogle and W.A. Reiners. This presentation won the 1995 Braun Award for best student presentation and was excellent. The work examined the habitat associations of various exotic species and developed predictions for the spread of the exotics.)

WILDLIFE POLICIES REVIEWED

A 2-hour panel presentation and discussion on "Wildlife management in the U.S. national park system: the self-regulation theory revisited" was a highlight for NPS participants. Unfortunately, it was held in the evening and only 100 people attended (the daytime presentations averaged much larger audiences even though 15 or more sessions often took place concurrently). The presentation began with a brief introduction by NPS Associate Director, Natural Resource Stewardship and Science, Mike Soukup and was followed by three case studies on the NPS natural regulation policy. Jerry Wright of the National Biological Service, University of Idaho CPSU, summarized the presentations, and then opened the discussion to the audience for a second hour.

Brian Underwood (National Biological Service, SUNY–Syracuse CPSU) described the proliferation of white-tailed deer populations in smaller eastern units of the national park system and resulting conflicts with park neighbors and state wildlife management objectives. NPS managers in these units are operating on a much more local scale than state wildlife managers, which contributes to the problem (caused by habitat alteration and lack of native predators). The second example from Isle Royale National Park, Michigan, was presented by Rolf Peterson of Michigan Technological University. He described the isolated and unstable moose-wolf system in the park that he and others have studied for 38 years. The current wolf population is "genetically challenged" and Peterson predicts extinction within the next few years; he is also very pessimistic about the potential for a natural recolonization of the island (due in part to urbanization on the mainland). Furthermore, Peterson worries that NPS management policies discourage restoration. The final case study was presented by NPS Intermountain Field Area Associate Field Director, Natural Resource Stewardship and Science, Dan Huff who described the history and controversy over natural regulation on the northern range of Yellowstone National Park, Wyoming. NPS management of ungulates on the northern range has included shooting 4,600+ elk (more than half of the herd) in 1962, on one extreme, to the current natural regulation policy (which includes monitoring of ungulate populations, range conditions, and erosion, and more than 25 recent and ongoing studies on the northern range). Huff concluded that it is appropriate for the National Park Service to monitor and study the area as a natural experiment with intervention a possibility if monitoring indicated that irreversible changes are occurring.

The ensuing discussions illustrated the wide range of positions ecologists and wildlife biologists hold on the "natural process" regulation of wildlife populations in parks. At times, the debate became polarized but, overall, some excellent points were raised. Possibly the most important was that NPS managers should consider the scope of their management objectives (usually local) compared to the scope of management objectives of other wildlife and land managers (usually regional) to help understand and avoid conflicts. National Park Service resources can only benefit, in my opinion, when park managers seek to understand the current debate and range of positions in ecological management. The ESA annual meetings are a good place to seek this knowledge.

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FIRE IN ECOSYSTEM MANAGEMENT: SHIFTING THE PARADIGM FROM SUPPRESSION TO PRESCRIPTION

BY TOM ZIMMERMAN

HELD IN BOISE, IDAHO, LAST May, the 20th Tall Timbers Fire Ecology Conference continues to be the single best source of information and debate on wildland fire management in the country. The conference is an outgrowth of the fire ecology series initiated by the Tall Timbers Research Station in 1962. This series began and has continued for 34 years primarily as a determined educational effort. The principal goal has been to create an environment where the results of research and experience can be presented and documented to form a solid foundation for fostering a more intelligent and productive course of wildland fire and resource management. All 19 previous conferences have published proceedings that have markedly increased the state of knowledge regarding wildland fire management. Cosponsors of the conference included the Tall Timbers Research Station, The Nature Conservancy, U.S. Fish and Wildlife Service, National Park Service, U.S. Forest Service, and Bureau of Land Management.

Since the first conference in 1962, land managers have shifted their thinking and subsequent management practices from a one-dimensional approach of total fire control to a more multidimensional role of incorporating fire suppression and prescribed fire use into wildland fire management (figure 1). This shift has been largely due to the increased understanding of the role fire plays as a natural process. As our knowledge has increased, we have been able to identify both positive and negative effects of past management practices. While we have succeeded in preserving expansive tracts of forest resources, aggressive and increasingly sophisticated fire suppression techniques have been responsible for such negative effects as changes in stand structure and age-class distributions, and increased accumulations of woody fuels, all of which are combining to cause a large-scale decline in ecosystem health, particularly in the western United States. Considerable effort and attention has been focused on the need to increase prescribed fire applications to combat unhealthy ecological trends, accelerated fuel accumulations, and other effects of prolonged fire exclusion.

Figure 1. One of the first, large, long-duration prescribed natural fires to be managed on an interagency basis on both Forest Service and National Park Service lands, the Coyote Fire burned in Yellowstone National Park, Wyoming, last August.

Fire suppression has changed forest stand structure, age-class distributions, and accumulations of fuels to cause a decline in ecosystem health, particularly in the western United States.

Given the scope and importance of these ecological concerns, this conference was extremely relevant to today's manager. This year's conference was one of the best attended in the series, with over 300 participants from countries around the world. The agenda included 10 sessions with more than 100 presenters of oral papers, poster papers, and panel discussions. Topics included prescribed fire and risk assessment; prescribed fire in the western and southeastern United States; prescribed fire and avian communities; international perspectives; fire, silviculture, and ecosystem management; and, political and philosophical issues and their limits on pre-

Continued in middle column on page 30

YELLOWSTONE INVESTIGATES ACCESS AND PROPERTY RIGHTS TO GENETIC RESOURCES

BY BOB LINDSTROM

I RECENTLY ATTENDED A SCIentific conference sponsored by the U.S.D.A. Agricultural Research Service entitled, Global Genetic Resources–Access, Ownership, and Intellectual Property Rights. Held last May at the Beltsville Agricultural Research Center, Maryland, the conference was attended by 300 scientists, lawyers, and intellectual property-rights specialists from around the world. Yellowstone National Park managers have become interested in this topic particularly as it relates to the commercial use and patenting of products from National Park Service research specimens (figure 1). I participated by presenting a poster discussing "Yellowstone Thermophiles and Biotechnology: An Intellectual Property Dilemma," which included industrial applications of 11 Yellowstone specimens.

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Figure 1. Replete with organisms adapted to life at high temperatures and often with considerable commercial potential, hot springs, such as Emerald Pool in Yellowstone's Black Sand Basin, have become symbolic of a dilemma to preserve biodiversity in parks, while allowing for utilitarian research.

The majority of the conference presentations focused on the loss of biodiversity throughout the world, and what could be done to preserve representative voucher populations. Manipulation of genetic material has been performed by humans since the beginnings of agriculture more than 5,000 years ago. Modern food crops and livestock are crossbred, hybridized, and genetically engineered to meet the dynamic needs of modern society. Much upgrading of our food supply has been accomplished by farmers, fine-tuned by the modern techniques of agricultural research, and marketed in cooperation with the private sector. Such characteristics as semidwarf varieties, fungal rust resistance, and frost hardiness in modern wheat are derived from the biodiversity of developing nations.

Forty percent of modern pharmaceuticals are obtained from plants, most of which are located in the tropical zones of the Third World. Biotechnology has accelerated the manipulation of economically important natural resources by using techniques of tissue cultures, genetic cloning, and overexpression (abnormal production) of gene products. However, many species–valuable in and of themselves, as well as for food crops or medicines–are threatened with extinction due to habitat loss caused by human expansion and development. The loss of in situ (in the field) genetic diversity is a serious problem in the strategic reserves of the human food supply. The agricultural research community's response is to promote *ex situ* (in the laboratory) preservation including seed banks or germplasm production outside the natural habitat of the species. When a war and famine in Ethiopia caused the extinction of a locally important grain, ex-situ seed stock from the U.S. Department of Agriculture was provided to reestablish the drought-tolerant local variety.

Obviously, we also wish to preserve native resources in situ in places like Yellowstone and other parks and reserves around the world. A related issue focused on commercial use of these resources, which was of interest to me, representing the National Park Service. Our primary mission is to preserve park resources, but secondarily, we must provide for public enjoyment of the resources, as long as no harm is done. Research permits are the only allowable means of access to genetic resources and are sanctioned under the provisions of the Code of Federal Regulation (CFR) 36 2.5, "Research Specimens." As global biodiversity is steadily depleted, biosphere reserves such as national parks become increasingly important sources of genetic resources.

Conference participants heard about the 1992 United Nations Convention on Biological Diversity that established an international common law considering genetic resources intellectual property belonging to individual member states. Intellectual property rights (IPR) are simi-

lar to copyright laws in that they protect the owner of these easily copied or pirated resources. The National Biodiversity Institute of Costa Rica (INBio) is leading the pack with respect to IPR, implementing biodiversity preservation by marketing genetic resources to biotechnology companies. Income from biodiversity is used to preserve and protect conservation areas, substituting ecotourism and research for traditional slash and burn agricultural clear-cuts and grazing monocultures.

Yellowstone has often set the precedent in conservation biology, and once again we find ourselves on the forefront of biodiversity preservation. Genetic material from a single Yellowstone microorganism is now the basis of a product that revolutionized molecular biology and generates sales of over 200 million dollars per year: the PCR (Polymerase Chain Reaction). (See Lindstrom's article on PCR in *Park Science*, **16(1)**:12-13.) The gene, a segment of DNA producing DNA polymerase, was removed (transformed) from the hot spring bacterium *Thermus aquaticus* Yellowstone type-1 (*Taq* YT-1). This research specimen was collected by Thomas Brock in 1967 from the Lower Geyser Basin. He published a description of *Taq* and deposited a copy of the specimen into the American Type Culture Collection (ATCC), a nonprofit repository of microbiological specimens. Due to its tolerance for near-boiling temperatures, the product of this gene, *Taq* DNA polymerase, performs the enzymatic amplification of DNA on an industrial scale providing a "silver bullet" in the study of DNA science.

Kerry Mullis, working for Cetus Corporation, invented PCR in the 1980s when he came up with the idea of using a heat-stable enzyme to produce unlimited copies of "target" DNA. The enzyme chosen to be named in the patent was DNA polymerase from *Taq* YT-1, ATCC# 25104, as deposited by Thomas Brock in 1967, collected under a research permit signed by John Good, Yellowstone Chief Naturalist. Uses of PCR include DNA fingerprinting, disease diagnostics, and forensic analysis. Since PCR can be used to amplify any type of DNA, even fossil DNA can be reproduced. PCR was basis of the Jurassic Park biofiction scenario, where fossil dinosaur DNA preserved in amber was recovered and amplified into living organisms.

The conference poster "Yellowstone Thermophiles and Biotechnology, an Intellectual Property Dilemma" presented information on several other significant industrial applications based on heat-stable enzymes from Yellowstone, also available through the American Type Culture Collection. One organism, *Thermoanaerobacter ethanolicus* is adept at converting cellulose from waste products into ethanol for use as gasohol. A U.S. patent on this organism has been granted to Dr. Jürgen Wiegel under contract with the U.S. Department of Energy. Other organisms that aid in bioleaching of gold ore, removal of paint from military aircraft, and facilitate food processing were mentioned among the many uses of heat-stable industrial enzymes.

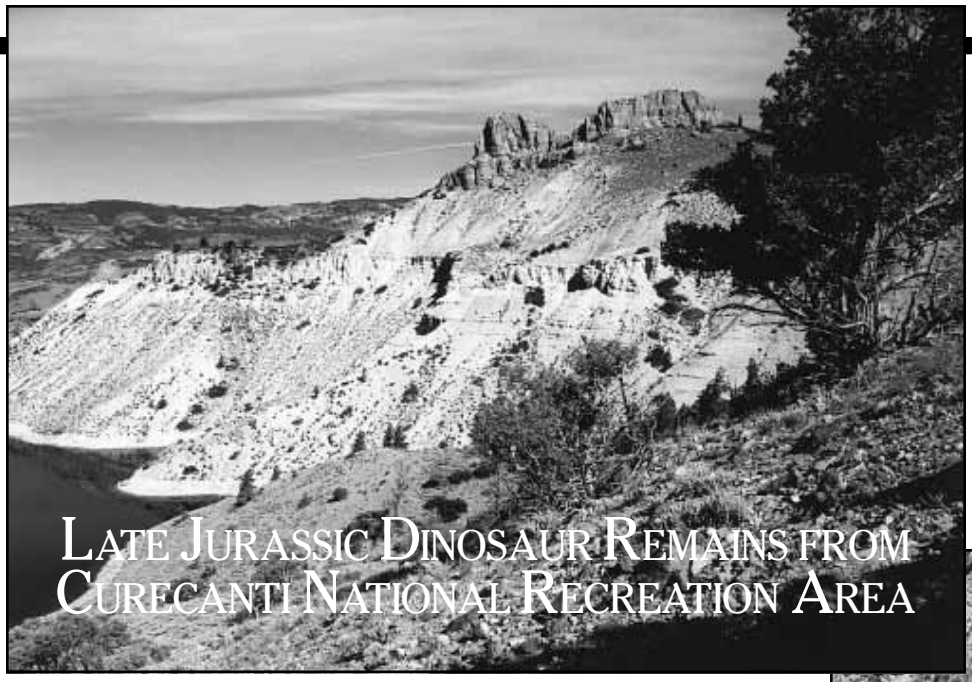
The ownership of specimens collected under authorized research and collecting permits is retained by the National Park Service, according to the Code of Federal Regulations. However, when *Taq* YT-1 was named as the source of DNA polymerase in the PCR patent by Cetus Inc., the inventor used our sample for commercial purposes without notification or permission. Since the National Park Service could be viewed as "resting on its laurels" during the patent application process, a case could be made that no proprietary interest exists. On the other hand, no one knew that *Taq*-based PCR would revolutionize the world of DNA science, and that the patent alone would be sold for $300 million. At present, neither the National Park Service nor the American public reaps any intellectual property benefit or royalty from this invaluable genetic resource.

During the conference I had a chance to visit with the president of the American Type Culture Collection. He is interested in working with the National Park Service in establishing an ATCC "Yellowstone Collection." Since there are currently 28 Yellowstone specimens already contained in the ATCC Catalog, 1992 edition, a section on Yellowstone thermophiles would give NPS managers some control over those existing and future deposits of rare thermophiles by including a blanket NPS policy on commercial use of publicly owned resources.

Yellowstone and other national parks are recognized as critical for preservation of biological diversity, for many purposes, including important utilitarian benefits. The potential and existing commercial use of products derived from resources collected from Yellowstone must be evaluated for its impacts, positive and negative, on park visitors and the public who share ownership in the national parks. If funding is ever generated by genetic resources, the money should be used to perpetuate conservation as demonstrated by the Costa Rican model, and not be depended upon for day to day operating expenses.

Income from biodiversity is used to preserve and protect conservation areas, substituting ecotourism and research for traditional slash and burn agricultural clear-cuts and grazing monocultures.

Bob Lindstrom is Management Assistant with the Yellowstone Center for Resources. His phone number is (307) 344-2234.



Late Jurassic Dinosaur Remains from Curecanti National Recreation Area

Figure 1. Morrison Formation exposures in the Dillon Pinnacles area of Curecanti National Recreation Area, Colorado.

Figure 2. Close-up of 3½ sauropod vertebrae, 1½ of which are partially covered by a plaster jacket. A deer lumbar vertebra is included for scale (arrow). The specimen was encased in a plaster and a burlap jacket to protect it during transport to the preparation lab. A thick layer of tissue paper was placed on the specimen before the plaster and burlap to prevent the plaster from adhering to the fossil bone.

By Anthony R. Fiorillo, Richard L. Harris, and Cathleen L. May

Curecanti National Recreation Area encompasses the eastern portion of the Black Canyon of the Gunnison, and shares a common boundary with the Black Canyon of the Gunnison National Monument. Both are located in west-central Colorado and are on the Gunnison River, a tributary to the Colorado River. Curecanti contains three dams that comprise the Wayne N. Aspinall Unit of the Upper Colorado River Storage Project. The largest reservoir created by the dams, Blue Mesa Reservoir, is also the largest body of water in Colorado and serves as a major recreational resource for anglers and water recreation enthusiasts.

Geologically, the park is recognized for exposures of rock that date to over 1.7 billion years in age, making them among the oldest in western North America. In addition to these well-recognized resources, the park also contains fossils that have significant scientific and educational value. The most important of these is in the Upper Jurassic Morrison Formation (approximately 150 million years old) in the park (figure 1).

The Morrison Formation of the western United States has produced the vast majority of the Jurassic dinosaurs from North America. However, most of these remains have been derived from only a few major localities (e.g., Dinosaur National Monument, northwestern Colorado, the historically important sites of Como Bluff in southeastern Wyoming and Cañon City in southern Colorado, and others). This important fossil unit, comprised largely of ancient stream, floodplain, and lake deposits, is found at the surface or in the subsurface from Montana to New Mexico and from Oklahoma to Utah. The youngest part of the Morrison Formation is the Brushy Basin Member, which is the source of most of the vertebrate remains from this formation. The age of this rock unit has traditionally been considered to be Late Jurassic. Historically, climatic interpretations for Morrison Formation deposition range from wet to dry and most specialists have suggested a strong seasonality during Morrison times. Given the large geographic extent of the Morrison Formation, many gaps still exist in understanding the distribution of dinosaurs from this interval of time.

A New Find

In the area surrounding the town of Gunnison, only one significant dinosaur find had been reported previously (Bartleson and Jensen, 1988). A new dinosaur locality was discovered in the Morrison Formation during recent paleontological fieldwork at both Curecanti and Black Canyon of the Gunnison. This site has already yielded the remains of two dinosaur taxa (groups).

The quarry discussed in this report is noteworthy for two reasons. First, this is only the second major dinosaur discovery site in the Morrison Formation between the historically important Cañon City area of the southern Front Range and the Uncompaghre uplift in western Colorado. Second, the discovery of this site in a park not previously recognized for its paleontological resources, emphasizes the point that important management issues may include resources not traditionally recognized within individual parks.

The quarry is at the edge of a lense-shaped, fine- to medium-grained sandstone that thickens to 1.5m (4.9 ft) and is at least 30m (98 ft) in lateral extent along the outcrop exposure. Sedimentary structures within this sandstone suggest a flood event with rapidly decreasing flow velocity.

As mentioned, the remains of two dinosaur taxa have been found at this quarry: an articulated partial sauropod[1] skeleton consisting of several vertebrae (figure 2), ribs, pelvic bones, a femur, fragmentary limb material, and isolated theropod[2] teeth. The sauropod has been referred to the genus *Apatosaurus* (Fiorillo and May, in press) and the initial theropod tooth assigned to the genus *Allosaurus* (Fiorillo and May, in press). Subsequent work has yielded additional teeth that are poorly preserved but are archosaurian, i.e., reptilian, in nature.

Isolated predatory dinosaur teeth are commonly found at sites where articulated or associated dinosaur skeletons also exist (Fiorillo, 1991). These occurrences are typically interpreted as the shed teeth of predators as the predators fed on the carcass.

Sediments Yield Clues

Sediment grain size is an estimator of flow velocity in stream deposits. A good deal of experimental work has been done to provide a means to estimate the relationship between sediments of a given size and the corresponding bones that would have been carried by those stream flows. A large disparity between sediment size and the fossil bone size probably indicates that the fossil bones were not transported to the site as part of the *bedload*[3] of the stream. At the Curecanti dinosaur site a large disparity exists between bone size and grain size; therefore, the bones at the site were not part of the bedload of the current. The articulated nature of the skeleton suggests that the sauropod was transported to the site as a bloated carcass. After being buried, this specimen was probably scavenged by at least one *Allosaurus* and a crocodilian.

When the site was discovered, the global scientific importance, and the regional educational potential, were immediately recognized. This site is located along the shores of the Blue Mesa Reservoir in the national recreation area. Previous destruction of bone material at the site was due to prolonged exposure to the weather and wave action during periods of high lake level. Excavation was deemed the only viable alternative for preserving this resource.

Excavation Ensues

A carefully coordinated excavation project involving the National Park Service, the Dallas Museum of Natural History, the United States Forest Service, and the Academy of Natural Sciences of Philadelphia is currently ongoing. The National Park Service has provided the logistical support and framework for the excavation while the Dallas Museum of Natural History and the Academy of Natural Sciences of Philadelphia have provided the technical expertise for the fine-scale excavation. The first large plaster jacket containing several sauropod vertebrae was removed during the summer of 1995, and subsequent jackets were removed during the summer of 1996. All of these jackets are currently being prepared for detailed study.

Detailed paleontological and sedimentological study of the Morrison Formation of Black Canyon of the Gunnison National Monument and Curecanti Recreation Area have yielded several additional insights into the changing ancient environment of this important rock unit. Results of the other components of this overall study of the Morrison Formation ecosystem will be presented after the data are analyzed.

This discovery in a park not previously recognized for its paleontological resources, emphasizes the point that important management issues may include resources not traditionally recognized within individual parks.

[1]Sauropod refers to quadrupedal, plant-eating saurischian dinosaurs, such as apatosaurus (brontosaurus-type), that have long necks and tails and small heads.

[2]Theropod refers to bipedal, carnivorous saurischian dinosaurs, such as allosaurus, that usually have small forelimbs.

[3]Bedload is that portion of alluvium in a stream that is transported along the streambed and not in suspension in the water column.

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PHOTO BY DON RIEPE

Figure 2. A question mark butterfly feeds on "bait," a mixture of beer, molasses, and rotting fruit. Baiting is used to inventory shy, woodland species.

a simple questionnaire and sent it to various federal and state parks and wildlife refuges, 463 areas in all. Circulation was subjective, but was based on natural area management relevance (i.e., national historic sites, monuments, etc., were generally omitted as were refuges concerned mostly with fisheries management). This is not to suggest that these areas have no interest in lepidoptera; to the contrary, many smaller parks with limited natural resources can be enhanced by considering butterflies and moths in landscaping designs. The public will also appreciate these enhancements.

A total of 260 parks and refuges responded for an overall 56% return rate. The breakdown is as follows: national parks–64% (80 returns from 122 parks); national wildlife refuges–58% (104 returns from 177 refuges); state parks–46% (76 returns from 164 state parks). The higher percentage of return from the national parks is possibly related to the questionnaire being generated from within the National Park Service. The lower return rate from state parks may relate to their mandate for a more active role in recreation or to fewer biologists (naturalists) on staff than federal agencies. Interestingly, however, 24 (30%) of the responding state parks had active management plans for encouraging or enhancing species of lepidoptera.

We asked whether the natural area had developed a checklist or conducted any inventory of lepidoptera, had exhibits or displays, conducted research or studies, had any threatened or endangered species, or actively managed habitats for any species of butterfly or moth. The response was generally positive: Eighty (30%) areas had (or were working on) an inventory or checklist of lepidoptera. Forty-seven (18%) actively managed parks to encourage, enhance, or restore lepidoptera. Twenty-two (8%) had federal or state threatened or endangered species. Forty-four (16%) had exhibits or displays highlighting lepidoptera and 84 (32%) had studies (past or ongoing) conducted in a park or refuge. Forty-seven (18%) respondents wrote comments on the back of the questionnaire stating an interest in or desire for more information about butterfly and moth species. Seventy-three (28%) sent enclosures with the questionnaire, which consisted of checklists, partial inventories, endangered species studies, and pest management plans.

> *One respondent stated, "It is encouraging . . . that you are considering . . . a group of wildlife species that has not been at the center of attention in the past."*

Discussion

While the response was generally positive, a significant percentage of federal and state parks and refuges appeared to know relatively little about the lepidoptera in their areas. Many parks were concerned about pest species such as gypsy moths; some managed passively for lepidoptera (i.e., as a by-product of prescribed burns, or restoring native prairie grasslands); other parks responded solely to endangered species management mandates for such species as the Karner blue, Schaus' swallowtail, Myrtle's silverspot, or regal fritillary to name a few. Two parks were concerned about illegal collecting. Eighteen areas (especially state parks) reported planting butterfly gardens. While 80 (30%) respondents reported having a checklist or inventory, many were considered partial, having been based on cursory surveys or small collections. Others reported that they were "thinking of doing it," had a survey "in progress," or "anticipate [doing] one."

While some parks had an interest in generating an inventory, they cited lack of funds to initiate one. Perhaps other groups (e.g., butterfly or bird clubs, Audubon Society chapters, The Nature Conservancy) would be able to assist with this undertaking. Donation boxes

Figure 3. A mowing plan that allows weedy edges to grow each year benefits lepidoptera. Purple gerardia is the host plant for the common buckeye butterfly.

Figure 4. Bumblebee moth (Haemorrhagia axillaris), *a diurnal species, routinely feeds at butterfly bush* (Buddleia).

Figure 5. Woodpiles provide winter habitat for the mourning cloak, questionmark, and several other species that overwinter in the adult life stage. Herptiles, small mammals, and other wildlife also benefit.

placed at visitor centers could bring in additional funds to support such programs.

The many local garden clubs may be willing to help defray expenses and provide volunteers to care for planted areas such as butterfly gardens or open field management zones. Also, state funds may be available, generated by income tax check-offs or special license plate fees set aside for nongame management programs. Volunteers may also be gleaned from contacting national groups such as the North American Butterfly Association, The Xerces Society, or The Lepidopterists' Society.

At Gateway National Recreation Area, volunteers from the New York City Butterfly Club have spent many hours in the field over a 10-year period and provided us with a complete inventory of butterflies (70 species) along with a fair representation of moths (227 species). Moths constitute a much more diverse and difficult-to-identify group, usually outnumbering butterfly species ten times. By this formula we have probably identified less than half the number of species present.

Inventorying Lepidoptera

Maintaining open fields or planting patches of milkweeds and other wildflowers will concentrate lepidoptera and reduce the need to go far afield to survey them. Shy, woodland species can be attracted to bait by smearing rotting fruit on bark (figure 2). This works especially well for many species of moths. We use a fancy mixture of fruit, molasses, and stale beer, but an old banana will suffice (why waste beer?). As many species of butterflies are attracted to specific larval host plants, knowledge of these plants should afford a clue to the presence or absence of species. Since many butterfly species are short-lived as adults (2-3 weeks), knowledge of their emergence is paramount, too, as you may have only a brief window of opportunity to see flying individuals. While monarchs, question marks, red admirals and others migrate southward in August and September (especially along coastal beaches), other species such as painted ladies, cloudless sulphurs, and variegated fritillaries are still emigrating northward. This flux of movements provides the opportunity to find additional species in parks during all seasons except winter (in the north).

As for the question relating to past or ongoing studies, 84 parks (32%) responded favorably, although many were in planning, proposal, or "hope to" stages. Some were part of regional or

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Butterflies continued from page 17

state surveys while others were related to tagging or counting monarchs during migration.

Of Money and Moths

In a time of declining budgets, management strategies for butterflies and other insects can be relatively cost effective. Some parks spend many hours maintaining acres of lawn. By allowing some areas to grow into "butterfly gardens" (i.e., fields of wildflowers), managers can save money by mowing once or twice yearly instead of every 2-3 weeks during the growing season. Unmowed areas could be edged (mowed a few feet just off roadways) or sculpted into patterns to give them a "managed" or aesthetic look (figure 3). Mowed trails within these fields would provide easy access for visitors and interpretive programs. Landscaping around buildings with flowering plants will enhance aesthetic appeal while providing a nectar source for butterflies and hummingbirds. We have found the best attractant to be butterfly bush *(Buddleia davidi)* (figure 4). However, it is an exotic and you may want to stick with native species. Many butterfly gardening books are currently available for helping with selections (see references at end).

At Gateway, we have been actively enhancing habitat for lepidoptera for the past 10 years. In many cases it has been as simple as not mowing, mowing less frequently, creatively mowing to leave more weedy edges or patches, planting a few host plant species such as hackberry *(Celtis* spp.) or willows (*Salix* spp.), providing overwintering cover (log piles [figure 5, previous page]) and planting native wildflowers and shrubs as nectar sources. If possible, plantings should be chosen to bloom at various times during the growing season and provide food for larvae. Some knowledge of lepidopteran species present will help guide you in plant selections.

In our experience, managing for lepidoptera has proven to be enjoyable and rewarding for staff, volunteers, and visitors. We hope that this simple questionnaire has spurred some interest in other parks and that we can form a network of communication regarding management concerns and ideas.

Butterflies and moths are ideal subjects for interpretive programs and resource management and landscaping plans.

Obtaining Further Information

If you would like a copy of the questionnaire, a list of references, a butterfly brochure entitled "Butterflies of Jamaica Bay" or have any general questions write: Don Riepe, Gateway National Recreation Area-Wildlife Refuge; Floyd Bennett Field; Brooklyn, NY 11234. By E-mail contact barbara_toborg@nps.gov. For information about butterfly groups and July 4th censuses in your area contact the North American Butterfly Association; 4 Delaware Road; Morristown, NJ 07960; (201) 285-0907. On the Internet you can join a lepidoptera discussion group by sending an e-mail message addressed to: LISTSERV@YALEVM.CIS.YALE.EDU. The message should read: SUBSCRIBE LEPS-L [your name, not in brackets]. You can also access LEPS-L as a newsgroup through sci.bio.entomology.lepidoptera.

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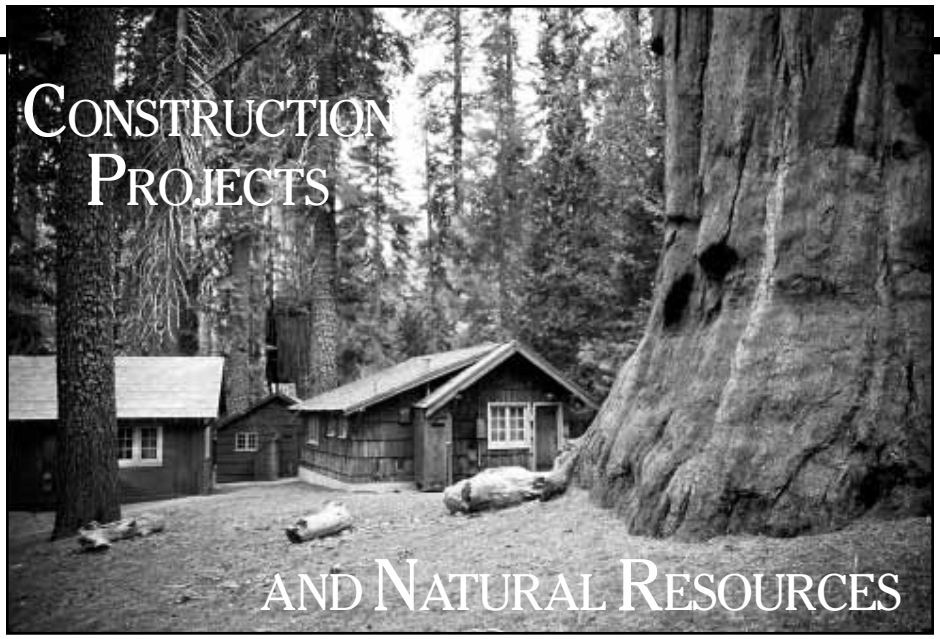

Figure 1. Built amid the Giant Forest in Sequoia National Park, cabins and park housing promote soil compaction, a threat to the behemoths, and must be removed. A new process to award NPS construction funds recognized this project as the highest priority in the national park system. Costing more than $100 million dollars, work of this magnitude will not be entertained in the future unless specifically directed by Congress. However, the evaluation process now considers the benefits of all construction projects to natural resources and targets more affordable proposals as detailed in the following pages.

Natural resources may benefit from new construction evaluation process

By Abby Miller

A NEW LOOK FOR THE NPS line-item construction program suggests that natural resource managers should pay more attention to construction projects as resource management solutions. The NPS line-item construction program (see sidebar on page 21) was reengineered in 1995 and 1996, in part in response to congressional expressions of concern, including cost overruns and a finding that "the priority system is undecipherable." The NPS National Leadership Council (NLC) approved the *Servicewide Development Strategy: The Next Decade* to establish direction for the program, including objectives that every dollar spent on a construction project adds value to the park and the national park system and that every project contributes to resource protection, high quality visitor experience, or improved park operations, including operating in a sustainable and environmentally responsible manner.

In July, the results of reengineering the priority-setting process were implemented for the first time. In the past, the National Park Service relied on the collective wisdom of its senior managers in an informal process to set construction priorities. The new system uses a formal process and a project assessment team to rate and rank projects for review by the development advisory board, a new NLC committee, which in turn develops a priority list for full NLC approval. The assessment team has representatives from each field area, including park, system support office, and field office-level personnel, and representatives of the associate directors for cultural resource stewardship and partnerships, natural resource stewardship and science (the author), administration, and operations. The process was coordinated by Roger Brown, special assistant to the associate director for professional services.

Based on the recommendations of a departmental task force, Associate Director for Professional Services Denis Galvin selected a decision-making system called "choosing by advantages" or CBA, which was developed by a former U.S. Forest Service employee. The objective of the process is to focus on the importance of individual contributions, or specific advantages, of each project, rather than the importance of broad, abstract categories–for example, visitor services are "more important" than resource protection. Paraphrasing an example used in training, CBA focuses on whether a specific difference in weight is more or less important than a specific difference in stability in choosing between two canoes as opposed to whether weight or stability in the abstract is the most important decision factor. To use differences among actual projects requires rating scales to be developed based on the projects at hand (i.e., for each priority-setting effort), rather than generically.

> *The definition of what constitutes a "construction" project is broader than many believe; it could be a natural resource rehabilitation project.*

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Figure 2. Open to the elements and subject to vandalism, this fossilized sequoia tree stump at Florissant Fossil Beds National Monument, Colorado, will be protected in the future through construction of a shelter structure.

Rating Factors Determined

The assessment team met in February 1996 to develop factors to reflect the direction of the development strategy. We first chose four broad objectives–resource protection, visitor services, operations, and "other." The "other" category allowed parks to articulate the advantages of projects that were not captured elsewhere. Each objective has one or more factors–threat elimination, treatment, and support under resource protection; visitor experience and visitor safety under visitor services, etc. The project call, issued last year in April, required information related to these factors, in addition to the 10-238 forms traditionally used for construction projects. Examples of information related to the factors include resource significance as denoted by designations (such as biosphere reserve, world heritage site, and listed threatened or endangered species) and site visitation.

Projects Reviewed

In July, the assessment team met for 6 days to review the projects. After evaluating the greatest benefit (most important advantage, in CBA parlance) provided by any project under each factor, the team judged "eliminating threats" (one of the factors) to the Giant Forest at Sequoia-Kings Canyon National Park by removing facilities from the grove (figure 1, page 19) as the single most important advantage of any project within any of the factors. As a result, this advantage or benefit became the benchmark to create a scoring scale to apply to the advantages of all projects within all of the factors. The Sequoia project received 1,000 points for its advantages in threats elimination and all other advantages were compared to that one and scored.

Although the Sequoia undertaking demonstrates that natural resource projects can be judged highly beneficial under the new system, project submissions with natural resource protection objectives or spin-off benefits were limited in number. This was not true for cultural resource projects since so many cultural resources are facilities themselves and construction projects are integral to their protection.

Water Resources Connection

Most of the projects with benefits to natural resources were projects to reduce or eliminate water pollution. Sewage treatment projects were the most common, although less so than in the last priority-setting process. Upgrades of such plants at Yellowstone and Glacier Bay that eliminated discharges to sensitive waters, and had good information about the discharges and the threats they pose, scored relatively high in the "eliminate threats" factor. Projects to remove septic systems that were leaking near wetlands or significant or sensitive water resources at Cape Cod and Acadia also scored well. Two highly scored projects at Mammoth Cave and Wind Cave dealt with preventing polluted waters from entering cave systems.

Figure 3. Trails within Great Smoky Mountains National Park are degrading. Not only is visitor safety a concern, but soil is eroding into streams, threatening aquatic life, and vegetation is being trampled. The new construction evaluation process considered these multiple impacts and funded the project, which will repair, rebuild, realign, or relocate 400 miles of trail.

> *Good, objective data are necessary for a natural resource rehabilitation project to score well.*

Other project advantages that received points for resource treatment or threat elimination included new or redesigned visitor facilities described as necessary to control impacts to natural resources (figures 2 and 3). Although some natural resource benefits were ascribed to many visitor facilities, those that were judged

to have the most significant resource-related advantages were those described as designed specifically to address a threat to natural resources, particularly camping, waste discharge, and erosion next to water resources. An example is a campground and parking facility designed to prevent indiscriminate and unlimited vehicular camping on beaches at Glen Canyon. Other visitor-related projects receiving high points for spin-off benefits to resources were the replacement of inadequate comfort facilities and the establishment of trails at two Hawaiian parks where "searching for relief" and social trails result in trampling of habitat for endangered plants and bird nesting sites.

Of interest in the "other" category is the advantage of evaluating a project with no direct resource protection value of its own, but that has a bearing on subsequent projects with high resource protection values. In Grand Canyon, a visitor center needed to be relocated first before a new transportation system–that would itself reduce air emissions–could become operational. The desired final outcome necessitated the first project and was judged important in sending a signal to our partners in air clean-up efforts that we are willing to do our part.

Overall Benefits Important

The CBA process requires that projects be ranked not only in order of their individual benefits or advantages, but also in order of their advantages per dollar, i.e., advantage/cost ratio (Note: This is similar to a "cost/benefit" ratio with the important difference that benefits, or advantages, are *not* expressed in dollars). The objective is to get the most value for the national park system from the dollars available to the line-item construction program. For example, the top project could have an "advantage" of 2,000 points worth of benefits (as determined in the scale-making and assigning process previously described) for 2 million dollars, but the same 2 million dollars could buy 4,000 points of benefits by funding several smaller projects. Then decision-makers (the development advisory board and the National Leadership Council) must decide whether several smaller projects further down the benefits list are collectively a better investment for the park system than the single, top-ranked project.

The NLC decided to begin the transition to use of the advantage/cost ratio by using it within three categories of construction projects based on their cost–under $3 million, $3 to $8 million, and $8 to $20 million–to identify priority projects for the fiscal year 1999 program. One-third of the funds allocated to the line-item construction program for that year will be used for projects in each category. This approach will allow a few large-cost projects to be initiated or continued while funding many more medium- and small-cost projects. A new call will be issued late this calendar year to develop priorities for fiscal year 2000 using the CBA-based process with the expectation that the advantage/cost ratio will be more closely followed than it was for fiscal year 1999. Given this increased attention to advantages produced per dollar

Continued on page 30

What is Line-item Construction Funding?

By Patty Neubacher

Line-item construction funding is a specific appropriation within the NPS budget that supports major development activities for units of the national park system, including new construction and repair or rehabilitation of existing infrastructure. A "line-item program" means that there is a line item in the budget justification for each construction project requested. Funds appropriated for a specific line-item project must be spent exclusively on that project.

Line-item funds are *no-year* funds, available until expended. The need for no-year funds essentially defines the type of work the construction appropriation represents–i.e., the work is of a size and complexity that requires a number of years to complete, making the use of annually expiring funds impractical. The work is characterized by long-term planning followed by construction that could extend over several fiscal years.

How are funds requested?

Funds for line-item construction projects are requested using a standard NPS form 10-238 and any supporting documentation. The form is used to describe the project and provide a justification and cost estimate for the proposed work. Many parks and field areas are now using an electronic database version of the 10-238 program to develop and store information on all unfunded project needs.

The budget formulation process for a line-item construction project is a *bottom-up* process. That is, parks start the process by originating the 10-238 documents. They develop 10-238s primarily using planning documents as a guide. All requests must be in conformance with policy and planning documents, including general management plans, statements for management, development concept plans, interpretive prospectuses, and servicewide guidelines and directives.

How are priorities established?

Once the 10-238 has been approved by the park superintendent, a park priority number is assigned. The document is forwarded to the field director for review, approval, and assignment of a field area priority number.

Field directors typically assign priorities with the assistance of a priority committee. Membership on a priority committee varies by field area but is characteristically organized with park, cluster, field office, and technical representatives. Once field area priorities are established, the projects are submitted, via the Associate Director, Professional Services, to the project assessment team for ranking.

Patty Neubacher is the Assistant Field Director, Administration, Pacific-West Field Area.

Assessing the Condition of Riparian-Wetland Areas

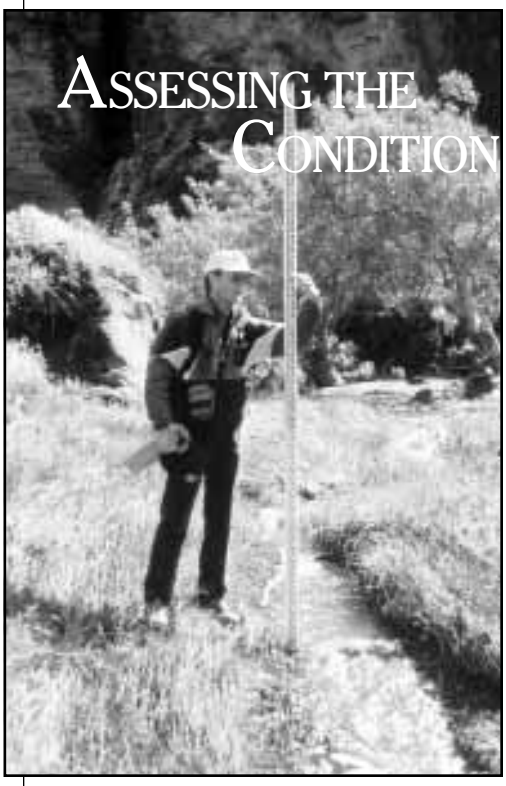

Figure 1. Cañada Lobos (Channel Islands National Park, California), located within a cattle exclosure, is a properly functioning wetland. The area features diverse and vigorous plant life that protects the stream banks from erosion and improves water quality.

By Gary Rosenlieb, Joel Wagner, and Bill Jackson

THE MANY BENEFITS OF maintaining healthy riparian-wetland systems have been well documented in the natural resources literature. Healthy riparian systems improve water quality primarily by decreasing sediment transport, rebuilding and replenishing floodplains, reducing streambank erosion, retaining soil moisture, and supporting the development of diverse flora and fauna communities. Riparian areas are also magnets for many competing uses that can conflict with resource protection. Domestic livestock congregate in riparian-wetland areas for forage, water, and shade; streams are dammed or diverted for various uses; and visitors utilize riparian areas for fishing, hiking, boating, and other recreational pursuits.

In order to properly manage these important resources, park managers must be able to assess riparian-wetland conditions and take steps to resolve any problems. All too often, however, when asked to assess the condition or overall health of our riparian areas, we natural resource managers are at a loss to respond with much more than, "they look OK to me," or, "they look terrible," without a strong rationale for either conclusion. Given our critical role in the conservation of soil, water, vegetation, and wildlife resources, it is essential that we have proper tools to evaluate the health of the riparian systems under our stewardship, especially when multiple competing uses are present.

The Process

A riparian-wetland assessment tool developed recently by the Bureau of Land Management (BLM) was used by the Water Resources Division staff of the Natural Resource Program Center in 1995 to evaluate riparian conditions in two national parks. This method, called the "Process for Assessing Proper Functioning Condition," is keyed to an interdisciplinary team assessment of riparian area "functionality" rather than a costly, intensive data collection effort. The goal is rapid assessment, which can be applied over large areas relatively quickly. It may be used as a "triage method" that can help separate areas that are functioning well from those in need of more intensive evaluation and management.

The *functioning condition* of a riparian area refers to the stability of the physical system, which in turn is dictated by the interaction of geology, soil, water, and vegetation. A healthy or stable riparian-wetland area is in dynamic equilibrium with its streamflow forces and channel processes. In a healthy system, the channel adjusts in slope and form to handle larger runoff events with limited perturbation of the channel and associated riparian-wetland plant communities.

Important to note is that evaluation of functional condition is not simply an assessment of the ecological status or seral stage of the vegetation community. Rather, evaluation is based upon the concept that in order to manage for such things as potential natural vegetative communities, the basic elements of physical habitat must first be in place and functioning properly. For example, a system recovering from a recent fire can be in an early successional stage but it may still be in properly functioning condition.

Based on assessments of hydrologic, vegetative, and erosional elements (see the checklist in table 1) of the riparian area, the method assigns one of the following functionality ratings to a riparian-wetland area:

Proper Functioning Condition

Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris are present to: (1) dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality; (2) filter sediment, capture bedload (see the definition for *bedload* at the bottom of the middle column on page 10), and aid floodplain development; (3) improve floodwater retention and groundwater recharge; (4) develop root masses that stabilize stream banks against cutting action; (5) develop diverse ponding and channel characteristics to provide habitat and the water depths, durations temperature regimes, and substrates necessary for fish production, waterfowl breeding, and other uses; and (6) support greater biodiversity. Similar factors are assessed when evaluating *lentic* (standing water) wetland areas as explained in USDI-Bureau of Land Management (1994).

Functional-At Risk

These riparian-wetland areas are in functional condition, but an existing soil, water, or vegetation attribute makes them susceptible to degradation. For example, a stream reach whose upper watershed is being overgrazed may have the attributes of a properly functioning system, but it may be poised to suffer severe erosion in a future large storm due to artificially increased runoff upstream.

Nonfunctional

Riparian-wetland areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, etc., as already described, are nonfunctional. The absence of certain physical attributes such as a floodplain where one should exist are indicators of nonfunctioning conditions.

Riparian Functionality in the National Parks

In 1995, staff from the Water Resources Division, in cooperation with the BLM and staffs of Channel Islands National Park, California, and Great Basin National Park, Nevada, used the process for assessing proper functioning condition to evaluate the functionality of riparian areas on Santa Rosa Island in Channel Islands and the Lehman, Snake, and Baker Creek drainages in Great Basin. These parks provided an ideal testing ground for the assessment process in that they represent differing physiographic and climatic provinces (Southern California coastal zone at Santa Rosa Island vs. the montaine basin-range province at Great Basin). In addition, both parks are grazed by domestic cattle. Santa Rosa Island is subject to continuous year-long grazing, while a seasonal rest-rotation grazing system is employed at Great Basin. Riparian functionality in both parks was assessed by an interdisciplinary team consisting of a hydrologist-geomorphologist, botanist, water quality specialist, wetland scientist, and a range management specialist. Examples of "properly functioning condition," "functional-at risk," and "nonfunctional" riparian areas in these parks follow.

Table 1. Hydrologic, vegetative, and erosional attributes that are evaluated for riparian-wetland functionality

Hydrologic

- Floodplain inundated in "relatively frequent" events (1-3 years)
- Active-stable beaver dams
- Sinuosity, width-depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
- Riparian zone is widening
- Upland watershed not contributing to riparian degradation

Vegetative

- Diverse age structure of vegetation
- Diverse composition of vegetation
- Species present indicate maintenance of riparian soil moisture characteristics
- Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events
- Riparian plants exhibit high vigor
- Adequate vegetative cover present to protect banks and dissipate energy during high flows
- Plant communities in the riparian area are an adequate source of coarse and large woody debris

Erosion Deposition

- Floodplain and channel characteristics (i.e., rocks, coarse and large woody debris) adequate to dissipate energy
- Point bars are revegetating
- Lateral stream movement is associated with natural sinuosity
- System is vertically stable
- Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Santa Rosa Island-Cañada Lobos (Wolf Canyon)

Diagnosis—Properly Functioning Condition

Cañada Lobos (figure 1), located within a cattle exclosure, represents a riparian-wetland area that was rated to be in "proper functioning condition" by the interdisciplinary team. The riparian area contains a diverse and vigorous herbaceous and woody vegetative community that protects the banks by dissipating stream energy associated with flood flows, thereby reducing erosion and improving water quality. The herbaceous plant community, consisting primarily of Mexican rush and saltgrass, has developed root masses that have stabilized the stream vertically and horizontally, filtered sediment, and captured and retained bedloads that aid floodplain development. The process has created diverse channel characteristics and promotes greater biodiversity.

Santa Rosa Island—Windmill Canyon

Diagnosis—Functional-At Risk

This segment of Windmill Canyon (figure 2, page 24) is grazed by horses but not cattle. The establishment of willow provides the capability to dissipate some stream energies and trap sediment that aids in floodplain development and improves floodwater retention. However, in spite of the presence of some attributes of functionality, this segment was rated as "functional-at risk" because certain vegetative and hydrologic attributes make it susceptible to degradation. For example, herbaceous bank cover is completely lacking, thus making the bank more susceptible to erosion and lateral cutting. The trans-

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port of large quantities of bed and suspended sediment loads to the segment from unprotected upper watersheds also prevents this stream segment from obtaining full proper functionality.

Figure 2. Windmill Canyon (Channel Islands) is a functional-at risk stream. Vegetative bank cover is lacking, but the presence of willows allows for some ability to dissipate stream energies.

Santa Rosa Island—Old Ranch Canyon

Diagnosis—Nonfunctional

Old Ranch Canyon (figure 3), subject to continuous year-long cattle grazing, is a "nonfunctional" riparian-wetland area. Neither adequate vegetation nor appropriate landform is present to dissipate stream energies associated with high flows. During floods, the stream channel migrates, erosion continues, sediment is not filtered, water quality is altered, and floodwater retention and groundwater recharge are limited. The channel is not providing ponding or channel characteristics that provide habitat conditions necessary for enhancing biodiversity.

Great Basin National Park—Lower Snake Creek

Diagnosis—Functional-At Risk

Karst geology, hydrology, and diversion by humans are important features that dictate the "functional-at risk" rating for this riparian reach. Prior to diversion, upper Snake Creek lost almost all of its flow to the karstic aquifer that underlies downstream portions of the creek. In order to "harvest" additional water from the drainage, local irrigators constructed a pipeline to divert water from upper Snake Creek, bypass the karst area, and then release it to lower Snake Creek for transport to their land. The diversion has most likely impacted the lower reach by increasing flood flows in a channel that had evolved in response to smaller flows. Figure 4 shows one of several headcuts observed in lower Snake Creek that, though temporarily stabilized by woody debris, could continue cutting in response to large flows. The headcuts are lowering the base level of the channel by 2-3 feet in some areas. As a result, woody and herbaceous riparian-wetland vegetation in these segments are in a downward trend.

Figure 3. Old Ranch Canyon (Channel Islands) is a nonfunctional riparian-wetland area. It has neither adequate vegetation nor appropriate landform to dissipate stream energies.

Figure 4. Lower Snake Creek (Great Basin) is a functional-at risk stream. Woody debris has temporarily stabilized the stream, but erosion is still possible during large flows.

Conclusions

The process for assessing proper functioning condition is an assessment tool that can be used to rapidly evaluate and categorize the functional condition of riparian-wetland areas. When applied by an experienced interdisciplinary team, riparian areas that are in danger of losing functionality can be identified and management prescriptions can be developed and applied. While the assessment process is a valuable tool in the hands of an experienced interdisciplinary team, it may not be suitable for all riparian areas. This is a qualitative process that has been developed from more strenuous quantitative monitoring procedures that are documented in the BLM Ecological Site Inventory (ESI) methodology. In some cases, the more expensive and time consuming ESI procedure must be used to determine riparian functionality.

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Gary Rosenlieb, Joel Wagner, and Bill Jackson are Hydrologists with the Natural Resource Program Center Water Resources Division in Fort Collins, Colorado. Inquiries can be made to Joel Wagner in the Lakewood, Colorado, office at (303) 969-2955.

PHOTOGRAPH BY TOM YARRISH

Figure 1. Named for the site of its origin, Mt. Vision, the Vision Wildfire was the largest in Point Reyes National Seashore in the last 60 years. The use of GIS (geographic information systems), however, aided both the fire suppression and natural resource rehabilitation efforts.

INTERACTIVE APPLICATION OF GIS DURING THE VISION WILDFIRE AT POINT REYES NATIONAL SEASHORE

BY SARAH G. ALLEN, DAVID KEHRLEIN, DAVID SHREVE, AND RICHARD KRAUSE

THE MOST DEVASTATING wildfire to burn in Point Reyes National Seashore, California, in over 60 years spread rapidly through the park in the fall of 1995 (figure 1). Over 12 days, the fire burned more than 12,000 acres and destroyed 45 homes on state, federal, and private lands. At the height of the fire suppression campaign, 2,164 personnel, including 74 hand crews, 27 bulldozers, 7 air tankers, 7 helicopters, and 196 fire engines, were involved. Named the Vision Fire after the site where the fire was ignited in an illegal campground (Mt. Vision), the lessons learned from this incident also provided tremendous insights into fire management.

One lesson learned was the usefulness of geographic information systems (GIS) and global positioning systems (GPS) in the fire suppression and rehabilitation efforts. This is the story of how a team of GIS specialists and resource managers applied GIS during a wildfire in a wildland-urban interface, and what we recommend to better prepare for the use of GIS in such an emergency.

BAER TEAM ASSESSES IMPACTS

Shortly after the fire began, the Point Reyes Superintendent called in the Burn Area Rehabilitation Team (BAER team), a multiagency group with expertise in plants, animals, soils, water resources, cultural resources, structures, and roads and trails. (See the Highlights story on the BAER team in *Park Science* **16(1)**:6). Their primary task was to document both the fire effects and fire suppression impacts on park resources. Within 2 weeks, with the aid of GIS, this team was able to make a comprehensive assessment and recommend actions to the National Park Service for short- and long-term restoration and rehabilitation.

Plant communities within the fire area are diverse and include marshland, coastal prairie, coastal grasslands, riparian, coastal dune, northern coastal scrub, bishop pine forest, and Douglas-fir forest. Each community has associated species that are unique to California and the world. Within the burn perimeter, many species of plants (23), mammals (8), birds (24), insects (8), amphibians (4), reptiles (2) and fish (4) are sensitive or endemic to the park. Several species have special recognition under the U.S. Endangered Species Act and the California Endangered Species Act.

Figure 2. The BAER team noted the variability of blaze intensities. Where it was hottest, the fire will retard vegetation recovery and promote erosion, two processes that the park will monitor.

The assessment noted extraordinary changes in the physical, chemical, and biological status of park resources. A number of plant communities and associations burned at very high to severe intensities (figure 2), influencing recovery of the ecosystems. These included Bishop pine forests, coastal scrub, northern coastal prairie, and some Douglas-fir forests. Many of these communities occur on steep slopes exceeding 54 degrees. Soil associations within the burn are highly prone to erosion and repel water following moderate to intense fire. Erosion potential is also very high due to locally high rainfall (14 inches per month).

Fire suppression actions associated with containing and controlling the Vision Fire relied heavily upon direct and indirect

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mechanized bulldozer fire line construction. Bulldozer line construction totaling 23 miles occurred primarily within the wilderness; much of it occurred in the upper reaches of watersheds with impacts to existing trails with direct line construction on extremely steep and unstable slopes. In some areas, the fire lines traversed locations of known noxious weeds and increased the potential for spread of these species. Down slope are numerous watersheds, riparian areas, wetlands and estuaries.

Both the fire and suppression activities exposed many cultural resources; both Native American midden sites and historical ranch dump sites dating back to the turn of the century were uncovered. In addition to the 45 structures destroyed by the fire, tens of telephone poles were damaged and an estimated 2,000 hazardous trees posed a risk to park visitors along roads and trails.

As part of the fire recovery effort, the park initiated several studies to evaluate fire and fire suppression effects on the ecological integrity of communities within and adjacent to the burn area. GIS-GPS will help to monitor treatments and affected resources to determine the efficacy of measures taken to mitigate suppression and rehabilitation actions.

GIS Support Arrives

During and immediately following the fire, the park used GIS and GPS to map and monitor the daily and hourly spread of the fire (figures 3 and 4), measure fire suppression actions, assess damage to natural resources, and evaluate damage to adjacent homes in the wildland-urban interface. Technicians created numerous GIS-GPS data layers, including those for fire intensity, bulldozer line locations, and fire perimeter over time. These data layers were integrated in a form that enabled the park to measure, monitor, and map several data themes simultaneously, providing a more comprehensive understanding of the effects of the fire.

These tasks were possible only through the efforts of many personnel and the generous support of state and federal agencies, private organizations, and vendors. Point Reyes National Seashore, like many parks, had a fledgling GIS program with some equipment and was in the process of upgrading and moving its GIS resources to new quarters when the fire occurred. Fortunately, within 12 hours of ignition, the California Office of Emergency Services dispatched a strike team of GIS specialists to aid in the fire analysis. This self-contained team included four GIS specialists and computer hardware and software capable of assessing the spread of the fire. Upon this foundation, a fully operational GIS lab was in place within 2 days of fire ignition.

The GIS lab extended to three offices, and cables snaked through hallways networking computer hardware between GIS platforms. At the height of the operation, hardware consisted of two Sun Microsystems UNIX-based workstations (with Arc/Info and ArcView software), two DOS-based personal computers (one with PC ARC/INFO and the other with MapInfo), two laptop computers, two Hewlett-Packard HP650C DesignJet printers, a digitizer, and various smaller printers. During the fire, the GIS team consumed five rolls of plotter paper, four color cartridges, several reams of paper and tens of diskettes.

Numerous people with computer systems administration skills, including GIS and GPS experience, rotated through the GIS lab, which helped keep the operation running smoothly, 24 hours a day. Individuals came from the National Park Service (field area office and Golden Gate National Recreation Area); the University of California, Berkeley; the California State Lands Commission; and the Burn Area Emergency Rehabilitation (BAER) team. Additionally, one person acted as liaison between the GIS lab and the outside world, helping to interpret the needs of the "customers" and what the lab could produce. The language of users and producers often necessitated translation because many disciplines (e.g., geology, hydrology, ecology, computer science) were combined into the GIS.

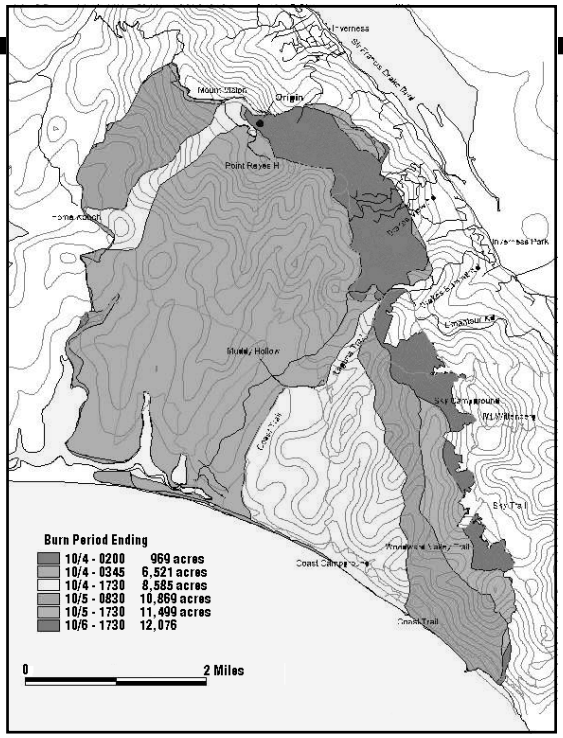

Figure 3. Through the use of GIS, staff were able to produce detailed fire perimeter maps that not only aided fire suppression efforts, but also documented resource damage for follow-up rehabilitation.

GIS Products

Map "users" ultimately defined the products we generated; however, the demand for and the sophistication of products evolved over time as users perceived the value and capability of the GIS output. Users included decision makers from all disciplines, fire fighters, public information officers, the BAER team, researchers from universities, and the general public.

Initially, the most critical information required from the GIS lab was the fire perimeter. Twice per day, a helicopter equipped with a GPS unit flew the fire perimeter, and a map was promptly produced for the fire fighters. Another critical data layer was the location and condition of structures destroyed by the fire. The California Department of Forestry, Marin County Fire Department, and NPS personnel surveyed homes in the burn area with various GPS unit models (Trimble Navigation, Light ProXL, and Basic Plus) and collected data on the condition and location of structures. Within 4 days of fire ignition, and while the fire was still burning, these data were converted to a GIS data layer and overlaid with a county parcel map to identify the owners of the structures.

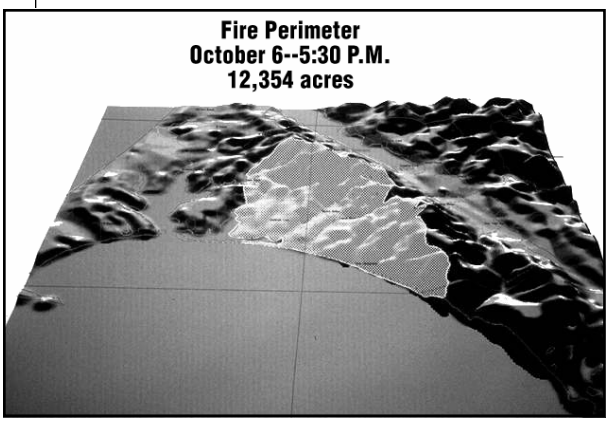

Figure 4. The GIS team produced a multivariable, simulated, 3-dimenional map, which indicated that topography is important in defining high intensity burn areas. The hottest zones occurred along ridges where winds were highest.

Data were also gathered using GPS on location of hand and bulldozer fire lines, roads, trails, fire suppression effects, noxious weeds, vegetation plots, photo points, and survey points. GIS was then used for mapping, measuring, and monitoring post-fire analysis of burn effects and rehabilitation prescriptions. Examples of preliminary products generated include generalized location and identification of high to moderate burn intensity zones, of fire suppression measures, of cultural resources in relation to bulldozer lines, and of threatened and endangered species in relation to fire suppression actions. As users perceived the ability of GIS to measure and calculate information, they requested reports on acreages, linear distances, and other parameters.

Several data layers already existed in the park GIS, including soils, digital line graphs (DLGs), digital elevation models (DEMs), and a few U.S. Geological Survey digital orthophoto quads (maps produced from aerial photographs that are corrected for parallax and referenced to control points on the ground); however, a crucial missing data layer was a digital vegetation map. A recent Landsat Thematic Mapper (TM) image was available but it was not ground-truthed and could only be used for general reference. Instead, we created a vegetation map using the USDA Natural Resources Conservation Service digital soils map and correlating the information with the associated vegetation types. This proved surprisingly useful for some of the analyses with some adjustment based on spot checking with aerial photos.

As time allowed, we also added more precise and inclusive information to the existing GIS databases. Examples include measuring more precisely the extent and location of potential soil erosion sites, monitoring the spread of noxious weeds and the recovery of vegetation communities, and locating roads and trails with greater accuracy (the USGS DLGs were inaccurate). These data were crucial in assessing fire effects and guiding rehabilitation and mitigation prescriptions.

To speed up production of maps and to assure conformity in style, we brought in specially tailored, preexisting programs (AML–the programming language for Arc/Info) and developed new ones. At one point, we plotted a California Department of Fish and Game Heritage Program species list of concern from the State Lands Commission in Sacramento via the Internet on a plotter at Point Reyes.

Making Improvements

The fire teams faced several challenges when using GIS that cost precious time. With just a little preplanning, many of these issues could be eliminated. For example, GIS support was not formally linked to the incident command structure; consequently, the GIS team responded to many nonprioritized requests. A simple solution would be to place the GIS function in the incident command structure. Products should be prioritized with those that support fire operations being highest priority.

Many problems specific to GIS occurred. Differences in map projections and data scales created incompatibilities. Data were often incomplete and sometimes out of date or of poor quality, and file naming conventions and data categories needed to be standardized. Unfortunately, we lost the opportunity to track the fire history because maps drawn by firefighters were lost as the GIS lab was gearing up. Improvements would include adopting a map projection standard and maintaining the software to convert nonstandard projections. A metadata form might also be developed and maintained during the fire to aid in standardized data input. The simple act of providing a bin for early map storage might prevent future map losses. One set of hard copy maps should also be kept in a secure place. We could have devoted more time to the GIS products themselves if we had prepackaged GPS data dictionaries for field data collection. Likewise, prepackaging software that would facilitate GIS products to be made from maps of several sizes would have helped. Furthermore, this software needs to transfer easily across computer platforms.

Not only was translation between platforms poor, but hard disc space was also inadequate. Permission to access files on the UNIX workstations also caused trouble. An experienced system administrator was always needed but not always present. Despite lacking the space for bulky computer systems, digitizers, and plotters, we still could have used more computers. We had no method to track computer system performance problems for follow up. A virus, brought in a laptop computer, plagued systems for a couple of days before being identified and removed. Scanning for viruses as new equipment is brought in would be a good idea as is providing a log book to document computer problems. Establishing solid vendor contacts would also help so that problem solving can occur swiftly when a computer disaster occurs. Maintaining a list of computer trained contacts could help address problems that occur in the

The park used GIS and GPS to map and monitor the spread of the fire, measure fire suppression actions, assess damage to natural resources, and evaluate damage to homes.

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Lincoln Boyhood National Memorial Reforests

Figure 1. The Drackett grant provided funds for the reforestation project, which began in December 1992 with 100 trees.

By Don F. Adams

IN SEPTEMBER 1992, LINCOLN Boyhood National Memorial, Indiana, received a $40,000 grant through the National Park Foundation from the Drackett Company (manufacturers of O'Cedar, Drano, Vanish products) to reforest 0.025 ha (2.5 acres) of land adjacent to the Memorial Visitor Center and parking plaza. On May 6, 1993, following the presentation of the check to Superintendent Paul Guraedy by former NPS Director James Ridenour, the honored guests, the Drackett Company, National Park Foundation, and NPS representatives visited the site to turn spadefuls of earth around a 4.6m-tall (15 ft) ash tree. These actions launched the reforestation project, made known the Foundation's support, and recognized the Drackett Company's generosity and their "Great American Clean Up Campaign." (Note: S.C. Johnson Co. absorbed the Drackett Company in 1993-1994.)

Planting Begins

Managers opted to first plant 100 landscape-size native hardwoods averaging 2.76m tall (8 ft) in the south meadow east of the visitor center (figure 1). A local nursery accomplished this in December 1993 for $6,000. The bundled-up crew of two men and two women planted, staked, and wrapped 20 black oaks, 30 white oaks, and 10 each, red oaks, shagbark hickories, dogwoods, and white ash–all in one day. Our only concern was that a few trees seemed to march in straight lines instead of appearing randomly placed; the trees were spaced 3m (10ft) apart. (We planned this spacing in order to freely maneuver a pickup truck, water truck, and ATV.) On the next round of planting in April 1995, we added 30 more trees to the south meadow, plus a contractor replaced 14 trees that had died.

Trees that died? Yes! Although only five trees failed to leaf out in the spring, the summer of '94 was uncommonly hot and dry. Rainfall was six inches below normal. Despite fire hose waterings by park staff and Youth Conservation Corps (that included a few great water fights) we lost nine more trees due to temperatures reaching the high 90s. Apparently, we also lost some to creatures that we didn't know about as we found inch-long, grayish white worms inside the dogwood tree trunks. We were lucky in one respect: the brazen, grazin' white-tailed deer left our trees alone–this time.

Another challenge in 1994 was the attempted takeover of the south meadow by weeds, grasses, and thousands of thorny black locust sprouts. So we mowed the meadow in late summer and successfully applied Round Up™ herbicide around the bases of all the new trees. That year, a remnant highway and abandoned septic system east of the visitor center were also removed and the area landscaped for about $10,000.

In the spring of 1995, another landscaping company planted 200 white oaks, red oaks, ash, shagbark hickory, black cherry, and black walnuts in the north meadow. Interestingly, on recommendation of the landscaper, they planted these young trees experimentally in "family groups," or clusters, with the same spacing, as opposed to the totally random planting in the south meadow. A maintenance crew mowed the meadows and used Round Up™ herbicide to control weeds and grasses around the trees. Monitoring found that our new dogwood trees planted in 1993 were infested with borer insects, but no action was taken to purchase and apply the recommended Dursban (insecticide) at that time. (A tree care expert informed us that injection fertilization of the trees in spring and fall would likely reduce or eliminate the need for Dursban.) Impressed with this reasoning, we plan to initiate a periodic fertilization program.

For 1996, we awarded the third planting contract for $6,000. The contract called for setting 100 2.16m-tall (7ft) native hardwoods in the old roadbed east of the visitor center parking plaza, and replacing about 34 trees that had died in the adjoining meadows.

Problems included delays in receiving the trees, heavy rains and soft ground, which delayed planting by 2 weeks and required the planting crew to use wheelbarrows to transport trees to the site. (The contractor grumbled, but we held firm.) A crew of four, as was customary with this company, hand dug the holes for the trees, which by now were in full leaf. We experienced another delay of 2 weeks getting the replacement trees planted in the meadows, apparently because of other commitments by the company. After several calls, the crew finally returned and planted the trees, which had been "parked" in their ball and burlap "diapers" and kept watered down by park staff. (This time we grumbled–loudly!) Following more calls, the crew returned and fin-

ished the job by mulching and staking the replacement trees.) To date, 18 of the newly planted landscape trees have died and have been replaced by the contractor. Weekend watering, however, is benefitting all the trees and, as landscapers like to say, "may bring the rest out."

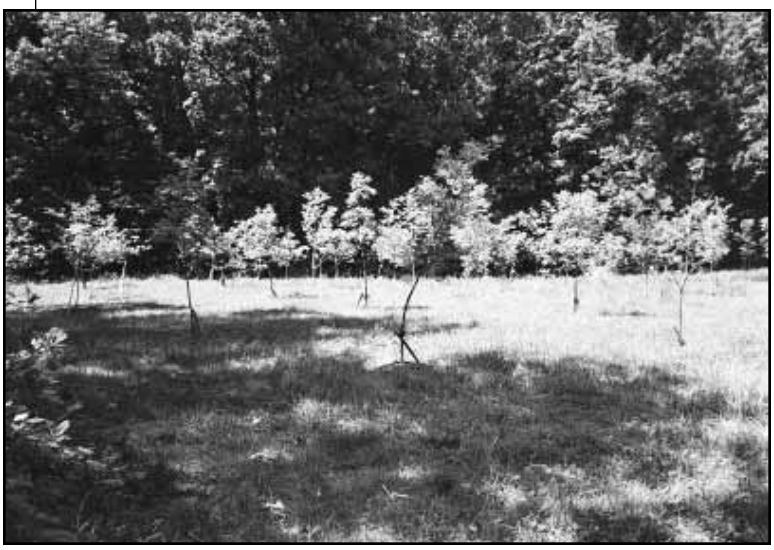

Figure 2. Trees in the North Meadow are doing well and are beginning to look like a fine young forest.

Looking Back

We did not realize the awesome responsibility of nurturing 100 trees initially, then 200 more, and finally 450 landscape-size natives when we received the munificent $40,000 grant. We also did not comprehend that baby oaks become mighty and need water, extra nutrients, and lots of care. For example, summer rainfall in southern Indiana seldom furnishes an inch of rain a week. Although we water the trees, we have found it difficult to keep up with the task as staff has melted away through the years. The YCC (Youth Conservation Corps) is gone. VIPs (Volunteers-in-Parks) are difficult to find. The maintenance staff is down. Resource managers are willing, but are becoming older and slower and creaky in the joints. Fortunately, enough money remains in the Drackett account to contract fertilizing, pesticide care, and tree replacements for the next 2 years–time needed for young oaks, ashes, hickories, dogwoods, and walnuts to establish themselves, spread their roots, and fight off insects.

The deer returned. Oh yes! Young bucks with blazing hormones and itchy antlers rubbed raw many of our healthiest landscape trees a year ago. All survived–bucks and trees–but the superintendent had all she could do to restrain the resource management ranger from charging the deer with trespass and high velocity rock salt.

In summary, despite all kinds of problems, the landscape trees planted in two meadows and the old roadbed over the past 4 years are beginning to look like a fine young forest (figure 2). With care, we can be proud of our contribution to the life of Lincoln Boyhood National Memorial, as we watch our youngsters start to grow big and strong for future generations. After all, it was in this place 170 years ago that two mothers and a father watched their youngster grow big and strong, and wondered –would he get on?

We did not realize the awesome responsibility of nurturing 100 trees initially, then 200 more, and finally 450 natives

Don Adams is the Resource Management Ranger at the park. His phone number is (812) 937-4541.

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evening or on weekends. Connections with GIS specialists from other agencies, organizations, and universities through conferences, and professional societies, were the key to getting the GIS lab jump-started during the Vision Fire.

Finally, GIS is a technical specialty, and its capabilities were not well understood by fire staff, which resulted in redundant efforts. For GIS to function smoothly in this environment, more than one person per agency is needed who has GIS experience (training) and an understanding of the capabilities and limitations of this management tool. A debriefing meeting, held shortly after the event, is also useful in documenting problems such as these and leading to improvements.

The Vision Fire at Point Reyes is a wake-up call for many private and public entities. Although impossible to contemplate and identify every problem in providing GIS related services during fires or other emergency operations, we are convinced that GIS is, and will continue to be, a vital tool to emergency responders in the future. We hope that by documenting our experiences, identifying the problems we encountered, and identifying preplanning considerations, more public and federal agencies will be better prepared to handle emergency incidents more effectively.

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Sarah G. Allen, Ph.D., is an Ecologist with Point Reyes National Seashore and can be reached at (415) 663-8522, ext. 224; e-mail: sarah_allen@nps.gov. David Kehrlein and David Shreve are with the California Office of Emergency Services in Sacramento. Kehrlein's phone number is (916) 262-1699; Fax: (916) 262-1697. Shreve's number is (916) 262-1455, Fax: 916-262-1697. Richard Krause works for the Warm Springs Reservation in Warm Springs, Oregon; (503) 553-2416.

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Research for the book was begun as a potential project for The Wildlife Society. But, in the end, The Wildlife Society refused to publish it and the authors sought out Island Press and several nonprofit foundations for publication support. One of the greatest values of the book is that it provides us a glimpse into the thought processes of some very accomplished people, some of whom have long histories of research in, and for, national parks, but all of whom seem to have problems with managing for "naturally evolving ecosystems." Most of the discussions are interesting, if dated, but do a better job of documenting the limitations and ambiguities of contemporary wildlife science than inculpating NPS management decisions. The reader will also find a substantial number of internal conflicts such as the admonition for developing more "park-specific, ecologically defined policies" and yet calling, also, for the minimum level of human interventions.

But in the end, even the "Future Directions" chapter disappoints. The authors call for using public input to set goals at the park level, integrate park and national park system goals, employ the least management possible, base management on quality research, consider management experimental, and monitor, monitor, monitor! If you've heard these things before (like, for the last 30 years), and don't need another dose of the obvious, you might check out Sam McNaughton's review of the book in the Journal of Wildlife Management [60(3):1996; 685-687] or just wait for the *Cliff Notes* version.

Dan Huff is the Associate Field Director for Natural Resource Stewardship and Science, Intermountain Field Area. His phone number is (303) 969-2651.

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scribed fire. Individual presentations were varied and meaningful. They described the most current techniques and procedures for wildland fire management, state-of-knowledge summaries, and new technologies including computer software.

Of particular interest was the panel discussion on political and philosophical limitations to prescribed fire. Panel members presented a stimulating exchange highlighted by Secretary of the Interior Bruce Babbitt's charge to reach a consensus among land users and to strive to make prescribed fire more effective and successful. Another panel member, while describing limitations to prescribed fire in a lighthearted fashion, may have actually given the most succinct summation when he stated that fear, greed, ignorance, and apathy are the principal limitations to increased prescribed fire application.

Several intriguing field trips augmented the formal presentation portion of the conference. These included tours of the National Interagency Fire Center; the Snake River Birds of Prey National Conservation Area; the World Center for Birds of Prey; and past, present, and future fire management considerations on the Boise National Forest.

The 20th Tall Timbers Fire Ecology Conference dealt with an important topic for present and future wildland fire management. Information shared will be valuable now and for years to come in enhancing understanding, learning, and application of management actions. Conference organizers should be proud as this conference achieved the goal of creating an environment where research and experience could be shared to further success and productivity in wildland fire and resource management. The sum and substance of the conference will be captured through peer-reviewed papers that will be published in a formal proceedings available during 1997.

Tom Zimmerman is a Fire Management Specialist with the Fire Management Program Center unit of the NPS National Interagency Fire Center. His phone number is (208) 387-5215.

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in the line-item construction program (and the continued decline in available funding), large projects will become increasingly difficult to justify. In the future, extremely large projects such as that to improve water delivery to the Everglades (in Florida) and the Elwha Dam removal in Washington (restoring a river drainage for salmon and steelhead spawning) may be better considered outside the line-item construction program. It is difficult to develop a meaningful scale to cover projects where the magnitudes of costs and benefits are so different.

In Summary

This was the first time we used the new process and we learned a lot. We know that good judgment about relative differences among projects can be exercised only if the information about the projects is good; this time, that was not always the case. Many project writeups still "gilded the lily," but we learned what information and in what form is needed to facilitate objective judgments. Nevertheless, The assessment team felt that the system was fair. All participants worked hard and conscientiously, including trying to deal consciously with their personal biases.

Park resource managers may learn some lessons here. First, if construction solutions can help deal with resource problems, resource personnel should work closely with their facility manager as they design projects. Second, the definition of what constitutes a "construction" project is broader than many believe. If a project costs more than $500,000 and less than $20 million, it may be eligible for construction funding and it does not have to be a building; it could be a rehabilitation project. Third, projects that have resource benefits of any kind will receive more credit for those advantages if good, objective data are included in the package. Finally, the system is explicitly open to resource protection projects–resource-related projects will get a fair evaluation.

Abby Miller is the Deputy Associate Director for Natural Resource Stewardship and Science. Her phone number is (202) 208-4650.

Ecological Restoration Workshops Announced

By William Jordan

THE SOCIETY FOR ECOLOGICAL Restoration is launching a new program of workshops for professionals involved in ecological restoration or related activities such as habitat or vegetation management, species restoration, or pest control. Lasting one to three days, the workshops will take place in 10 North American cities through May. According to John Rieger, District Biologist with the California Department of Transportation and one of the program coordinators, "a lot of people are getting involved in restoration work and they are looking for information [they] just can't find in books or journals. That is what we are offering through this program." Rieger explains that the workshops are the first step in creating the New Academy for Ecological Restoration, a school without walls that provides training for restoration practitioners.

The schedule for the first round of workshops is:

Budgeting Stewardship
Seattle, January 8; Sacramento, January 22; Denver, March 26

Desert Restoration
California City, April 30-May 2

Managing Seeds
Sacramento, January 29, April 4

Mycorrhizal Fungi
Morgantown, January 6-7

Plant Salvage
Seattle, January 15; Toronto, February 27; Dayton, April 15

Restoration Planning (introduction)
Seattle, January 16-18; Toronto, February 24-26; Dayton, April 16-18

Restoration Planning
Phoenix, January 6-7; Sacramento, January 27-28; Denver, April 21-22

Soil Geomorphology
Seattle, January 9-10; Sacramento, January 30-31; Denver, March 27-28

Wildlife Habitat
Seattle, January 13-14; Sacramento, January 23-24; Denver, March 20-21

For further information about fees and registration, contact Katy Kressin, New Academy Workshops, Society for Ecological Restoration, 1207 Seminole Highway, Madison, WI 53711; Phone-FAX (608) 262-9547; e-mail: ser@vms.macc.wisc.edu; web site: http://nabalu.flas.ufl.edu/ser/SERhome.html.

William Jordan is on the faculty of the University of Wisconsin in Madison and can be reached at (608) 265-8557.

Meetings of Interest

February 5-8 The 33rd annual meeting of the Western Section of the Wildlife Society will take place at the Bahia Hotel in San Diego, California. The session is entitled, "Monitoring Our Wildlife Heritage: What do we have? How do we know?" For further details, contact Dr. Reginald H. Barrett, 145 Mulford Hall, Berkeley, CA 94720-3114; (510) 642-7261; FAX (510) 643-5438; e-mail: rbarrett@nature.berkeley.edu.

February 16-23 "West Mexico for Land Managers" is being offered as a field workshop by the Colorado Bird Observatory as a way to promote international conservation initiatives. Western Mexico provides winter habitat for a majority of North American migratory songbirds and many Mexican endemic species, and is a global conservation priority. The week-long field trip with Mexican biologists will provide hands-on experience with the birds, habitats, management areas, and land managers of western Mexico. Cost is $1,200 (room and board), and airfare is between $350 and $650. Contact Chuck Aid of the Colorado Bird Observatory for further information at 13401 Piccadilly Road, Brighton, CO 80601; (303) 659-4348; FAX (303) 659-5489; e-mail: cobirdob@aol.com.

March 14-18 The 62nd North American Wildlife and Natural Resources Conference will take place at the Omni Shoreham Hotel in Washington, D.C. This premier annual meeting of North American natural resource managers, scientists, administrators, and educators will explore the theme, "seeking common ground in uncommon times." Contact the Wildlife Management Institute for further information at 1101 14th Street, NW, Washington, D.C. 20005; (202) 371-1808; FAX (202) 408-5059.

March 17-21 Albuquerque, New Mexico, is the venue for the Ninth Conference on Research and Resource Management in Parks and on Public Lands, the George Wright Society Biennial Conference. While the bedrock assumption underlying the creation of parks and reserves is that they will be

Continued on back page

Meetings of Interest (cont'd)

MARCH 17-21

GEORGE WRIGHT SOCIETY MEETING CONT'D

protected in perpetuity, today's world is characterized by the dizzying pace of technological change, rapid human population growth, large-scale alteration of ecosystems, the disintegration of shared cultural views of history, declining government budgets, and an increasingly fragmented and volatile political climate. The theme of the conference, "Making Protection Work: Parks and Reserves in a Crowded, Changing World," acknowledges the rapidity of change and the difficulty of protecting cultural and natural attributes in parks over the long term and stresses the importance of innovative and flexible thinking to achieve preservation. Cosponsors are the National Park Service, Eastern National Park and Monument Association, and the USGS Biological Resource Division. Contact Bob Linn or Dave Harmon for further information at (906) 487-9722; FAX (906) 487-9405; e-mail: gws@mail.portup.com; or web site: http://www.portup.com/~gws/gws97.html.

APRIL 8-10

The U.S. Forest Service is sponsoring the conference, "Exotic Pests of Eastern Forests," which takes place this spring at the Club House Inn and Conference Center in Nashville, Tennessee. Organizers hope to increase awareness of existing and potential exotic pest problems in the eastern United States, discuss best management practices, and identify gaps in knowledge and technology. Sessions and posters will address mile-a-minute, honeysuckle, fire ants, chestnut blight, gypsy moth, purple loosestrife, and several other species. During a half-day field trip, experts from the Tennessee Department of Agriculture and Tennessee Exotic Pest Plant Council will discuss biodiversity and exotics, strategies for prevention and control, introduction and spread, public awareness and education, use of pesticides, and economic impacts on land values. Registration is $125. For more information, contact Dan Brown at (404) 347-7193 or Kerry Britton at (706) 546-2455.

MAY 12-16

SAMPA III, the Science and Management of Protected Areas Association conference, will take place in Calgary, Alberta, and will address the theme, "linking protected areas with working landscapes and conserving biodiversity." Five environments (marine, prairie, mountain, boreal forest, and the North) will be profiled. Abstracts are due January 17. Contact Patricia Benson, SAMPA III Secretariat, #552, 220 4th Avenue SE, Calgary, Alberta, Canada T2G 4X3; (403) 292-4404; FAX (403) 292-4404; e-mail: sampa3@pch.gc.ca; WWW: http://www.worldweb.com/ParksCanada-Banff.

MAY 18-21

Reno, Nevada, plays host to the Fifth National Watershed Conference, "Living in Your Watershed." Contact John Peterson for further information; FAX (703) 455-4387.

JULY 14-15

The Natural Resource Program Center, Geologic Resources Division, is cosponsoring the Rocky Mountain Symposium on Environmental Issues in Oil and Gas Operations, now in its fourth year. To be held at the Colorado School of Mines, the conference will address pollution prevention, ecosystem management, air and water quality, visual impacts, road and pad siting, and reclamation. Registration is $295 by June 16, $345 thereafter. The January 3 deadline for papers or posters is fast approaching. Contact Bruce Heise (NPS cc:Mail, e-mail: bruce_heise@nps.gov, or (303) 969-2017) for additional information.

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