



Geologic Resources Division

2002 Annual Report





Geologic Resources Division

2002 Annual Report

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Natural Resources Program Center

Geologic Resources Division
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Cover: Draperies and stalagmites at Carlsbad Caverns National Park. Photo by Ronal Kerbo.

Opposite: Tokositna Glacier and Mount McKinley, Denali National Park and Preserve. Photo by John Burghardt.



Fire Island National Seashore. Photo by Rebecca Beavers.

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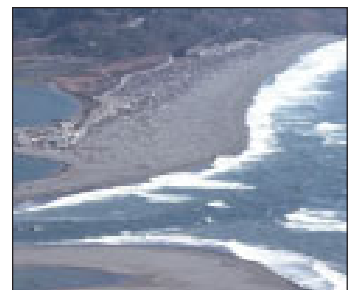
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A Look Ahead from the Division Chief

By: David B. Shaver

This 2002 Annual Report provides a summary of the accomplishments of the Geologic Resources Division of the NPS and our extended network of geoscience partners. The Division strives to provide professional expertise and support to resolve the geologic resource management concerns of parks across the Service, as well as to help parks deal effectively with minerals development in and around parks. In addition, the Division provides leadership in the development of NPS geology-related programs and policies.

The Geologic Resources Division was created in 1995 as a component of the Natural Resources Program Center, under the Associate Director for Natural Resources Stewardship and Science, National Park Service. Within the NPS, the Division has functional responsibility for the earth sciences encompassing cave and karst systems, coastal and shoreline processes, disturbed land restoration, fossil resources, surficial processes such as glaciers and landslides, and other processes that form or act on geologic features and landforms, as well as overseeing the NPS minerals management program. The Division is located in Denver, Colorado, with a liaison office in Washington, D.C.

As the Division's history illustrates, geologic resource management as a program area is a relatively new function for the NPS. In the past the NPS relied on other agencies and the academic community for geologic expertise. As a consequence, park managers were often uninformed about the significance of geologic processes and resource issues. Even now, the geology staffing within the Service is quite limited. This limited internal staffing makes it particularly important for the NPS to develop collaborative partnerships with other governmental geologic agencies and the external geoscience community in order to provide parks with geoscience expertise. As a result, the Division has devoted significant attention to establishing and maintaining connections with the U. S. Geological Survey and state agencies to obtain assistance for NPS geologic planning and projects. We also commit extensive effort to facilitating relationships with the non-governmental geologic organizations and the professional academic community as a way to link parks with critically needed geoscience research and knowledge. The on-the-ground

achievements of these partnerships are dependent on the involvement of park and support office staff. These park-level connections, which are crucial to the overall success of the NPS geologic resource management program, are reflected throughout this report.

We have organized this Annual Report to facilitate understanding of the Division's projects and illustrate linkages to other NPS programs. The first introductory articles highlight two significant Servicewide efforts: the continuing development of the National Cave and Karst Research Institute, and completion of a Geologic Resource Management Action Plan that lays out a strategic path for the overall NPS program. The rest of the articles featured in this year's report are organized around six general themes. However, as you will note, many articles actually encompass more than one theme and could fit under several of the categories. These overall organizational themes are:

Resource Protection – highlights examples of park geology and minerals management projects

Restoration – highlights disturbed lands restoration projects in parks

Inventory and Monitoring – identifies geologic features and understanding vital geologic process driving park systems

Professionalization – provides examples of field guidance and training, and division staff learning

Collaboration – highlights interagency, international, and broad natural resource partnership efforts

Educational Outreach – identifies projects in the NPS and with external organizations to raise geoscience awareness and provide professional support for park geology-related needs

Park Assistance – lists most of the specific park resource management projects that Division staff were involved in during the year.

We hope you enjoy reading this report and find it of value. I know you'll find that the articles provide uplifting examples of the commitment and dedication of all of our NPS employees. Also, you may learn something new and interesting about the incredible natural resources and geologic wonders entrusted to the care and management of the National Park Service. Please let me know if you have comments or suggestions for improvement in our Annual Reports.



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National Cave and Karst Research Institute- Completion of the Interim Phase

By: Zelda Chapman Bailey, Louise D. Hose, Ronal Kerbo

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The vision of a National Cave and Karst Research Institute administered by the NPS was suggested over 15 years ago at Carlsbad Caverns National Park. The Institute concept grew out of the need for coordinating research in the park's newly discovered Lechuguilla Cave, the need to partner with speleological groups, and the heightened awareness of cave and karst protection and management by the passing of the landmark Federal Cave Resources Protection Act of 1988.

During a visit to Carlsbad Caverns National Park in 1989, Senator Jeff Bingaman of New Mexico took an interest in the concept of an Institute. His staff worked with park staff and others over the next several months to draft the legislation. That process culminated on November 15, 1990, with Public Law 101-578, which directed the NPS to study the "feasibility of establishing a National Cave and Karst Research Institute in association with the NPS Cave Research Program."

The NPS and a panel of experts completed the feasibility study by delivering a 66-page report to Congress in December 1994. The study recommended that the Institute be jointly administered by the NPS and another entity. Congress had identified the NPS as project lead because, at the time, it managed over sixty park units containing significant cave resources. The study identified Carlsbad, New Mexico as one of the potential locations because of its strong community and political support, and the region contains numerous, diverse caves and karst.

The National Cave and Karst Research Institute Act was introduced in the U.S. House of Representatives on June 26, 1997, sponsored by New Mexico Representatives Skeen, Schiff, and Redmond. New Mexico Senator Jeff Bingaman introduced the Senate version on July 15, 1997. The National Cave and Karst Research Institute Act (Public Law 105-325) was signed into law on October 31, 1998. The purposes of the Act are to (1) further the science of speleology; (2) centralize and standardize speleological information; (3) foster interdisciplinary cooperation in cave and karst research programs; (4) promote public education; (5) promote national and international cooperation in protecting the environment for the benefit of cave and karst landforms; and (6) promote and develop environmentally sound and sustainable

resource management practices.

In July 2000, an Interim Director for the Institute, Zelda Chapman Bailey, was recruited to lead efforts to establish the Institute in an "interim phase" by defining the scope of operation, designing an organizational structure, forming partnerships, finding funding sources and a physical facility, and defining research needs. The interim phase was anticipated to span about three years. A "gearing-up phase" is expected to begin in 2003 with staff recruitment

and the transition from the Interim Director to a permanent Director.

Activities and Progress in 2002

- A booklet, initiated in 2001 by the Institute and the Karst Waters Institute (KWI), which is tentatively titled "Protection of Cave and Karst Areas on Federal Lands," was written and should be published in 2003.

- The draft manuscript of the U.S. Geological Survey (USGS) Circular, "The Nation's Cave and Karst Resources: Science and Management," began by the Institute and United States Geological Survey (USGS) in 2001, was completed and reviewed by four technical reviewers: two from outside the government and two USGS scientists. Publication should be in late 2003.

- The Institute and USGS sponsored and coordinated the first regional workshop, hosted by the Kentucky Geological Survey in Lexington, to discuss criteria for the National Karst Map, which is a collaborative program initiated in 2001. Workshop attendees represented state geological surveys in the Appalachian region and some adjacent states. The meeting was very successful in providing a forum for jointly planning the content and form of a national map and for discussing criteria for mapping on local and state scales. The Institute, using input from this initial meeting, began the design of the website that will serve the National Karst Map and link to sources of state and local karst maps and related data across the nation. The prototype website was sent to reviewers in federal and state agencies, universities and private businesses.

- The Kentucky Geological Survey was funded to conduct a nationwide survey of state geological

Ron Kerbo surveys Musk Ox Cave at Carlsbad Caverns National Park.
Photo by James R. Goodbar.



surveys for the National Karst Map program in order to provide a summary of criteria used in each state to identify and map karst areas.

- New Jersey Geological Survey was funded to provide digital graphics of karst in the state for the National Karst Map program web site.

- The Institute, New Mexico Tech, and the City of Carlsbad established a Memorandum of Understanding to provide the framework of a 'consortium' to guide the continued development and management of the Institute.

- Charters were drafted and sent for approval to establish two advisory boards for the Institute for management issues and for science and education issues.

- The City of Carlsbad began the process of soliciting credentials and bids from design and construction firms for the Institute building. Design probably can begin in early 2003, but construction depends upon appropriation of additional state and federal funds.

- The Institute and Western Kentucky University (WKU) established a Cooperative Agreement to facilitate research and resource management projects that will contribute to the scientific understanding, interpretation, management, and protection of caves and karst systems; and, to the development of national and international education and outreach efforts.

- Under the cooperative agreement with WKU, the WKU Biotechnology Center will conduct a nationwide exploratory survey of DNA extracted from cave sediments. The first steps, identifying sample sites and developing protocols for sampling, are underway. Information will be made available on the Internet to any interested research scientists.

- Also under the cooperative agreement with WKU, the Institute is supporting a graduate program for cave and karst resource managers that is tailored to schedules of federal resource management staff who wish to further their educational background.

- Partial funding was provided to the following organizations for the publication of three books: Denver Museum of Nature and Science for *Vertebrate Paleontology of Pleistocene Cave Deposits in North America*; National Speleological Society for *Cave Conservation and Restoration*; and, Boston University for *A Guide to Bats of North America*.

- The Institute printed 1,000 copies of *Exploring Caves and Karst Curriculum Guide* by the American Caves Conservation Association for their use and to support National Caves Association educational programs.

- The Institute was one of the sponsors of the USGS Karst Interest Group Workshop, held in August in Shepherdstown, West Virginia. This meeting was an excellent forum for bringing together karst scientists from a variety of federal, state, and local agencies, universities, and private firms.

- A brochure was designed to provide basic information on the Institute and was first distributed at the 2002 annual Geological Society of America meeting in Denver.

- Negotiations began with the National Speleological Society (NSS) to establish a cooperative agreement that would lay the groundwork for the NSS to loan part or all of its extensive book collection to the Institute.

At the end of calendar year 2002, the interim phase of the Institute was essentially complete and staffing had begun. The Division solicited applications for the position of Director of the Institute in late June through early July 2002. Dr. Louise D. Hose was selected as the first permanent Director. She reported to Carlsbad in mid-December 2002. The hiring of a permanent Director and establishment of an office in Carlsbad marked the transition to the "gearing up phase" of Institute development. Dr. Hose brings a wealth of experience in cave exploration, and cave and karst research and education. The Interim Director is overlapping for a few months to ensure a smooth transition and to complete some of the activities begun during the first two years.

The Institute enjoys an immense amount of support in the City of Carlsbad and has received intense interest from the national and international cave and karst community. Dr. Hose has been involved in numerous meetings with Carlsbad officials, federal land managers, and community groups. She is also participating in the design process for the new Institute building in Carlsbad, exploring new potential partnerships such as with the National Institute of Health, and meeting with Congressional staffers and NPS officials. She is serving on a National Science Foundation grant review panel and is responding to scores of questions from cave and karst interests around the world who are curious about the activities and direction of the Institute.



Above: Louise Hose repels into a cave at Grand Canyon National Park. Photo by Gary Stiles.



Zelda Bailey explores Cave of the Winds in Colorado. Photo by Patrick Tucci.

More information about the National Cave and Karst Research Institute can be found at www.nps.gov/nckri

Geologic Resource Management Action Plan Complete

By: David B. Shaver

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In 2002, a team of NPS representatives convened at the request of the Associate Director for Natural Resource Stewardship and Science to prepare a Servicewide action plan for geologic resource management. The work group and the plan it developed were modeled after action plans prepared in 1999 for other program areas as part of the Natural Resource Challenge. The action plan calls for increased use of geologic information and expertise to enhance park decision making and resource protection, and sets out a five-year implementation strategy.

The work group that met in April concluded that the NPS faces several major challenges in geologic resources management. First, there is a severe deficit of geoscience expertise and geoscience information in parks. Second, due to the lack of professional geologic expertise and information, the NPS has inadequately addressed geologic processes in park planning and decision-making ranging from natural resource protection to visitor safety and infrastructure design. Third, the NPS has underutilized the partnering opportunities available with outside experts. This is largely due to the systemic lack of park-based geoscience personnel to identify needs and engage the United States Geological Survey (USGS) or other experts to help address resource management concerns. To address these challenges, the team drafted an action plan that was circulated broadly within the NPS for review. Based on comments received, the plan was then revised and submitted to the Associate Director in November.

The action plan calls for the NPS to assure that sound geologic resource management decisions occur throughout the System and sets out a strategy to address this task. Geology, as defined in the plan, involves numerous related branches and disciplines such as disturbed land restoration, geochemistry, geomorphology, marine geology, mineralogy, paleontology, seismology, and soils. NPS resource management needs involve both geologic processes and features. Geologic processes are the physical and chemical forces that act within natural systems, such as erosion, sedimentation, glaciation, dissolution, and seismic activity. Geologic features are the products and physical components of geologic processes, such as arches, beaches, canyons, caves, fossils, geysers,

minerals, sand dunes, soils, and volcanoes.

The full scope of NPS managed geologic resources is very broad — more so than most managers realize. Across the System, more than 160 parks contain nationally significant geologic resources including 150 with scientifically important fossil deposits, 68 with dynamic shoreline geology, 79 with cave and karst systems, 52 with geothermal systems, and 33 with volcanic features. Additionally, park museum collections have over 63,000 geological and nearly 211,000 paleontological specimens. Most park projects and funding needs fall into the areas of disturbed lands restoration, surficial geology and geomorphology, soils, and paleontology.

The work group analysis, supported by several earlier studies, concludes that NPS has a Servicewide need for in-house geologic expertise and funding for geoscience related projects. The NPS geologic program is limited to about 50 employees in geology-related positions, with no established project-funding source. The current program is not capable of addressing the large volume of NPS needs related to inventory, monitoring, protection, assessment, and restoration of geologic resources. The lack of geologic field staff results in consequences such as park facilities interfering with geologic processes, exposure of park visitors and staff to geologic hazards, incomplete public education programs, and loss of irreplaceable geologic resources to theft and vandalism.

The Geologic Resources Action Plan outlines a five-year program that will improve the Service's ability to gather, analyze, integrate and use geoscience information in planning, resource management, resource protection, and public education. The plan would augment NPS expertise by adding geoscience staff, largely at the field level where specialists can interface directly with park managers, resource professionals, engineers, and maintenance staff. Increased access to staff with geoscience knowledge would provide for better integration of geologic considerations in park planning and decision-making. Field staff would also increase the NPS capacity to collaborate with external geoscience professionals and partners at the

local level who can further assist parks in managing and restoring geologic features and processes.

The plan is structured around the following goals and proposed actions:

GOAL A: Develop an integrated understanding of geologic resources to support park management and operations, and improve access to geoscience information. Key actions include:

- Evaluating current staff geologic expertise to identify opportunities to better utilize existing staff skills, utilizing existing funds to support geologists participation in park inventory and monitoring efforts, and encouraging USGS, university, and local geologist participation in park vital signs network program development.
- Pursuing budget initiatives to increase staff and provide regions and park networks with minimum technical expertise, e.g., a geologist in each park vital signs network and a geoscience position in each regional office.
- Providing funds for geology-related vital signs inventories and monitoring projects to support sound management decisions and long-term park planning.
- Providing funding for fossil and mineral collection management.

GOAL B: Preserve, protect, and restore geologic resources in parks. Key actions include:

- Updating resource management guidance to integrate geologic considerations into park planning, management, and decision-making.

•Enhancing stewardship abilities and skills through professional development of managers and staff.

•Developing partnership arrangements to establish and facilitate access to the geoscience expertise of other federal, state, and private organizations.

•Establishing a geologic resource management competitive funding source for park geology projects.

GOAL C: Increase public awareness and collaboration. Key actions include:

- Improving linkages between parks and the academic and professional community to help park staff analyze geologic features, understand processes and resource status, identify research needs, and develop public information products.
- Working with education and interpretation professionals in federal and state agencies and the geologic community to develop high-quality geologic information transfer programs.
- Using professional volunteers and the external science community to help parks develop geologic interpretation/education, geologic hazard maps, and other products to explain geologic processes to the public.
- Establishing a matching fund to facilitate projects with education organizations and other groups involved in geologic research and information transfer

The various action items set out in the five-year strategy total about \$10 million dollars and 40 new staff positions. Obtaining NPS and

“The action plan calls for the NPS to take on the responsibility of assuring that sound geologic resource management decisions occur throughout the System and sets out a strategy to address this task.”



Canyon de Chelly National Monument. NPS photo.

Resource Protection



Bryce Canyon National Park. NPS Photo.

Banner Year for the Geoscientists-in-the-Parks Program

By: Judy Geniac

For the Geoscientists-in-the-Parks (GIP) Program, 2002 was a banner year. Sixty-four GIPs completed work in more than 65 park units, almost ten times the number of GIPs placed in 1996, the inaugural year. The range of projects was much broader in 2002 than in the past and met more of the parks' needs. Projects included collecting and analyzing data and summarizing research on coastal processes, caves and karst features, glacial changes, fossil localities and conditions, water quality, geomorphology, and other physical features and processes. This work contributed to the inventory and monitoring of geologic processes and features as well as providing park interpreters with an understanding of the geologic resources in their park. Projects focusing on interpretation included paleontology field trips for park staff and expertise to help develop a draft general publication on the ecosystem represented by the Jurassic Morrison Formation, part of the "Age of Dinosaurs."

Park staffs used the new on-line GIP proposal system (currently being upgraded) to submit more than 125 proposals, more than in previous years. As always, there was an effort to seek a balance of proposals covering interpretation, education, research, and resource management. The on-line GIP web site is also used to advertise park vacancy announcements for seasonal, term, and permanent positions.

Assistance in sponsoring, advertising, and competitively placing GIPs came from the Geological Society of America (GSA) and the Association for Women Geoscientists (AWG), both seasoned partners to the GIP Program. A grant from Newkirk, Engler and May Foundation (NEM) helped the Division support more than 50% of the GIPs.

The GIP program also saw some publicity this year. Division staff contributed to an article in the June 2002 issue of the *AAPG Explorer*, the monthly newsletter of the American Association of Petroleum Geologists, highlighting some of the impressive projects done by GIPs.

The focus of the GIP program in the future is threefold: funding, range of assistance, and park contacts. Funding has fluctuated dramatically over past seven years. The grant from the Newkirk, Engler and May (NEM) Foundation

made a dramatic difference in the number of parks that we could help in 2002. Since, in most cases, park housing is not available, more direct funding is needed to help parks utilize local expertise. In 2003, the Division will work with organizations that have voiced interest in increasing outside funding. This will be done in concert with seeking NPS funds to help match the outside grants. The Division hopes to utilize existing and future funds and partnerships to address the broader spectrum of park needs.

While 2002 saw a broader array of proposals, it is clear that park staffs are not aware that the GIP program now addresses all of the earth sciences including hydrology, meteorology, geology, soil science, and integrated resource studies such as using geology and GIS to locate populations of threatened and endangered species. Because of the geoinicator scoping meetings, led by Division staff, parks are becoming more aware of the areas GIPs could be of assistance. These meetings help to bring together physical scientists and park staff who are familiar with park resources to identify and summarize the inventory, monitoring, and research needs of the park. As part of these 2-3 day workshops, the participants try to identify which projects can be done by GIPs. The park can submit proposals via the on-line system. A great deal of work needs to be done in parks, and GIPs will have many outstanding opportunities in the future.

In response to requests from parks for a mailing list to receive updates on the proposal process, proposal requirements and selections, a list serve will be developed in 2003. Parks and park staff names can be added to the list at anytime.

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Program Coordinator



In the summer of 2002 Jenda Johnson combined her masters degree in volcanology and her career as a videographer in order to help Hawaii Volcanoes National Park document its volcanology and explanations of the park's geology. Thanks to Jenda, the park now has a video on this topic that if can show to the general public as well as to new park personnel. Jenda was sponsored by Newkirk, Engler and May. Photo by park staff.

Geoscientist-in-the-Parks 2002 Activities and Accomplishments

All Coastal Parks and Sleeping Bear Dunes National Lakeshore

- Developed comprehensive Servicewide coastal website: design, text, images.

- Developed fact sheet and newsletter.

- Assisted with work on Sleeping Bear Shoreline project.

All Ocean Coastal Parks

- Completed shoreline beach nourishment and coastal engineering database updates and queries for NPS units on the East coast.

- Compiled a GIS database.

Arches National Park

- Developed annotated bibliography of past geologic research of park area.

- Participated in scoping session-GPRA Ib4-Human impacts on geologic processes.

- Conducted water quality sampling.

Assateague Island National Seashore

- Compiled and synthesized existing information regarding shoreline change data in the coastal National Parks. The GIP worked closely with databases that ASIS and associated researchers have compiled over the last 20 years.

- Created a GIS database that included NPS units with shoreline monitoring programs and rates of shoreline change, with ongoing analysis.

Big Bend National Park

- Provided search and documentation of museum fossils to determine which were from within current park boundaries.

Blue Ridge Parkway

- Consulted on geologic exhibit design and fabrication during major renovation project at the park's Museum of NC Minerals.

- Consulted with area and regional university geologists; reviewed text for the new geologic exhibits, provided interpretation at the site, and producing subject-specific text on the project.

- Helped locate and collect appropriate museum objects for the exhibits from area universities, the park's collection, and local sources.

- Acted as a community liaison and informed visitors of the significance of the project.

Bryce Canyon National Park

- Designed a virtual auto tour (photos and text) of the park, now posted to the park website.

- Edited teacher activity guides, now posted to the park's geology-education website.

- Provided resource information to park visitors via ranger programs, guided hikes, and assistance in the visitor center. Presented guided hikes, children's programs and stationary presentations.

- Provided education outreach with local schools, tested the Geodetective webpage activities.

Acadia National Park Assateague Island National Seashore Canaveral National Seashore Cape Cod National Seashore Cape Hatteras National Seashore Cape Lookout National Seashore Cumberland Island National Seashore Gateway National Recreation Area Gulf Islands National Seashore Padre Island National Seashore

- Scanned aerial imagery (Jim Allen's slide collection). Created archive of digital images was completed, along with site descriptions and context for historical sites and development, appropriate metadata.

Cape Hatteras National Seashore

- Evaluated volumetric changes in frontal dunes by using LIDAR technology.

- Assessed which areas will be more prone to overwash processes.

- Established a methodology for monitoring overwash areas and patterns within the park by using GIS technology. Produced maps and databases to educate park staff and the public.

Cape Hatteras and Cape Lookout National Seashores

- Continued ongoing research to examine the modern evolution of Core Banks both parks.

- Mapped (GPSed) significant barrier island processes including ephemeral inlet formation, inlet migration and overwash. Through aerial interpretation and GPS surveys, created

Katie Bobb, a Geoscientist-in-the-Parks through the Geological Society of America GeoCorps Program, performs her memorable "Rock Dance" for visitors at Great Sand Dunes National Monument and Preserve. She also helped the park to measure dune height changes using GPS and to measure and record data from unconfined aquifers. Photo by park staff.



ecological maps for the most active locations.

- Incorporated data into GIS.
- Performed geochronological analyses of mollusk shells.
- Collection created at key times of the year at important sites, supplementing existing collections.
- Performed analysis to define the distribution of fossil material on the beaches at both seashores, to determine water temperatures at the time the shells were living, and to relate the shell distribution to the underlying geologic framework.
- Prepared an educational brochure on the occurrence of fossil shell material.

Capitol Reef National Park

- Began the large inventory of the subaqueous (Triassic reptile) track ways in the Moenkopi Formation, taking GPS data of locations and conditions.
- Created new databases and entered GPS data. Took digital photographs to record the site condition. Presented evening geology talks to visitors from throughout the world. Co-hosted the Junior Geologist program and the week-long geology day camp.

Carlsbad Caverns National Park

- Developed geology curricula for elementary, junior high and senior high students, including targeted lesson plans and teaching materials (maps, geologic cross sections, charts, models and audio visual resources).
- Presented educational programs for park visitors and training for staff.

Capulin Volcano National Monument

- Provided geologic expertise to NPS GMP/EIS staff.
- Examined what were thought to be ancient lake shorelines to further define them. Determined sites were not lakes, but were dammed waters from a landslide, providing insight into the past ecosystem and the associated physical processes.

Colorado National Monument

- Added geology sections to the interactive interpretive kiosk (e-Ranger).
- Advised the Facilities Manager and Chief Ranger concerning various geologic hazards

within the monument. Consulted on geologic GIS layer and associated analysis.

- Provided reviews of publications.
- Provided geology training to volunteers.

Craters of the Moon National Monument

- For the park website: wrote a summary of the park geology, explanation of volcanic bombs, explanation of the Great Rift, and created a pictorial geology dictionary with text.
- Provided information at the park visitor center and guided geology walks to park visitors.
- Located, documented and mapped a variety of geologic features (tree molds, water holes associated with ice deposits in caves and other volcanic features).

- Inventoried some of the monument caves.

Denali National Park and Preserve

- Monitored glacier surface elevation and flow velocities.
- Aided in future studies of global warming, used radar and electromagnetics to measure glacier depth, dug snow pits to calculate yearly snow-water equivalents.
- Worked on seismic profiles to determine depths of gravel pits.
- Performed survey on slope failure (slump) threatening park road.

- Designed the park's glacier website

Death Valley National Park

- Researched maps and literature; used GPS to locate 32 park strata.
- Discovered that there are 55 different formations and collected samples of 41 formations.
- Cut surfaces of samples at the University of Las Vegas's lab.
- Many samples added to the geologic collection. Samples of each strata will be used to create a stratigraphic display in the park visitor center, helping park visitors understand the geology of the park.

Dinosaur National Monument

- Assisted with paleontology lab (preparation and

Additional information on the Geoscientists-in-the-Parks program may be found at: the geology intranet site at <http://www2.nrintra.nps.gov/grd/> and the geology internet site at <http://www2.nature.nps.gov/grd/>

documentation of dinosaur fossils) and fieldwork Interpreted fossil resources to visitors.

Arches National Park
Bighorn Canyon National Recreation Area
Capitol Reef National Park
Colorado National Monument
Curecanti National Recreation Area
Dinosaur National Monument
Glen Canyon National Recreation Area
Hovenweep National Monument

•Photographed Morrison formation and fossils in parks and helped draft the general publication for Morrison ecosystem and the discoveries made in the recent study.

Florissant Fossil Beds National Monument

•Assisted with paleontologic excavation, preparation and curation of fossil specimens, inventory and monitoring of sites, database development, and research. Latter included self directed research for masters thesis.

•Provided public education on area geologic and paleontologic resources.

•Conducted on-site interpretation at active paleontology digs.

Fossil Butte National Monument

•Explained to visitors at a fossil dig site how paleontologists do research and the importance of protecting the fossil resources.

•Conducted research on the fossil of the Green River Formation and presented results at a professional forum: the Geological Society of America annual meeting/conference.

Gateway National Recreation Area

•Compiled and synthesized existing information regarding surfing locations in the coastal national parks.

•Worked closely with the Surfrider Foundation to obtain relevant documentation and document access to the surf sites and descriptions of the surf characteristics.

•Created a GIS database on NPS surf sites, the level of use, and the quality of the surf. Used data as the subject of a coastal management Master's thesis.

Geologic Resources Division

•Compiled database of all past GIPs/ work (1996-2001).

Glacier National Park

•Performed literature and field work in researching (Masters thesis) the interaction between geomorphology and dynamics of plant succession near treeline.

Great Basin National Park

•Created a hydrological and geohydrological map and a surface and groundwater report of the Sand Creek watershed.

Grand Teton National Park and Fossil Butte National Monument

•Worked with Dr. Bill Wall of Georgia College and State University to complete park's paleo survey.

Gulf Islands National Seashore

•Evaluated effectiveness of previous efforts to restore island habitats following tropical storm impact.

•Provided a report with suggestions to guide reconstruction of park infrastructure.

Hagerman Fossil Beds National Monument

•Designed and conducted geology tours.

•Created and imitated several geology training workshops.

•Wrote a brief geology description for park natural resource staff.

•Proposed and drafted text for a quarry site.

Hawaii Volcanoes National Park

•Produced video of presentations given on geology field trip.

Lake Meredith National Recreation Area

•Provided background research and fieldwork to help in development of a new geological interpretive/educational program, wayside exhibits and upgrading the parks' geological web site.

•Provided guided talks to school children.

Lake Roosevelt National Recreation Area

•Developed and presented children's science programs, evening talks, guided walks, and a

A Geoscientist-in-the-Parks at Denali National Park through the Geological Society of America GeoCorps Program, Austin Baldwin was involved in the ongoing glacier monitoring program. He used differential GPS to collect glacier surface flow velocities and elevations. He used radar and electromagnetics to measure glacier thickness, and dug snow pits to calculate yearly snow-water equivalents. Photo by park staff.



presentation on lake safety. Collected Eocene fossils.

Lassen Volcanic National Park

- Led sampling of soil and tephra for study to understand the geologic framework of the Drakesbad Meadow to determine long-term management options regarding the preservation and/or restoration of the fen deposit.

- Assisted in sampling of soil and tephra for study to understand the geologic framework of the Drakesbad Meadow to determine long-term management options regarding the preservation and/or restoration of the fen deposit.

Mammoth Cave National Park

- Assisted with the Lesser Cave Inventory: trained to and accomplished travel in the backcountry to discover many cave entrances, previously unknown to the park.

- Used GPS to mark entrances, and then drilled and placed cave markers at entrance locations.

- Assisted with the Lesser Cave Inventory: used GPS to mark entrance locations, measured openings, wrote descriptions, took digital photographs.

- Assisted with cave restoration projects, including removal of a walkway deep in the cave (along with members of the National Speleological Society) and removal of a concrete wall to restore air flow at one entrance.

Mount Rainier National Park

- Continued the development of the Volcanic Hazards Curriculum Guide.

- Served as liaison between the USGS Cascades Volcano Observatory and park interpretive and education staff.

- Completed the collection of rock samples for educational use.

- Assisted with teacher workshops and seasonal training sessions.

- Revised a guided trail brochure focused on the volcanic and glacial features of the park.

- Presented evening geology talks and meteor talks, assisted in duties in the park visitor center and the museum. Answered questions from park visitors. (Paradise)

- Edited park's geology training manual, provided

evening talks on the park's volcanic and glacial history.

- Developed and presented a glaciers Junior Ranger program.

- Provided photographic monitoring of a supraglacial lake for the USGS's Cascades Volcano Observatory. (Sunrise)

Navajo National Monument

- Examined soils in arroyos at Keet Seel and Inscription House to collect data on past climates and environments. Assess the erosion problems found at these sites.

Nez Perce National Historic Park

- Developed surgical geology maps and associated written descriptions of six park sites and associated GIS layer.

North Cascades National Park

- Worked with other geologists to identify and map 23 distinct landforms (including floodplains, alluvial fans, debris cones, landslides, terraces, and valley walls) on 1:24,000 scale base maps.

- Examined what were thought to be ancient lake shorelines to further define them. Determined sites were not lakes, but were dammed waters from a landslide, providing insight into the past ecosystem and the associated physical processes.

Olympic National Park

- Compiled and synthesized existing information regarding coastal processes on the park's coastal strip.

- Worked closely with park's coastal ecologist and interacted with the US Army Corps of Engineers district office to obtain relevant documentation and follow plans for additions to the Quileute Jetty and associated structures.

Oregon Caves National Monument

- Performed cave restoration and photo monitoring work.

- Developed a pamphlet for a self-guided geology walk.

- Provided cave tours.

- Gave presentations on the geology of the park.

Ozark National Scenic Riverways

- Inventoried (located, took photographs, described, and took GPS coordinates of) caves and springs on the upper Current River.



Through the Geological Society of America GeoCorps Program, Dan Clark was a Geoscientist-in-the-Parks at Mammoth Cave National Park. His work on the Lesser Cave Inventory included measuring cave entrances, writing descriptions, taking digital photographs, and recording GPS locations. Dan's work also included cave restoration, such as the removal of a concrete wall to restore natural air flow to the cave. Photo by park staff.

- Work included filling out National Natural Landmark site evaluation forms.

- Participated in preliminary discussions of changing the resource management plan of Welch Spring, one of the largest springs in Missouri.

Petrified Forest National Park

- Assisted in researching historic documents for “lost” paleontological sites, then doing field searches to find and document these sites.

- Discovered new fossil sites.

- Excavated specimens.

- Provided answers to park interpreters’ questions.

- Collected stratigraphic samples and helped interpreters with display and text to explain park’s stratigraphy to park visitors.

- Assisted park with resource education duties.

Pipestone National Monument

- Performed a literature review of geologic research done in and near the park.

- Compiled list of geologic references.

- Wrote a summary of the park’s geology.

- Provided updates trail guides and pamphlets.

- Presented geology talks to the staff and guided tours.

- Wrote draft changes to outdated geology text in visitor center displays.

Pictured Rocks National Lakeshore

- Three professors (Michigan Technological University and Northern Michigan University) provided guidance on the development of the park’s earth science school curriculum for middle and high school students.

- Also assisted in developing a guide for an associated field trip.

Point Reyes National Seashore

- Designed earthquake poster, provided input for

redesigning earthquake trail, edited middle-school curriculum, updated website.

Pu’uhonua o Honanunau National Historic Site

- Identified trace fossils (tree bark molds) in lava tubes and provide written report to park.

Sunset Crater Volcano National Monument

- Interpreted the park geologic resources through developing and conducting interpretive walks, and designing and writing text for interpretive site bulletins, exhibits and signs.

- Continued to develop park’s field specimen collection of analysis of lava flow dating.

Timpanogos Cave National Monument

- Mapped geologic strata, created geology site bulletin.

- Mapped vegetation types to correlate with geologic strata.

- Led youth group (37 youth, 5 adults = 3100 hours)in cave I&M project.

Timucuan Ecological and Historic Preserve

- Studied a coastal area and deciphered causes of accelerated erosion and accretion.

- Wrote a report and provided recommendations for monitoring the inlets and noted areas in need of additional study.

Voyageurs National Park

- Worked with interpretive staff to prepare a geology Map and Guide.

Yellowstone National Park

- Collected monitoring data on geothermal sites (Norris, Mud Volcano, West Thumb) and entered it into database.

Zion National Park

- Examined what were thought to be ancient lake shorelines to further define them.

- Determined sites were not lakes, but were dammed waters from a landslide, providing insight into the past ecosystem and the associated physical processes.



A Geoscientist-in-the-Parks sponsored by the Association for Women Geoscientists, Dr. Annabelle Foos examines what was thought to be ancient lakeshores in Zion National Park. She determined that the sites were not lakeshores and therefore could not be indicators of where archeological sites might be located. Rather, the sites indicated a different past environment that included landslides that dammed streams and caused large and sustained floods. Photo by park staff.

Protecting Historic Resources in Klondike Gold Rush

By: Hal Pranger

First in May and then in July 2002, Division staff collaborated with the Water Resources Division (WRD) to help protect valuable historic resources in the challenging environment of Klondike Gold Rush National Historical Park (KLGO), Skagway, Alaska. The area being affected is the town of Dyea, located at the northernmost point of the “Inside Passage” and at the head of the infamous Chilkoot Trail. Dyea is located about four miles from Skagway and nine miles from the Yukon Territory. During the Klondike Gold Rush of 1897-1898, Dyea was the main port town where prospectors began their 400-mile trek into the Yukon looking for gold. The Taiya River has been actively migrating through Dyea since early in the 20th century. Bank erosion by the river has removed approximately 30% of the town, including historic buildings, artifacts, middens and a cemetery. It is apparent that the river will eventually scour away the entire town site unless the NPS intervenes. The goal of this project was to determine whether the Taiya River could be “stabilized” in an environmentally sound manner.



The Taiya River flows through the town of Dyea. Because of its dynamic nature, it is a threat to the valuable cultural resources of Dyea. Photo by Hal Pranger.

The hydrologic and geologic conditions of the Taiya River and its watershed are exceptionally dynamic. Retreating glaciers in tributary valleys produce large annual floods that carry thousands of tons of sediment downstream. At least three enormous glacial lake outburst floods have rushed down the Taiya River valley during the past 130 years. The largest known outburst flood occurred shortly before 1882, prior to white settlement, denuding much of the half-mile-wide valley. The second outburst flood occurred in 1897 and killed at least three Klondike gold prospectors. The most recent outburst flood occurred on July 23, 2002, just six days after Division staff flew over the site investigating the possible reoccurrence of such outburst events. The flood swept through Dyea and endangered

the lives of several campers and park staff.

Relative sea level is dropping at a rate of about two meters per century in this area, because the land is continuing to rise from the melting of an ice sheet that once was over a mile thick. Since the valley is relatively flat, the drop in sea level is exposing over a half mile of new valley floor per century. The newly exposed land is rapidly being overgrown by an encroaching forest. The fluvial processes at work in the Taiya River are active and complex due to the sandy

composition of its bed, the large volume of woody debris in the river, and the flashy streamflow that tends to move down a number of side channels. In addition, the local tides have an historic range of nearly ten meters. The region is seismically very active and tsunami risk is substantial. Enormous waves created by

landslides have also occurred in the region. All of these factors have created an active environment in which the Taiya River has quickly changed its morphology, sediment composition and position in the valley.

After evaluating the dynamic conditions of the site, the Division and WRD determined that engineered logjams (ELJs) would be the preferred means of stabilizing the Taiya River through Dyea. Engineered logjams are designed to function like natural logjams but can be constructed for long-term channel stabilization. Division staff organized a site visit with a leading expert in constructing ELJs, Dr. Tim Abbe of Herrera Environmental Consultants, Inc. Dr. Abbe has since delivered conceptual design plans for two options to construct several ELJs in Taiya River through Dyea. KLGO staff are working through the various NEPA and funding process to determine its next course of action. Whatever the outcome, it promises to be a wild ride in this geologically active area.

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NPS Water Resources Division Hydrologist, Rick Inglis, points out a tombstone perched precariously on the bank of the Taiya River. Photo by Hal Pranger.



Drilling Activity Rises as Three-Dimensional Seismic Exploration Increases

By: Pat O'Dell

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What is 3-D Seismic Exploration?

Seismic programs have long been a part of exploration for oil and gas. Geophysicists obtain images of subsurface formations by transmitting sound waves through the earth's crust and analyzing the energy that comes back to the surface. Until the early 1990s, all seismic reflection data were acquired as two-dimensional (2-D) images, a vertical slice of the earth's subsurface. Although 2-D data has resulted in thousands of discoveries, it provides only part of the puzzle and leaves much room for error. Huge advances in computing and digital technology, combined with better geophysical modeling, have made 3-D possible. If 2-D provides a "slice of the pie" then the newer 3-D technology provides the "whole enchilada." However, the land-use requirements of 3-D surveys, and thus the surface impacts, are proportional to the increase in imaging capabilities.



Drilling at Padre Island National Seashore increased in 2002 after 3D seismic surveys were run in the previous

From 1998 through 2001, a wave of three-dimensional (3-D) seismic projects rippled across parks along the Gulf Coast. Padre Island National Seashore, Big Thicket National Preserve, and the Barataria Preserve Unit of Jean Lafitte National Historic Park and Preserve were blanketed with surveys. Exploration companies surveyed over 200,000 acres total of National Park Service lands in four parks. The wealth of subsurface mapping information has both encouraged and discouraged operators from drilling new wells.

Three-dimensional seismic information allows companies to find and produce oil and gas with a minimum number of wells. For that reason, some industry proponents claim 3-D seismic is an exceptional tool for environmental protection. The idea being that increased efficiency (fewer nonproductive or "dry" holes) tends to lower overall environmental impacts since well drilling is much more land use intensive than are seismic surveys. That viewpoint sounds compelling. Yet, another might argue that the sophisticated subsurface imaging prompts drilling and results in discoveries in areas otherwise deemed too risky in the absence of 3-D data. Regardless of opinion on whether 3-D seismic exploration is increasing or decreasing the number of wells drilled, there is no debate that 3-D seismic technology is resulting in a significant improvement in drilling success. Companies are finding oil and gas fields that were missed using past technologies. In parks where operators have run 3-D seismic surveys the results have been mixed, but overall there has been more drilling than there was without the 3-D subsurface imaging.

In Big Cypress National Preserve, an operator surveyed a 16 square-mile area over an existing oil field to help assess potential for expanded development. With preliminary information, the operator discussed extending the field and scouted potential drilling locations with Preserve staff. However, the expansion plans fell by the wayside once the seismic data was fully analyzed. Without 3-D an operator might have drilled additional wells to define the boundary of their field.

In the Barataria Preserve unit of Jean Lafitte, the outer edges of two separate 3-D surveys conducted two years apart combined to cover the entire unit. Although the companies designed the surveys to image areas outside the Preserve, the peripheral data inside the Preserve has generated interest. Though it is too soon to know whether or not drilling will occur in the Preserve, there would likely be no interest at all in the absence of 3-D seismic data.

At Big Thicket and Padre Island the 3-D information is not only generating drilling prospects, but the drilling prospects are resulting in new oil and gas discoveries. The new findings come despite the fact that both areas have a long history of oil and gas exploration and production. Using 3-D results, three of the next four wells drilled in Big Thicket found new petroleum reserves. The discoveries have prompted additional drilling targets in and around the Preserve. Operators have indicated plans for at least a half dozen more wells in the Preserve in the immediate future. In the past few years, all the wells drilled in Big Thicket were directionally drilled from surface locations outside the Preserve. The Preserve's narrow water corridor units and wet environment are logistically conducive to that trend. However, new surface drilling locations inside the Preserve will be part of the future just as they have been part of the history.

Three-dimensional seismic exploration at Big Thicket has not led to more drilling in all cases. One operator decided to plug existing wells in a field with waning production, yet drilled one last well, just to be sure. Another operator just plugged four aging gas wells in the wake of a 3-D survey. Somewhere between new discoveries

and decisions to plug are surveys that have identified technically, but not economically, viable petroleum targets.

At Padre Island National Seashore, a single company owns the exploration rights on the island proper as well as a number of offshore tracts surrounding the island. The operator speaks of “dozens” of potential drill sites inside the park. The company has drilled several wells outside the Seashore, but thus far, only one well inside. That well was completed as a gas producer. The NPS has approved two more wells, and one other is early in the permitting process. It is somewhat premature to say how successful future drilling at Padre Island will be, but operators who drilled two holes in the mid-90s without the benefit of 3-D came up dry.

Coincidental to 3-D exploration in these parks, oil and gas prices began to rise in late 1999 and have remained at levels averaging 50% higher than the previous decade. The 3-D information results in exploration efficiency, but product prices probably play a larger role in the overall numbers of new wells. As the industry steps up exploration and production activity with increasing product prices, expect that Park Service lands will not be spared. If prices hold firm, there will be more seismic activity, more drilling, and more production in parks. The Division will continue to dedicate its efforts to help parks ensure that operators conduct business in a manner least damaging to park resources.

In-Park Gravel Extraction Could Lessen Impacts

In order to build roads, trails, facilities and campsites, parks need gravel. In some cases importing gravel creates more impacts than extracting it from in the park. Three parks are analyzing their options for gravel use. Denali National Park and Olympic National Park are analyzing the conflicting need for maintenance and construction materials with the mandate to protect park resources. Mount Rainer National Park submitted a technical assistance request to GRD to begin the gravel planning process. These parkwide gravel plans will:

- Calculate parkwide gravel needs;
- Identify gravel sources in and out of the park;
- Evaluate the impacts and conflicts associated with in-park extraction versus importing;
- Plan an importation-extraction-restoration scenario that best protects park resources while providing materials needed for roads and trails;
- Integrate environmental compliance into the overall and site-specific project design.

Once completed, these plans will enable park maintenance staff to obtain materials for safe roads and trails with a minimum of resource conflict for 10-20 years into the future.



Park Maintenance extracts gravel from Finley Creek Bridge at Olympic National Park to protect the bridge and maintain flows. Photo by Mark Ziegenbein.

Protecting Surf Resources in the National Parks

By: Rebecca Beavers and Adam Stein

Right: Surfers enjoy the waters near the end of a seawall at Golden Gate National Recreation Area. Photo by Norb Psuty.



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“The inventory documented the type, season, and level of use of each area along with management issues that could affect the surf.”

In many regional surfing circles National Parks are synonymous with excellent surfing. Cape Hatteras, Cape Canaveral, and Gulf Islands National Seashores have abundant surfing opportunities that draw thousands of surfers each year. Ocean Beach in Golden Gate National Recreation Area and Malibu Beach, a California State Park in Santa Monica Mountains National Recreation Area, are two of the numerous west coast locations that are visited by many of California’s 600,000 surfers. As a recreational resource, surf is of primary importance to surfers and surf related visitors. But it also influences the aesthetic experience of many other park visitors and, in some cases, is culturally significant. Unfortunately, the locations, characteristics, and threats to surfing areas in the National Parks have not been well documented. The NPS is beginning to gather information on this valuable natural asset to enhance its protection.

In 2002, the NPS Geoscientists-in-the-Parks program and Surfrider Foundation jointly funded an inventory of surfing resources in the National Park System. This project included surfing locales or breaks from the Great Lakes to American Samoa and identified 85 surfing spots in 25 separate NPS units with 28 units still under study. The inventory documented the type,

season, and level of use of each area along with management issues that could affect the surf. It also identified surfing resources with major cultural significance or especially high levels of use. Many parks were unfamiliar with their surf breaks and will benefit from the findings, including digital data, which will be reported to managers in 2003. The information will be easily applicable to park management issues because the data will also be made available in a Geographic Information Systems (GIS) database.

A recent case study at Sandy Hook in Gateway National Recreation Area, illustrates how one park effectively resolved a management problem involving a prized surfing resource. The surf in “Big Cove” is the result of a lengthy New Jersey seawall that extends into the southern boundary of the park, producing waves that surfers enjoy. However, this focused wave energy threatens to erode the shoreline along the only road accessing northern portions of the park and other infrastructure. In developing plans to protect this critical area, park staff reviewed shoreline monitoring data on the erosion problem and discussed management options with surfing organizations. The combination of open communication and scientific information enabled the park to make an informed decision that benefited all parties. In 2002, the park replenished beach sand to protect park infrastructure, but in small enough quantities and at a distance far enough away from the surf break to ensure its preservation. Russ Wilson, superintendent of the Sandy Hook unit, summed up the positive outcome. “Through an open dialogue...we have made several changes in the design to the interim beachfill project.... We are pleased that we could work together to design a project to satisfy the needs of the National Park Service, while ... working to minimize any potential adverse effect on surfing....”

Below: Shoreline erosion in the Critical Zone at Gateway National Recreation Area. Destruction of the road occurred during this storm period. Photo by Norb Psuty.



Landslide Hazards in the National Park System

By: David L. Steensen

Landslides include a wide range of phenomena involving downslope ground movement, such as rockfalls, deep slope failure, shallow debris flows, and avalanches. Gravity acting on a slope is the primary cause of landslides, but there are other important and dynamic factors that serve as triggers. Saturation of slopes by precipitation (rain or snowmelt) weakens soil and rock by reducing cohesion and increasing the pressure in pore spaces, pushing grains away from each other. Erosion and undercutting of slopes by streams, rivers, glaciers, or waves increase slope angles and decrease slope stability. Earthquakes create stresses that weaken slopes and physically cause slope movement. Perhaps most significant from a management perspective, the over weighting, and/or under cutting of slopes for facilities, roads, trails, mines, and other man-made structures change the natural slope equilibrium and cause slopes to fail.

The NPS has been aware of landslide hazard issues since parks were first created. In the past landslides were often viewed as extreme or unusual events that had to be cleaned up and/or stabilized. More recently, it has been recognized that landslides, like other geologic processes, are natural and play a fundamental role in shaping ecosystems.

Nevertheless, human activities may accelerate landsliding processes by altering the land surface for agriculture, grazing, development, or other uses. Structures and facilities may be located in the path of natural landslide zones increasing the potential for damage or destruction. Safety hazards to staff and visitors are a prime concern at parks with virtually any topographic relief. Recent and well-known events that have affected park lands include the 1995 Madison County Event (Shenandoah NP), the 1996 Happy Isles Event (Yosemite NP), the 1997 New Year's Day Event (Redwood NP, Whiskeytown NRA, Oregon Caves NM, Lassen Volcanic NP, and Yosemite NP), the 2001 New River Event (New River Gorge NR), and the 2002 Rockfall Event (Zion NP).

Slope failure and associated flooding events may cost parks hundreds of millions of dollars. This cost is even greater when considering all of the smaller, more routine landslides that parks deal with on a regular basis, such as cut-bank failures along road corridors or rockfall along roads, trails and overlooks.

Response to slope failure events has typically been reactive, on a case by case basis. That is, when a landslide event occurred, the NPS dealt with the consequences of that event (i.e., cleanup, stabilization, repairing damage, etc.). More recently, however, incident responses have been significantly more proactive, including large-scale inventories and assessments of the changes to natural and, in many cases, cultural resources. Assessment teams, similar to the Burned Area Rehabilitation Teams used for areas affected by forest fires, are being used for landslide areas as well. These teams are comprised of geomorphologists, hydrologists, botanists, fisheries biologists, archeologists, and many others to evaluate what kind of event occurred, when and why it occurred, and what the impacts were, and what response is needed for resource protection.

The NPS lacks an adequate and comprehensive approach to planning, assessment, monitoring, information management and dissemination, mitigation, and emergency preparedness and response to catastrophic slope failure. In a few cases, Mount Rainier NP, Yosemite NP, and Shenandoah NP, for example, parks have developed planning documents addressing landslide and rockfall prone areas based on available information. Nevertheless, at most parks subject to significant slope failure, comprehensive landslide hazards assessment and planning are not available.

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A large boulder demolishes a portion of park housing at Zion National Park. Fortunately, no one was injured. NPS photo.



However, the NPS has the basic framework in place to implement such an effort. This framework is contained primarily in the NPS Management Policies (2001). The principle approach to natural processes, including landslides, is to allow them to operate unimpeded (§4.1, §4.8.1.5) and to treat the effects of natural processes only when necessary (§4.1.5). Such necessary exceptions may include provisions for visitor safety (§8.2.5.1), which allow parks to provide safe experiences, and for facility siting (§9.1.1.6) which encourages the avoidance of natural hazards. Combining these policies with the NPS planning framework (e.g., Director's Order 2), will enable parks to be prepared for future events. Given the potential effects of global climate change (e.g., increased frequency of intense storms), such preparedness is warranted.

The NPS is not alone in the need for comprehensive landslide hazard assessment, monitoring, and planning. Federal land management agencies such as the Bureau of Land Management and the Forest Service, many municipalities, and most states must address landslide hazards. The U.S. Geological Survey has taken a lead role in developing a nationwide Landslide Hazards Mitigation Strategy to reduce losses from landslides. The Strategy provides a framework for responding to rising costs from landslide hazards nationwide by developing and facilitating partnerships among governments at all levels, academia, and the private sector. These partnerships would focus resources on landslide research, mapping, assessment, real-time monitoring, forecasting, information management and dissemination, development of mitigation tools, and emergency preparedness and response.

Further information on the USGS Landslide Hazards Mitigation Strategy can be found online at: <http://geology.cr.usgs.gov/pub/open-file-reports/ofr-00-045/>.



This large scale debris flow changed many miles of stream habitat at Shenandoah National Park. Note park staff in left center of photo for scale. Photo by Dave Steensen.



In an effort to contain the oil spill, responders to the oilwell blowout in Obed Wild and Scenic River deploy a boom. NPS photo.

Oil Well Blowout at Obed Wild and Scenic River: An Ounce of Prevention is Worth a Pound of Cure

By: Patrick O'Dell

On Friday afternoon July 19, 2002, in Morgan County, Tennessee, oil and gas drillers labored on a bluff high above the confluence of Clear and White Creeks of the Obed Wild and Scenic River. The crew was ill prepared for what they would find: a high-pressure, high-flow-rate oil zone. Oil surged into the well from 2,500 feet below the surface, quickly filling a pit at ground level. With no equipment for closing the well, the crew's grip on the situation was tenuous at best. Within hours, oil and gas poured uncontrollably from the well while workers scrambled to contain the worst of the mounting spill volume with vacuum trucks and hurriedly built pits and dikes. With both time and space working against them, the crew was unable to prevent the stream of oil from seeping into the ground, breaching dikes, and cascading down the cliffs into the creeks of Obed Wild and Scenic River. On Saturday morning, a single spark grew into a huge fireball rolling down the hill consuming the volatile vapors rising from the oiled waters, and then receding to its source leaving pools and trails of burning oil.

By Saturday afternoon, a response team was fully mobilized as local, state, and federal emergency workers converged on the site. Firefighters suppressed the incidental fires, and specialized oil well firefighters from Texas squelched the

well fire. Park staff joined in the battle by providing operational assistance and important natural resource information to incident command. With the well on fire, much of the new oil flowing from the well was burning before it could reach the water. However, an untold volume of oil seeped through the thin soils around the well into the highly fractured sandstone bedrock and began slowly oozing from an underground pathway into Clear Creek at the waterline. Booms placed in Clear Creek collected the oil and prevented it from moving further downstream. The Texas firefighters proved their value by snuffing the well fire and securing the well. Responders worked on the problem of removing the oil from the soils and waters, and set up a longer-term containment and recovery scheme to tackle the ongoing oil seep at the bank of Clear Creek. No incident response of this nature is without glitches, but overall the response ran smoothly. Still, the incident taxed the human resources of the park and directed them away from other important functions.

The Obed and its tributaries form a rugged landscape of wild land and water giving home to a wealth of plant and animal life including no less than four threatened and endangered species, and providing a haven for outdoor

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enthusiasts of canoeing and kayaking, fishing, hunting, hiking, and swimming. Approximately five miles of Clear Creek were closed to public use, and concern for the resource lingers knowing that much time and work remains before the consequences of the spill are fully understood.



The fiery blowout rages above the creeks of Obed Wild and Scenic River. This well location on the edge of the river gorge provided little time and space for effective spill control. Photo by Pat O'Dell.

The damage assessment team attends to these concerns by helping direct a natural resource damage assessment. Under the Oil Pollution Act, the company responsible for the spill is liable not only for all oil removal costs, but damage caused by the spill, including compensation for natural affected resources. The Division played an active role in the aftermath by assessing remaining threats to park resources posed by the well. Six months after the blowout, the area remains under the control of the Environmental Protection Agency (EPA) because of issues related to oil released into park waters, and the mechanical integrity of the surface casing of the well.

Response and damage assessments are critical elements of a common challenge: balancing the rights and needs of extractive mining and petroleum industries while ensuring the protection of park resources, which often are the

last vestiges of critical habitat for threatened and endangered species. We are becoming more and more proficient at incident response and the process of damage assessment. That is good news for parks like Obed and Big South Fork National River and Recreation Area, which are situated in the most prolific mineral production areas in Tennessee. Rather than just reacting to these incidents, we need to look at preventative measures to ensure they are not repeated. The most important task is making the industry and their regulators aware of the locations and values of important natural resources found in Obed. Once these resources are brought to their attention, these groups generally take the necessary steps to protect them. After all, it serves their interests as well.

Renewed interest in prevention nearly always follows an accident of this size, and rightly so. Within days the State of Tennessee directed operators to use blowout prevention equipment. Tennessee then opened their entire oil and gas program to public review and comment – a process in which the Division, Obed, and Big South Fork participated to help ensure future protection of park resources. An improvement in preventative measures cannot come quickly enough, as news of the gusher has excited the oil and gas community and new wells are already being drilled in drainages near the park. The balancing act continues.

Legal Challenges of Managing Oil and Gas Rights in the National Parks

By: Edward Kassman

As interest in domestic oil and gas exploration and development increases, industry and environmental organizations have increased their scrutiny of parks that regulate the exercise of nonfederal oil and gas rights. In 2002, an oil and gas operator and the Sierra Club brought claims in federal court against Big Thicket National Preserve and Padre Island, respectively, challenging the parks' management of oil and gas operations. With assistance from the Division and the Washington and Field Solicitor's office, the parks are confident that they will maintain the validity of NPS regulations and policy, which are key tools for protecting park resources and values from potential impacts associated with the exercise of oil and gas rights.

Premium Exploration Company v. Big Thicket National Preserve

In April 2001, the president of Premium Exploration Company, an oil and gas operator in the Big Thicket National Preserve, sued the NPS claiming that the NPS has no authority to regulate his operation. Since Premium acquired the operation in 1998, the Preserve had attempted to get Premium into compliance with NPS regulations governing nonfederal oil and gas operations at 36 CFR Part 9, Subpart B ("9B Regulations"). Frustrated by its efforts, the park suspended Premium's operations and closed off the location to further development activity. Premium then filed suit. Litigation over this matter has extended through 2002, and although the case is not fully resolved, the court has ordered the parties to agree on a plan of operations and a suitable performance bond.

Congress established Big Thicket National Preserve in 1974 "in order to assure the preservation, conservation, and protection of the natural, scenic, and recreational values of a significant portion of the Big Thicket area in the state of Texas." Located in the southeastern corner of Texas, Big Thicket brings together a unique mix of the eastern hardwood forests, the Gulf coastal plains, and the Midwest prairies. When Congress established the Preserve, it intended for the United States to purchase only the "surface interest" of park, leaving the mineral rights vested in private entities and the state. Congress believed, as it did for 12 other NPS

units, that through its regulatory authority the NPS could effectively mitigate or prevent impairment to park resources and values from oil and gas activities.

In 1976, the Atlantic Richfield Company (ARCO) issued a lease to a private oil and gas developer. This lease was subsequently transferred to a number of medium sized oil and gas companies, and, in 1998, to Premium, a small player in the oil and gas industry. Premium's present operation consists of one marginal gas well and a one salt-water disposal well. When Premium acquired the lease its operation's were already subject to the 9B regulations.

NPS's 9B regulations govern the exercise of nonfederal (private and state) oil and gas rights. These regulations require that oil and gas operators submit a plan of operations to the park for review and consideration for approval. The operator's plan is a "blueprint" of when, where, and how an operator intends to conduct its operations. The operator must also to submit a performance bond that ensures compliance with the plan. Under the 9B regulations, operators are exempt from many of the regulatory requirements if their operations pre-date promulgation of the regulations (January 8, 1979), or pre-date establishment of the park unit, and are operating under a valid federal or state permit. Once, however, the operation is transferred and a new permit is issued, the operator loses the exemption and becomes subject to the 9B regulations.

Long before Premium acquired its lease, the previous operator, who first acquired the lease rights after 1979, was required by state law to obtain new state permits to operate these wells. As soon as the state issued new permits for this operation, the 9B exemption provision ceased to apply. When Premium acquired the subject lease, it was, thus, subject to 9B.

The federal district court judge has required the parties to agree on a plan of operations and a suitable performance bond. The park is working closely with the operator on its draft plan and anticipates that this matter will be resolved this year.

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Operators comply with regulatory requirements at Big Thicket National Preserve. Here an operator plugs an exhausted gas well. Photo by Pat O'Dell.



Sierra Club v. Padre Island National Seashore

As it did in the Big Thicket National Preserve, Congress left the mineral rights in private and state hands when it established Padre Island National Seashore. Today, Dunn McCampbell Royalty Interest, Inc. holds the mineral rights beneath the land portion of the park, and the State of Texas holds the mineral rights beneath the submerged parklands in the Gulf of Mexico and the Laguna Madre. Recent efforts by BNP Petroleum, Inc to exploit the oil and gas resources beneath the park has given rise to a legal challenge by the Sierra Club over the park's authorization of BNP's activities.

Congress created Padre Island National Seashore in 1962 “. . .to save and preserve, for purposes of public recreation, benefit, and inspiration, a portion of the diminishing seashore of the United States that remains undeveloped . . .” In addition to being one of the last undeveloped barrier islands in the United States, Padre Island is also the summer nesting grounds for the smallest and most endangered sea turtle in the world – the Kemp's ridley. While the stresses of commercial fishing and egg poaching caused their numbers to decline in the latter half of the 20th Century, the Kemp's ridley population has recently seen a small but steady comeback.

Because the park manages a number of active oil and gas wells, and there is no sign of a decrease in activity, it determined that effective management of these rights would be best achieved with an oil and gas management plan (O&GMP). The plan “describes the overall approaches that will be implemented over the next 15 to 20 years, or longer, to manage existing and anticipated oil and gas operations, including the exploration, development and transportation of oil and gas underlying Padre Island National Seashore . . .” The park prepared a thorough Environmental Impact Statement and went beyond National Environmental Policy Act (NEPA) requirements regarding public involvement in the process. The park issued its Record of Decision on the O&GMP on August 14, 2000.

In May, 2001, the park received BNP's first proposal to drill a gas well - the “Dunn-Murdock #1.” The NPS reviewed this plan, prepared an

Environmental Assessment, and performed its mandatory consultation duties under section 7 of the Endangered Species Act (ESA). The Regional Director approved BNP's plan on January 2, 2002. BNP's drilling program required, among other things, that it transport all of its drilling equipment 14 miles down the beach using large trucks and a number of support vehicles. Given that frequent heavy truck traffic presented potential for harm to nesting sea turtles, the park required that BNP adopt certain mitigation measures. These measures included a 15 m.p.h. speed limits for all heavy trucks, and that each truck would be accompanied by trained “turtle monitors” on ATV's, driven in front of each haul truck to spot turtle nesting sites. Soon thereafter, BNP submitted two other drilling proposals for the Lemon and Lemonseed wells. The park conduct similar review, compliance and consultation on these wells and the Regional Director authorized BNP to proceed with these two wells on November 8, 2002. The park conditioned its approval of the Lemon and Lemonseed wells with the same mitigation requirements as those contained in the approval of Dunn Murdock #1.

In April 2002, the Sierra Club filed a complaint in Federal District Court against the NPS and the U.S. Fish and Wildlife Service alleging the NPS violated procedural provisions under the NEPA and the ESA when it approved the Dunn Murdock #1 well. In December 2002, the Sierra Club amended the first complaint to include the Lemon and Lemonseed wells, and also alleged that the park violated the ESA when it prepared its Oil and Gas Management Plan.

For each of BNP's three wells and the Oil and Gas Management Plan, the NPS complied with regulations, policy, NEPA and the ESA. In addition to complying with applicable law and policy, the park's required mitigation has proven to be effective in protecting nesting turtles as there has never been a documented take of a hatchling at Padre Island N.S. due to oil and gas vehicle access along the beach. The park shares the Sierra Club's desire to give all park resources the best protection it can, and believes that the court will find that it is doing so through compliance with and prudent application of its regulatory authority.

An oil and gas operator plugs and abandons a gas well in Big Thicket National Preserve. Photo by Pat O'Dell.



Bat-Compatible Closures of Abandoned Mines

By: John Burghardt



Corynorhinus townsendii, or Townsend's big-eared bat, is one of the bat species protected by mine gates at Lake Mead National Recreation Area. Photo by Dr. J. Scott Altenbach.

Increased urban development, deforestation, and exploitation of caves have significantly impacted natural bat habitats. Therefore, abandoned mines are critical to the survival of numerous bat species. However, closure of abandoned mines for human health and safety poses a further threat to bats. The Geologic Resources Division Abandoned Mineral Land (AML) Program has promoted the use of bat-compatible mine closures throughout the National Park System. To date the National Park Service has placed approximately 125 bat-compatible mine closures in 18 park units.

Habitat surveys for bats and other species are an integral part of the abandoned mine pre-closure inventory process. When surveys of mines slated for closure reveal potential bat habitat, qualified wildlife biologists accompanied by experienced abandoned mine safety personnel conduct internal surveys. Internal surveys are useful to determine the bat species and the reasons the bats are using a mine. Depending upon location, airflow, temperature, humidity, and other factors, bats may use different portions of a mine for a day roost, night roost, maternity roost (to give birth and raise young), a stopover site during migration, or as a place to hibernate in winter. People entering a mine could induce bats to abandon their home, threatening bat survival particularly during hibernation and maternity seasons.

Once the determination is made that a mine merits habitat preservation, a closure is designed to suit the specific needs of resident species. Construction takes place in a season when the mine is uninhabited or at a time and in a manner that will cause the least disturbance to the bats.

Most bat gates constructed in the National Parks have used a design developed by the American Cave and Conservation Association (ACCA). The ACCA design uses 4"x4"x3/8" angle steel for structural members and cross member supports with two 1/2"x1/2"x1/4" angle steel "stiffeners" welded inside each horizontal cross member. These stiffeners provide integrity to allow cross-member spans of up to 10 feet between the uprights, making the gates much more accessible for bats and less restrictive to airflow. The massiveness of the reinforced cross members effectively discourages vandalism, a major concern for any gate closure. Several parks have used a design developed by the Utah AML Reclamation Program, which now uses Manganal steel bars for its bat gates. Manganal steel cannot be cut with a hack saw, and Manganal bar gates require less welding than ACCA gates, thereby reducing the difficulty and cost of fabrication. These gates are particularly ideal at remote sites where the transport of minimal materials is essential.

In 2002, Lake Mead National Recreation Area used the Division's AML funding to construct several ACCA gates. Many of the mines in this region not only have bats, but also the endangered desert tortoise. Lake Mead has modified its gates to include a special tortoise portal that is small enough to exclude even small children, but large enough to allow tortoise access. These gates have been very successful at preserving habitat for both bats and tortoises.



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Bat gate mine closure at Lake Mead.
Photo by Bryan Moore.

Restoration



Katmai National Park and Preserve. NPS photo.

Current Restoration Work by the Disturbed Lands Restoration and Abandoned Mineral Lands Programs

By: David Steensen

Over 575,000 acres in 195 park units have been disturbed by previous human activities and are targeted for restoration work. These disturbances include abandoned mines, roads, dams, canals, railroads, grazed areas, campgrounds, and other abandoned sites. Lands disturbed by human activity often cause unwanted and long-lasting problems that affect other park resources and facilities. For example, altered soils and landforms may affect biological communities and habitats in negative ways. Erosion and sedimentation problems, exotic plant invasion, and unsightly scars, among many others, produce problems for parks attempting to manage areas as natural habitat.

Restoration work includes actions to accelerate natural recovery processes at disturbed areas. Such work usually addresses the biological and the physical components of the area to establish stable landscapes that are capable of supporting the natural ecosystem mosaic and fostering self-perpetuating native plant communities.

In addition to surface degradation and restoration issues, many of the 3,200 abandoned mine sites (found in 132 parks), including 10,000 underground openings or surface quarries, are moderate to severe safety hazards. Unstable structures, falling hazards, explosives, and poor air quality (trapped gases) are serious issues where visitors or staff can access unsafe openings.

Annual Program

The Division manages two Servicewide funds focused on supporting ecological restoration projects in parks. The Natural Resource Preservation Program – Disturbed Lands (NRPP-DL) funds are a sub-element of the program and are oriented toward all abandoned developments and agricultural areas. Money in the Abandoned Mineral Lands (AML) Reclamation fund goes specifically to the cleanup of lands and waters, and the elimination of safety hazards at AML sites. In addition, the Division's technical staff provides the cornerstone of our activities in parks by providing coordination, oversight, and guidance in land restoration issues. At the park level, the Division coordinates three primary park-specific activities: project funding, technical assistance, and Servicewide information transfer.

Project Funding

Parks submit proposals to the various Natural Resources funding categories, including NRPP-DL and GRD-AML, via the Servicewide Coordinated Call. The NRPP-DL category provides \$850,000 annually in project funds. The GRD-AML category provided \$136,800 in project funds in FY2002 (see *Program Needs*, below). The Division distributes project funds based primarily on the ranking of the competitive proposals. Division staff reviews project work plans for technical adequacy and provides oversight in relation to cost accounting, accomplishments reporting, and the preparation of technical guidance.

Program Needs

The NPS estimates that to restore priority areas over the next five years would require \$65 million. Long-term restoration costs could be as high as \$650 million. There have been no funding increases for NRPP-DL since FY2000. In the case of GRD-AML, where there is an estimated \$40 million backlog, there have been no funding increases since FY1998. The lack of funding is reducing the availability of funds for projects.

Technical Assistance

With expertise in surface reclamation, fluvial geomorphology and slope stability, Division staff work cooperatively with other Divisions within the Natural Resource Program Center as well as outside specialists to provide parks with:

- Assistance with disturbed land inventories, site characterizations, resource impact assessments, and issue identification;
- Analysis of human health and safety hazards and development of mitigation designs;
- Assistance with developing proposals for funding;
- Geomorphic and geologic analyses, volumetric surveys, development of materials and equipment, and cost estimates;
- Landform restoration designs, engineering specifications, well-plugging specifications, and contract scopes-of-work;
- Project oversight assistance; and,

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The above sequence of photographs shows the progression of restoring an abandoned road in the former Sunrise Campground at Mount Rainier National Park. The road fill was placed back into the cut from which it came originally. Care was taken to salvage all available topsoil, which was then placed on the finished surface, to establish the best growing materials for the reestablishment of native vegetation. Photos by Dave Steensen.

•Facilitation of access to multidisciplinary expertise for natural systems restoration and conservation of critical habitat.

Servicewide Coordination

In accordance with the Government Performance and Results Act (GPRA), parks report performance to Servicewide GPRA Goal Ia1A, which involves restoring parklands disturbed by land use. Division staff involved with GPRA Goal Coordination provides technical guidance to central offices and parks.

The Division also facilitates cooperation with park or regional staff and among staff from the other Natural Resource Program Center divisions for disturbed lands restoration activities through the establishment of the NRPC Restoration Technical Advisory Group. Examples include the establishment of working groups to prepare or update restoration language for the NPS *Management Policies* and restoration guidance for *Reference Manual - 77*.

Disturbed Lands Projects Funded in FY02

NPS unit	Region	Project Title	FY02 Funds
Buffalo River	MWR	Stream Corridor Restoration Within Boxley Valley Historic Use Zone (48068)	\$15,000
Great Basin	PWR	Disturbed Land Restoration, Bonita Mine (3546)	\$59,700
Denali	AKR	Restoration of the Caribou Creek Watershed (41852)	\$67,000
Golden Gate	PWR	Lower Easkoot Creek Habitat Restoration Project (36738)	\$4,000
Palo Alto	IMR	Restore Resaca Wetlands and Associated Wet Prairie Habitats (59917)	\$43,800
Channel Islands	PWR	Protection of Endemic Island Oak and Rehabilitation of Actively Eroding Areas on Santa Rosa Island (61387)	\$39,100
Fire Island	NER	Plug and Abandon Flowing Wells (2088)	\$8,800
Florissant Fossil Beds	IMR	Removal and Restoration of Earthen Dams (60108)	\$44,000
Denali	AKR	Remove Hazardous Conditions in the Kantishna Mining District (25166)	\$70,500
Lake Mead	PWR	OHV Restoration - N.Shore/Lakeshore Scenic Drive Areas (76803)	\$88,100
St. Croix NSR	MWR	Restore Caps Creek to a Brook Trout Stream: The Schultz Ponds Project (71860)	\$95,000
Buffalo River	MWR	Develop Strategy for Runoff from Park Roads (73895)	\$56,600
Big Bend	IMR	Phase 2 Nine Point Draw Watershed Restoration (71833)	\$80,600
Yellowstone	IMR	Reclaim 3 Miles of the Abandoned Turbid Lake Road and Reconstruct Turbid Lake Trail (70637)	\$70,500
Pinnacles	PWR	Old Pinnacles Road Restoration (77027)	\$107,300
TOTAL NRPP- DL FUNDS ALLOCATED			\$850,000

Abandoned Mineral Lands Projects Funded in FY02

Park	Region	Project Title (PMIS#)	FY02 Funds
Petroglyph	IMR	Reclaim Three Abandoned Cinder Quarries (60219)	\$40,600
Whiskeytown	PWR	Remove AML Roads: Orofino Creek Watershed (77027)	\$27,500
Wrangell- St. Elias	AKR	Kennecott Mine Project - Year Four (41569)	\$27,500
Lake Mead	PWR	AML Site Reclamation and Wildlife Protection (76598)	\$41,200
TOTAL GRD- AML FUNDS ALLOCATED			\$136,800



Left: Restoration efforts continue on the JA cone at Petroglyph National Monument. Photo by Deanna Greco.

Restoration of Three Cinder Quarries at Petroglyph National Monument

By: Deanna Greco

Petroglyph National Monument, New Mexico, was established to protect a variety of cultural and natural resources including five volcanic cones, hundreds of archeological sites and an estimated 25,000 images carved by native peoples. The Monument stretches 17 miles along Albuquerque's West Mesa, a volcanic escarpment that dominates the city's western horizon. The escarpment is the erosional remnant of a series of basaltic lava flows. Desert varnish, a layer of iron and manganese oxides, coats the blocks of basalt, providing the surface used by prehistoric people to carve the petroglyphs.

The escarpment was created by six identified volcanic eruptions and the resulting flows, all occurring about 130,000 years ago. Five steep volcanic cones near the western edge of the West Mesa formed during the last phases of the eruptions. The cones are composed of interlayered basalt flows and cinders. The three highest cones, JA, Black, and Vulcan, are in Petroglyph National Monument.

Three cinder quarries located along the line of volcanic activity were mined as recently as the mid-1980's, prior to the establishment of the Monument. Two of the quarries are located on the flanks of Vulcan and Black cones. A third quarry was excavated into a vesicular basalt flow south of the JA cone. The three abandoned cinder quarries present visitor safety hazards and visually impact the ethnographic landscape preserved by the Monument. Two of the quarries are located in a heavily visited area of the

Monument. Natural vegetation has made very little progress since mining ceased. A 60-foot highwall exists in one quarry and a 15-foot highwall in another. These two sites are easily accessible by visitors and pose a strong potential for visitors falling from the highwalls.

The Monument sought the assistance of the Division to conduct a site analysis and gather data to prepare reclamation designs. The identified objectives of the reclamation were to reduce the safety hazards, obliterate or minimize physical scaring, and provide for optimum revegetation at all three sites. The Monument acquired funding for the project in 2000 through the Abandoned Mineral Lands (AML) Program, which is administered by the Division.

Restoration began on November 18, 2002, through an interagency agreement with the Corps of Engineers Rapid Response Group. Division staff traveled to the Monument to work with the Corps of Engineers on project oversight. With limited funding, some decisions had to be made regarding which portions of the restoration plan would be implemented. By the end of the week, the funding had been exhausted with the largest quarry receiving the bulk of the effort. This site contained the 60-foot highwall and therefore, posed the greatest safety hazard as well as being the most aesthetically displeasing. For the small amount of money allocated for the project, a tremendous amount of work was accomplished and this first attempt at restoring the sites was a great success. The park plans to seek additional funding to continue restoration efforts.

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Division staff and volunteer Fred Angel survey a dam in Point Reyes National Seashore for restoration design. Photo by Mark Ziegenbein.



Restoration of Small Dam Sites in the National Park System

By: Hal Pranger and Mark Ziegenbein

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The NPS Dam Safety Database (updated June 2002) lists approximately 950 dams in the National Park System, of which 237 are listed as having “High” or “Significant” safety hazards. The database is not comprehensive, and it is likely that there are more than 950 dams in NPS units. It is also likely that more than 237 dams are candidates for removal because many “safe” dams are presently creating, or have the potential to create, significant natural, cultural, and historic resource impacts.

There are many reasons to remove unneeded and unmaintained dams. Unmaintained dams have the potential for failure. A sudden release of water at maximum reservoir volume and high streamflow can be violent. In addition to the inherent public safety hazards and property damage potential, a sudden discharge is likely to release tons of sediment to the stream system and may scour the streambed and riparian areas below the dam. This scouring and vegetative damage can create slope and stream bank instability and increased erosion in future years.

Intact dams impound and sometimes divert water that normally would flow downstream, providing riparian and aquatic habitat. Many fish species need the variability of an unregulated streamflow to survive. This habitat is often created in a healthy alluvial stream channel that is free to migrate across a valley bottom during

flood events. Dams capture the natural sediment loads and release fixed levels of streamflow. These factors, among others, prevent alluvial channels from maintaining their natural form and function. The health of a natural fluvial ecosystem is dependent on the natural variation of unregulated streamflow and sedimentation rates. Also, dams are artificial structures that can obstruct aesthetic views and reduce public enjoyment of the natural setting.

In 2002, Division staff assisted parks nationwide in the removal of unmaintained dams, developing plans to remove these dams, and developing management alternatives for unmaintained earthen dams. Specific projects include sites at Florissant Fossil Beds National Monument (FLFO), Lassen Volcanic National Park (LAVO) and Point Reyes National Seashore (PORE). At FLFO five impoundments were removed that crossed valley bottoms containing subirrigated wet meadows. At LAVO detailed topographic and bathymetric surveys were conducted to aid in development of alternative management plans. At PORE the Division provided assistance in implementing dam removal and the restoration of fluvial, tidal, and estuarine processes.

Florissant Fossil Beds

Since its creation by Congress in 1969, Florissant Fossil Beds has been internationally known for

its exquisitely preserved 35 million-year-old plant and insect fossils. But, FLFO has other important natural resources as well. FLFO is located on about 6000 acres of rolling hills and meadows at an elevation of between about 7,000 and 8,000 feet. Coarse loose gravel deposits are quite common throughout the park. In wetter areas such as around stock ponds and in stream drainages, the soils are poorly drained, highly organic and typically alkaline. A number of small intermittent spring-fed streams flow through FLFO. The uplands are mainly low, dry grass-covered hills with short shrubs, grasses, and annual or perennial herbs. There are also many dry gulches in the Monument.

There are 44 earthen dams in FLFO. All were built by the Soil Conservation Service in the 1930s and 1940s for erosion control and/or water retention. Five dams, all located in the Grape Creek and Upper Boulder Creek drainages were successfully removed. These dams had the greatest impacts, fewest benefits, and highest potential for restoration success. Three of the five dams impounded water either perennially or intermittently. The other two were constantly dry. Each of the dams crosses a section of valley containing valuable subirrigated wet meadows. The dams ranged in height from about two to twenty feet.

The dam removal project was completed with the reclamation and revegetation services of the U.S. Army Corps of Engineers (USACE) Rapid Response Center (RRC) using a highly-skilled contractor. The reclamation activities included placing the fill of each dam back into its original borrow pit, blending all materials inconspicuously into the surrounding terrain, revegetating the bare areas, and restoring streamflow back to the original drainages. The RRC completed the work within a week. The RRC will be restoring other sites in FY '03 at Petroglyph National Monument, Pinnacles National Monument and Point Reyes National Seashore. Because the RRC has a proven record of excellent restoration skills, the Division hopes to develop a long-term relationship with them to complete many more restoration projects.

Lassen Volcanic National Park

In 1932, the Sifford family, owners of the Drakesbad Guest Ranch, constructed the Dream Lake Dam in what is now Lassen Volcanic National Park. The purpose of the dam was to provide recreational opportunities for guests at the ranch, which it has for the past seventy years. Ranch records indicate that the dam washed out on two previous occasions: the winter of 1938 and the winter of 1952. On both occasions the

ranch owners reconstructed the dam by filling the breached areas with uncompacted fill material of unknown composition.

In the fall of 2001, Geologic Resources Division and Water Resources Division staff traveled to the park in response to a technical assistance request. Mark Ziegenbein (GRD geologist) and Gary Smiley (WRD hydrologist) conducted a site assessment that consisted of the following:

- Photo documentation of site features;
- Total Station survey of the dam, the borrow pit and surrounding topography;
- Bathymetric survey of the lake bottom;
- GPS survey of surface features around the dam;
- Visual assessment of soils, soil compaction, surface water flow and condition, erosional features, sediment contribution to surface waters, natural revegetation and revegetation potential; and,
- On-site discussion of restoration options.

The park is currently in the process of developing a management plan and an Environmental Impact Statement to evaluate management alternatives for the dam and reservoir.

Restoration of Lower Glenbrook Dam – Point Reyes National Seashore

In the 1950's, prior to the establishment of Point Reyes National Seashore, land developers constructed miles of roads and dozens of dams. One such dam, the Lower Glenbrook Dam, impounded water at the mouth of Glenbrook Creek where it entered the Limintour Estuary in Drakes Bay. The 600-foot long earthen dam flooded 10+ acres of tidal and subtidal marshland and impeded access of steelhead trout to sensitive habitat in Glenbrook Creek. In the early 1980s, a portion of the dam breached allowing the creek to flow through the constriction. However, the dam continues to impede natural stream channel migration and function, contributes sediment to the estuary and interferes with natural estuarine function. Using Disturbed Lands Restoration funding, in 1997 and 1998, the Division inventoried, surveyed, and developed restoration design drawings for the removal of the dam and restoration of the associated spillway and extraction site. However, the project has been postponed to complete an environmental review. Division staff continue to assist the park with project planning, oversight and cost estimating.

Disturbed Lands Restoration at Golden Gate National Recreation Area

By: Hal Pranger

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Division staff survey Marincello Road at Golden Gate National Recreation Area. Photo by Hal Pranger.

The Division assisted Golden Gate National Recreation Area (GOGA) with a broad array of disturbed lands issues during the year. Originally, GOGA asked the Division to evaluate four disturbed lands sites: an abandoned road, a partially reclaimed mine, a group of coastal dumpsites, and a disturbed coastal stream. However, during the site visit five more sites were added to the list – two ponds, a wetland, a trail passing through a landslide complex, and a trail repeatedly being covered with sediment. Even with such a wide assortment of sites, the Division was able to provide plans to restore, stabilize, or reconstruct each site. Because of time constraints, detailed recommendations were prepared for only three sites and more general advice for the other six. This report summarizes the projects and recommendations for the three sites that were evaluated in detail.

Marincello Road is a 1.5-mile long, 60 to 75-foot wide unpaved road corridor that was cut into a hillside in the 1960s in Tennessee Valley. It was intended to be the main thoroughfare to a proposed housing development that was never constructed. About 15 feet of the road corridor is maintained as a trail and for emergency access (see figure). Most of the rock and soil material that was excavated to create the road, about 700,000 cubic yards, was used to fill two small valleys and create level ground for development. Before the road was built, storm runoff flowed freely down numerous vegetated headwater drainages. Afterwards, the road bench captured and increased runoff that greatly increased erosion and sedimentation. The road corridor also became infested with exotic plants. Besides recommending immediate short-term maintenance recommendations, Division staff suggested that GOGA staff select one of three long-term stabilization options: (1) create permanent crossroad drains (~ \$150,000); (2) partially restore the road corridor slope (~\$400,000); or (3) fully restore the road corridor (~\$4 million). For each progressively expensive alternative there are increased ecosystem and aesthetic benefits and fewer maintenance requirements. If the park chooses any of these long-term alternatives, additional fieldwork would be needed to refine the design and cost estimate.

Capehart Quarry was a 3.8-acre gravel pit used for road aggregate until the 1980s. In 1988, 2.3

additional acres were disturbed in an unsuccessful attempt to reclaim Capehart Quarry. Topsoil was stripped and buried in the old pit, leaving bare and sterile chert bedrock exposed at the surface. The entire reclaimed site was seeded in 1988, but very little native vegetation took hold on the bare rock slope. However, the poor growing conditions were tolerable for invasive species such as French Broom. The native slopes immediately adjacent to Capehart Quarry are classified as habitat for the endangered Mission Blue Butterfly. Similar to Marincello Road, the roads uphill of Capehart Quarry divert flow over the reclaimed land and have carved tremendous gullies into the reclaimed hillslope. The Division recommended that GOGA immediately regrade the roads uphill of the site and fill in the gullies. It also recommended a field trial to construct a patchwork of ten vegetated 2-foot by 10-foot soil-filled trenches into the bare rock slope. The Division's long-term recommendations are to: (1) incorporate the results of the field trial into an overall site reclamation plan in two to five years; (2) remove and restore the largest road uphill of the site; and (3) install water bars on a small road/trail uphill of the quarry.

Hollis Pond is a small headland impoundment that was constructed between 1952 and 1968 to water livestock in upper Oakwood Valley. It currently is abandoned and filling with sediment. Only two six-inch diameter pipes lie on top of the embankment as outlets. The dam's surface is deteriorating and appears ready to fail. Water is within six inches of the top of the dam. Hollis Pond could rather easily be removed and restored to blend in with the surrounding landscape. The Division estimated that approximately 1500 cubic yards of material were excavated from the pond area to create the embankment and that up to 1250 yards of sediment have accumulated behind the dam. The Division recommended that GOGA remove Hollis Pond and fully restore the surrounding area. The preliminary cost estimate to restore Hollis Pond is about \$30,000.

The field visit indicated that there could be more disturbed sites at GOGA than just the nine evaluated during the site visit. A report to GOGA from the Division suggested that the park consider developing a comprehensive disturbed lands inventory and a systematic plan to restore those sites.

Parkwide Disturbed Lands Inventories: Black Canyon of the Gunnison National Park, Curecanti National Recreation Area, Buffalo National River and Joshua Tree National Park

By: Mark S. Ziegenbein

Before many of our National Parks were established, previous land users created disturbances and modifications to surface hydrology. After park establishment, the NPS also created disturbances related to park maintenance and construction. According to the NPS Performance Management Data System, there are 575,000 acres of disturbed lands in the Park System in need of restoration. These surface disturbances include: roads, parking lots, campgrounds, gravel pits, rock quarries, mine sites, oil and gas sites, buildings, dumps, dams, stream channel modifications, and drained wetlands. In most cases parks no longer use these sites and many sites have been inactive for more than 30 years. But, the impacts remain, including increased erosion and sedimentation, removal or alteration of vegetation and habitat, contamination, visual impacts and safety hazards.

NPS policy for disturbed lands states: “The NPS will reestablish natural functions and processes in human-disturbed natural systems in parks unless otherwise directed by Congress.”

The Division is assisting parks to inventory and evaluate these sites, recommend restoration actions, and implement the restoration needed to “reestablish natural functions and processes.” Division assistance may include providing guidance, examples and templates to enable parks to complete their own inventories, brokering assistance from other NPS offices, other agencies, universities or private environmental consulting firms, and/or Division staff performing the inventory, assessment, and

oversight.

A relatively new focus of the the Division’s Disturbed Land Restoration (DLR) Program is the development of parkwide inventories and restoration recommendations. Armed with the knowledge of the number, location and severity of resource impacts at these sites, park managers can prioritize these sites for remedial action, develop programmatic restoration Environmental Assessments (EAs), successfully compete for restoration dollars, and be more effective in protecting park resources from the effects of disturbed land sites.

In 2000, the Division developed a parkwide DLR inventory for Lassen Volcanic National Park. Since that time the park has initiated or completed several projects including successfully competing for DLR funding to restore an abandoned ski area, removing waste asphalt from four abandoned gravel pits, with the assistance from the Federal Highway Administration, and negotiating with the State of California to clean up waste metal and concrete from several gravel pits. This summer the Division is initiating restoration actions at a medium-sized rock quarry, removing about one-quarter mile of unneeded paved road and restoring a modified stream channel. The Division has begun the research and initiated a pilot project to protect the hydrologic integrity of a degraded fen (peat wetland).

In 2002, the Division assisted Black Canyon National Park and Curecanti National Recreation Area with parkwide disturbed lands

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Division and park staff discuss restoration options at an active gravel pit in Joshua Tree National Park. Photo by Mark Ziegenbein.



Division and park staff conduct GPS mapping of a prospect pit in Curecanti National Recreation Area. Photo by Mark Ziegenbein.



inventories and restoration recommendations. This three-week, two-park inventory was also used to field test the effectiveness of the newly developed Disturbed Land Inventory Protocol. Also in 2002, GRD assisted Joshua Tree National Park by performing an inventory and restoration design for in-park gravel extraction sites and assisted Buffalo National River with a roads inventory. Below are descriptions of these three efforts.

Black Canyon of the Gunnison National Park and Curecanti National Recreation Area

Realizing that they were facing an unquantified and undefined threat to park resources, the park superintendent and Chief of Resources requested assistance from the GRD to perform the following assessment:

- Assist in the inventory of the number, location and size of disturbed land sites in the park;
- Perform a cursory assessment of the potential impacts related to each site;
- Recommend remedial measures or additional information needed at each site;
- Develop restoration site diagrams and cross-sections if needed; and,
- Provide an order-of-magnitude estimate of time, equipment and materials needed at each site.

Division staff conducted fieldwork in the park September 16 - October 4, 2002. The resulting report addresses a total of 55 disturbed sites. A restoration specialist in coordination with park revegetation specialists conducted site inventories at 44 locations. The Division had previously inventoried and designed restoration at two sites and included these sites in the report. Site inventories consisted of:

- Locating each site on 7 ½' topographic quadrangle maps;
- Mapping site features using Geographical Positioning System (GPS);
- Photo documentation of site features;
- Visual assessment of soil compaction, and observing the presence or absence of soil or growth medium, surface water flow and condition, erosional features, sediment contribution to surface waters, vegetative community, natural revegetation and revegetation potential; and
- On-site discussions of restoration options.

Sites that require major recontouring and restoration work need detailed surveys in addition to the above inventory. Detailed surveys consist of:

- Detailed topographic surveys of the site;
- A thorough assessment of soils, surface water

flow, vegetation, and erosional features; and,

- Development of grading plans and restoration prescriptions.

The inventories will be used to prioritize the 55 sites so that funds are directed towards sites that are creating the most severe resource impacts. The general description of typical activities required to restore each of the six categories of disturbed sites may be used to develop a programmatic restoration EA. The restoration recommendations and designs may be used to implement remedial actions by park staff, or to compete for funding on larger, more complex sites.

Joshua Tree National Park

Similarly, in Joshua Tree National Park, land users and the NPS had created gravel pits and rock quarries to provide the raw materials for roads and park facility construction and maintenance. Disturbances related to these extraction sites include: gravel pits and rock quarries, access roads, asphalt mixing tables, stockpiles, staging and processing areas, and associated modifications to surface topography and hydrology.

- In 2001, the park requested assistance from the Division to perform a parkwide inventory and assessment of these sites. Division geologists and restoration specialists conducted fieldwork in the park April 30 - May 3, 2001, and February 4 - 8, 2002, covering a total of 19 sites ranging in size from ten-acre extraction and processing sites to minor half-acre gravel pits.

- The resulting report and site specific designs will enable the park to prioritize sites for restoration, develop a programmatic restoration EA, initiate action at relatively small sites, and compete for funding on the larger, more complex

sites.

Buffalo National River

Buffalo National River, Arkansas, was established for the purpose of conserving and interpreting unique scenic and scientific features, and preserving an important segment of the Buffalo River as a free-flowing stream. Because of park concerns about excess sediment and storm water flowing from roads into tributaries and directly into the Buffalo River itself, park staff sought technical assistance from the Division. The dirt and gravel roads that exist inside the park have been poorly constructed and maintained. Most of the road network is composed of old county roads existing when the park was designated. There is a lack of proper drainage structures and those structures that do exist have been improperly located or constructed. The excessive road runoff cuts across the landscape, impacting scenic values, diminishing visitor experiences, and increasing turbidity above natural levels. Therefore, the park felt a strong need to inventory and assess the active and abandoned road network inside the park to provide the necessary information to address the problem.

The objectives of the inventory and assessment were as follows:

- Identify information needs and develop and/or modify field inventory forms and specific assessment methodologies;
- Inventory and assess active, backcountry, and abandoned roads;
- Input inventory and assessment data into ArcView;
- Categorize and rank roads based on impacts;
- Recommend mitigation measures; and,
- Develop a final report of findings and cost estimates.

Division staff examine an abandoned gravel extraction site at Black Canyon National Park. Photo by Mark Ziegenbein.



Inventory and Monitoring



Isle Royale National Park. NPS photo.

Using Scoping Meetings as a Tool for Geologic Resources Inventory and Geologic Processes Monitoring

By: Tim Connors, Bruce Heise, and Robert D. Higgins

In order to meet Servicewide goals and objectives in inventory and monitoring, the Division facilitates scoping meetings in various NPS units in order to gain a better understanding of the geologic issues facing parks, and ways to implement programs that would be the most useful. Scoping meetings provide a forum for discussion about geologic resource issues, inventory needs, monitoring recommendations, utility of geologic maps, and the significance of geologic features and processes in park ecosystems. A unique component to these scoping meetings is the participants. Around 20-30 academic professionals, park personnel, other agency geoscientists (i.e USGS), and Division staff all join together for a common goal—sharing knowledge about park geologic resources in order to make more informed management decisions. Because of the considerable interest the geologic community has for park geologic resources, most of the non-NPS geoscientists participate in the scoping meetings at no cost to the NPS. The value of this donated service ranges between \$100,000-200,000 per year. The networking that often develops between the park staff and the geoscientists as a result of the scoping meetings is an invaluable asset for future cooperative work.

In 2002, the Division facilitated 29 geologic scoping meetings in NPS units. Two types of scoping meetings are conducted by the Division: Geologic Resources Inventory (GRI) and GPRA Goal Ib4 (identifying geologic processes and the human influences on those processes in park ecosystems). Both types of meetings, GRI and Ib4, are typically conducted at a given park over a two to three-day period. To kick-off the

scoping sessions, a geologic field trip is held to highlight park geologic resources and issues. A one to two-day meeting follows with detailed discussions about specific geologic-related issues facing the park. Resource management issues are also identified.

Geologic Resources Inventory

Twenty-three GRI scoping sessions were held in FY-02. The purpose of the GRI scoping session is to collect information on status of geologic maps available for each NPS unit. All available maps are identified and then a determination is made on which maps are useful and should be digitized. Other mapping needs are also identified. There is also a discussion on how the maps can be used for resource management decisions, facility locations, maintenance projects, and interpretive displays. After the meeting, a comprehensive report on all of the geology relevant to the park is written for resource management purposes. GRI staff is also maintaining a Servicewide database of all known geologic maps related to NPS units, and geologic bibliographies (GRBIB) as a subset of the NRBIB database.

Geologic Processes (GPRA Ib4)

In FY-02, six scoping meeting were held in NPS units to identify geologic processes and the human influences that affect those processes. After each meeting, geologic reports are prepared that address the park unit's specific geologic issues, geologic processes and the human influences on these processes, research, and inventory and monitoring needs.

Both types of scoping meetings have been successful in sharing knowledge about the park

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Additional information on geologic processes (GPRA goal Ib4) and the completed reports can be found at: <http://www2.nature.nps.gov/grd/geology/monitoring/ib4/>

Geologic Scoping Meeting Defined

A geologic scoping meeting is one of the first stages in the planning process, where a park can solicit input from a range of geoscientists, some with specific expertise in a given field of study, and others having knowledge of the local area. Through sharing knowledge, ideas, and concerns, the meeting helps to develop a general understanding of major geoscience resource issues and management concerns. The meeting produces a report that defines the issues, lists the topics that address significant resource protection, resource management, and planning needs, and helps define the possible direction for future actions.

NPS staff learn about the geology in Yosemite National Park from Allen Glazner, University of North Carolina, and King Huber. Photo by Lindy Allen.



More detailed information on the Geologic Resources Inventory is available at: <http://www2.nature.nps.gov/grd/geology/gri>. The bibliographies are available at: <https://science1.nature.nps.gov/naturebib/>

geology. Park staffs appreciate the “big picture” overview of geoscience issues, needs, and tools, while Division staff have an opportunity to become familiar with park specific geology, and can apply it to Servicewide issues. The scoping meetings also provide an opportunity for non-NPS geoscientists to participate and gain a better understanding of issues and challenges facing the NPS. The interaction among these three groups through scoping meetings has provided fresh ideas and new solutions to land management issues.

The Division will continue to facilitate scoping

sessions in NPS units. In the upcoming year, the Division is planning on revising the park scoping meeting process to incorporate discussions on issues that should be incorporated into the park’s General Management Plan and Resource Stewardship Plan. With few revisions to the focus of the scoping meetings, “Performance Management” objectives will still be obtained, while expanding to include issue identification, local inventory needs, monitoring suggestions, research, education about the utility of geologic maps, and the role of geology in park ecosystems.

Where Scoping Meetings Fit

The NPS has relatively few geologists Servicewide. Of the 30 parks that have geology staff, approximately one-third are paleontologists, another third are cave specialists, and most of the remaining third are geomorphologists (most focused on watershed management and site restoration). It does not appear that any park has the array of geologists needed to address all geologic concerns. This has created the demand for the Division to not only provide the traditional Washington Office role, but also to spend more time at the parks and with park staff. One way in which the division accomplishes this is through a wide spectrum of technical assistance projects designed to respond to specific park requests. Another method — that is increasing in popularity — is the use of park geologic scoping meetings.

Geologic Processes and Human Influence

by: Sid Covington, Robert D. Higgins and Katie KellerLynn

The NPS Strategic Plan goal Ib4, “Geologic Processes,” calls for parks to inventory their geologic processes and features and to document the human influences that affect them. This goal underscores the essential role that geology plays in the long-term health of park ecosystems, and the need to integrate geologic information into park decision-making. By identifying the human impacts to geologic features and processes (geoindicators), the NPS can begin to learn how to protect, mitigate, and restore these features and processes as well as other resources, such as vegetation and wildlife, which are dependent on them. Geoindicators are used as a tool to assess rapid change in the environment and provide some measure of ecological health. The goal of this phase is to identify the issues and generate written reports at 54 (20% sample) of the 270 parks that are characterized as natural resource parks.

In order to accomplish this goal, the Division holds scoping sessions at several parks each year. Park personnel, geoscientists from the United States Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), academic institutions, and the Division participate in these scoping sessions. The session usually includes a field trip and a meeting to discuss significant geologic processes, and human impacts on those processes. In addition, the meeting participants identify geologic inventory and monitoring needs and research opportunities.

Six separate scoping meetings, covering nine parks, were held this year including: National Capital Parks East (Anacostia Park), Northern Colorado Plateau Group (Arches National Park, Canyonlands National Park, Capitol Reef National Park, and Natural Bridges National Monument), Glacier National Park, George Washington Birthplace National Monument, George Washington Memorial Parkway, and Colorado National Monument. The Division also held a scoping meeting for Cape Cod National Seashore in Denver via telephone in March. Although several of the participants had attended a field trip the previous year, no scoping meeting was held at the park. Statistics from these scoping meetings can be found at: <http://www2.nature.nps.gov/grd/geology/monitoring/ib4/index.htm>

These scoping meetings yielded very useful results. They identified significant human

impacts on geologic processes in all ten park units, a need for long-term geologic monitoring, and information gaps that could be addressed by research. In FY 2004, the goal will be revised to reflect hydrologic as well as geologic processes. By that time, the Water Resources Division will be a full partner in implementing the goal. The knowledge that the Division obtains from this goal will be applied in developing a new goal for FY 2006. It will address the need to mitigate impacts to geologic processes.

Scoping Meetings

The Cape Cod National Seashore scoping meeting was unique in that it was the only meeting conducted by teleconference. Park staff, Division staff, and representatives from USGS and NOAA participated. The most important issues identified related to coastal processes, especially shoreline position and dune formation, groundwater, surface water, and wetlands. Much of the discussions centered on the great extent of human impacts on the Cape Cod area. The Division scoping team agreed that scoping meetings held via telephone are the least effective way to explore the issues and this method should be avoided in the future. There is no substitute for the immediacy of discussions held in the park immediately following a field trip.

National Capital Parks East consists of 12 major units in the Washington, D.C., area and adjacent Maryland. The scoping meeting held at Anacostia Park in May, focused mainly on Anacostia and nearby units. This meeting provided insight into the issues of geology in an

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Board walks near Glacier National
Park's Logan Pass Visitor Center help
mitigate human-caused erosion in
alpine meadows. Photo by Katie
KellerLynn.



Rockfall closes Rim Rock Drive in Colorado National Monument. NPS photo.



urban environment. Anacostia Park is a river corridor along the Anacostia River which flows into Potomac. Principal issues include storm water management, dredge and fill of the river channel, surface water quality (urban runoff), landfills, wetlands, soil quality, and shoreline accretion and erosion (especially at Piscataway Park).

There are 16 parks in the Northern Colorado Plateau Vital Signs Network Group. Of these, four parks were combined for one scoping meeting: Arches NP, Canyonlands NP, Capitol Reef NP, and Natural Bridges NM. The scoping meeting, held in June, was located in Moab, Utah. Although scoping several parks at one time is not the most effective way to learn about the specific issues of each park, there were many common issues among these four parks. The major issues included desert crusts, wind erosion, surface water and groundwater, and soil quality.

A scoping meeting was held for Glacier National Park in August, in conjunction with a park planning meeting and combined with a joint discussion and field trip to Waterton Lakes NP in Canada, co-sponsored by the NPS, Parks Canada, and the International Union of Geological Sciences. The major issues affecting Glacier are wetlands, quality and erosion of soils, slope failure and snow avalanches, and surface water issues, especially streamflow and surface water quality. Although glaciers and glacial features are the rationale for the existence of the park, it is well established that the glaciers are rapidly diminishing and will probably be gone in

30 years. Other than global warming, there is very little human impact on the rate of glacial retreat.

The scoping meetings for George Washington Birthplace National Monument (GEWA) and George Washington Memorial Parkway were held in September. As with National Capital Parks East, these parks reflect influence from the urban environment. GEWA has additional issues of coastal (Potomac River) erosion, slope failure and wetlands. The Parkway is unique in that it is a long, narrow corridor running through a highly urbanized environment.

The scoping meeting for Colorado National Monument (COLM) was also held in September. Major issues at COLM are rock falls and flashfloods, especially as they affect residents of Grand Junction in the valley below the Monument, and slope failure, as it affects the Rim Rock Drive. Wetlands, although limited in number and extent, are also of importance to the park. The scoping meeting was held in conjunction with planning meetings for the writing of a new General Management Plan for the park.

Whenever possible, scoping meeting are held in parks with significant geologic resources that are being influenced by human activities, working on General Management Plans, or are involved with the Vital Signs Network. The priority of future Geologic Processes scoping meetings will be driven by the Vital Sign Network, planning issues, or technical assistance requests presented to the Division.

Importance of Geologic Information in Urban Parks

By: Robert D. Higgins

Concrete, asphalt, steel, and glass have replaced the natural building blocks of rock, soil, and vegetation in our urban landscape. Rivers, lakes, and wetlands are either obliterated or unrecognizable, replaced with buildings, streets, and parking lots. Collectively, this is known as urban sprawl. Humans have made a lasting impact on the landscape. How can geologists contribute to addressing and understanding resource issues in the urban environment?

There is still much we do not understand about both natural and urban ecosystems. Many of our NPS units are in urban settings. The inventory and monitoring components of the Natural Resource Challenge Program provides urban parks with resources to better understand natural ecosystems prior to urban development, the effects of urbanization on natural systems, and changes needed to create a viable and sustainable ecosystem in the urban environment.

The Division has had an opportunity to play a key role in this effort by supporting Vital Signs Networks, including those with urban parks. The first part of the task is to gain an understanding of the geologic processes that have been disrupted by urbanization. The second part of the objective will be to help design near naturally functioning geologic processes that are compatible with the urban environment and are sustainable over time. The location of many urban NPS units and some of the preservation practices used in those units are contributing factors in the ecological analysis of the urban setting. Studying urban parkways will help the NPS understand the alterations of ecosystems by linear features such as highways, power lines, and pipelines. Urban parks offer an opportunity to study high visitor use and the resulting soil compaction and vegetation damage. Armored and channelized streams in urban parks can be assessed for loss of productivity. Comparisons of non-urbanized battlefields, farms and other cultural sites with the urbanized lands adjacent to them can provide clues about how natural systems may have functioned in the past.

The Division is already contributing in several ways. Through the Disturbed Lands Restoration Program, Division staff worked on ten restoration projects in urban parks, with the goal of restoring sites to ecologically functioning conditions. These disturbed lands restoration projects being implemented by the Division in urban parks are testing the ability to restore

geologic processes and establish natural or nearly natural functioning systems. This work has led to an appreciation of the complexity and difficulties involved in making urban ecosystems viable and sustainable. In many ways this is more complex than restoring natural ecosystems.

Division staff are implementing Servicewide GPRA Goal Ib4, designed to identify human influences on geologic processes. In 2002, the Division helped parks address issues of urban geology and human influences on geologic processes in urban ecosystems by using the GPRA Ib4 Geoindicators Scoping Meeting. The meetings were focused on George Washington Birthplace National Monument, George Washington National Memorial Parkway, and National Capital Parks East. The Division also participated in the series of National Capital I&M Network Vital Signs Scoping Meetings.

Urban expansion into relatively undisturbed areas will continue. Learning how to restore highly altered ecosystems either by mimicking natural systems or designing new ecosystems will be challenging. The role of geology is critical to understanding how ecosystems function. The NPS should have a key role in urban studies because of the number of urban units in the NPS. The Division will continue to provide geologic input to identify inventory and monitoring needs and to assess, design, and implement restoration projects that return ecosystems to desired conditions in the urban setting. Supporting this effort, the Division will also continue to improve the basic

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National Capital Parks East are located in the heart Washington DC. Geology plays a vital role in urban parks as well as natural resource parks. NPS photo.



Developing Coastal Mapping Protocols in the National Park System

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A comprehensive geologic resource inventory and mapping program is necessary for the effective management of our coastal National Parks. At present the NPS includes 97 coastal units encompassing more than 7,300 miles of shoreline. In coastal areas, surficial and subsurface geology are complexly intertwined with park flora, fauna, water, air, and cultural resources. In addition relative sea-level rise, geologic hazards, and anthropogenic modifications create an immediate need for detailed geologic mapping in coastal areas. In 2002, no mapping products or standards existed to meet this need. The Geologic Resources Inventory (GRI), cooperatively administered by the NPS Inventory and Monitoring Program and the Division, took an important first step in meeting the geologic and surficial landform mapping requirements of NPS coastal park units.

The GRI coordinated and funded a Coastal Mapping Protocols workshop held June 25-27, 2002, at Canaveral National Seashore (CANA) to address coastal park mapping needs and coastal management issues. This workshop brought together 38 federal, state, academic, and private industry employees including park managers, coastal geologists, resource specialists, information technology specialists and inventory and monitoring coordinators, to establish coastal mapping protocols for Atlantic and Gulf coastal parks in the NPS. Workshop participants discussed coastal park management issues and formulated a draft list of Coastal Landform Mapping (CLM) units that should be incorporated into coastal geology mapping products. GRI staff members will integrate these mapping units into the NPS Geology-GIS Data Model, the documented standard for digital geologic maps within the NPS.

Building upon this list of mapping units, the GRI scoping meetings will identify an inventory of the significant geologic resources contained within each coastal unit. In addition, scoping meetings will determine individual park mapping priorities and needs. The GRI will attempt to provide coastal NPS units with bedrock geology, surficial geology and/or landform mapping products. Mapping products should include GIS digital coverages, hard copy geologic maps, and/or supplemental information regarding significant geologic features and processes found

within each park unit. When possible, the GRI may also supply coastal parks with existing bathymetric, topographic, and benthic habitat mapping coverage. These maps will provide the geologic framework and base cartographic information necessary for park managers to effectively monitor

coastal change and shoreline dynamics. GRI coordinators have outlined several inventory action items and more specific project tasks related to CLM that will be included in the FY2003 GRI work plan.

The participants of the Coastal Mapping Protocols Workshop strongly encouraged a "holistic" ecosystem approach for the effective management of our federally protected coastal parks. To understand the broad range of multi-faceted issues commonly confronting coastal park managers, coastal landform maps should be integrated with biological and physical system components, including vegetation, species habitat, and oceanographic variables. Park infrastructure, boundary information, shoreline engineering, and cultural resources may also be integrated with the final geologic map products. GRI staff will work with coordinators of other Natural Resource inventories and their partners to identify and initiate possible integrated data collection and mapping projects. Cooperative projects may allow significant cost savings for the inventories and higher quality data products for park managers.



Jim Allen guides workshop participants on a field trip at Cape Canaveral National Seashore. Photo by Rebecca Beavers.

Focus Groups Help Identify Vital Signs

The Natural Resource Challenge has produced a realization within the NPS resource management community that there is less of an understanding of natural resources than previously thought. The political reality which controls federal funding changes, sometimes forcing short-term fixes to long-term problems. However, the need to utilize scientific expertise to compile information for decision-making is immediate. In many instances, the NPS does not have the scientific expertise to make recommendations to management in a short time frame, as is the situation with geologic resource information and management. Identifying “vital signs” for long-term monitoring of ecosystem health is one of the challenges we face. To select geological indicators of rapid environmental change for a given ecosystem demands a high level of understanding about natural system dynamics, both abiotic and biotic. A practicable way in which to solve the problem is to convene “focus groups” to deal with the need for technical and timely information.

A geoscience focus group brings the required expertise together with the staff and management of the park to provide key information and develop recommendations in a relatively short period of time, on the order of one to three days. This process utilizes the institutional knowledge of the group members and avoids the time consuming process of gathering and summarizing large amounts of data.

The Division is working with the NPS Vital Signs Monitoring Networks and CESUs to identify geologic expertise within the Inventory and Monitoring Network ecosystems. To date, geology focus groups have been successfully used in coordination with a number of network workshops. The NPS held focus group meetings in 2002 for three network groups: the National Capital Network, San Francisco Bay Network, and Mediterranean Coast Network. Five more geology vital signs focus groups are planned to convene in 2003.

This method continues to show promise to meet NPS needs in other areas as well. The Division would like to use the focus group concept for geologic planning and interpretation. It would be beneficial in the preparation of planning documents such as General Management Plans (GMPs), Resource Management Plans (RMPs) and thematic geologic resource plans.

Coastal Geology Information Sources

By: Rebecca Beavers and Kim Nelson

While many people recognize the national seashores and lakeshores as coastal resources of the National Park Service, few people are aware of the diversity of issues and challenges facing the more than 90 parks with coastal resources. Division staff initiated numerous projects designed to increase awareness and understanding of coastal issues. The first biannual *Park Coastal Geology* newsletter was completed in November 2002. This newsletter is intended to be a forum for discussion and to address items of interest to coastal park managers and other interested parties. The first issue included articles on coastal research, boundary issues and technical assistance. Future editions will include discussions about effective coastal management strategies, available coastal data and data sources, coastal mapping projects, and projects for monitoring shoreline change. The newsletter can be found at: http://www2.nature.nps.gov/grd/geology/shoreline/news_1_screen.pdf

The Coastal Geology Web site is currently under revision. This site provides coastal park managers with an overview of coastal environments, while examining the natural and human impacts that threaten our natural

resources. In addition, this site makes available technical expertise, policy guidance, and possible funding sources for coastal park issues and research. To view the site, go to: <http://www2.nature.nps.gov/grd/geology/shoreline/index.htm>

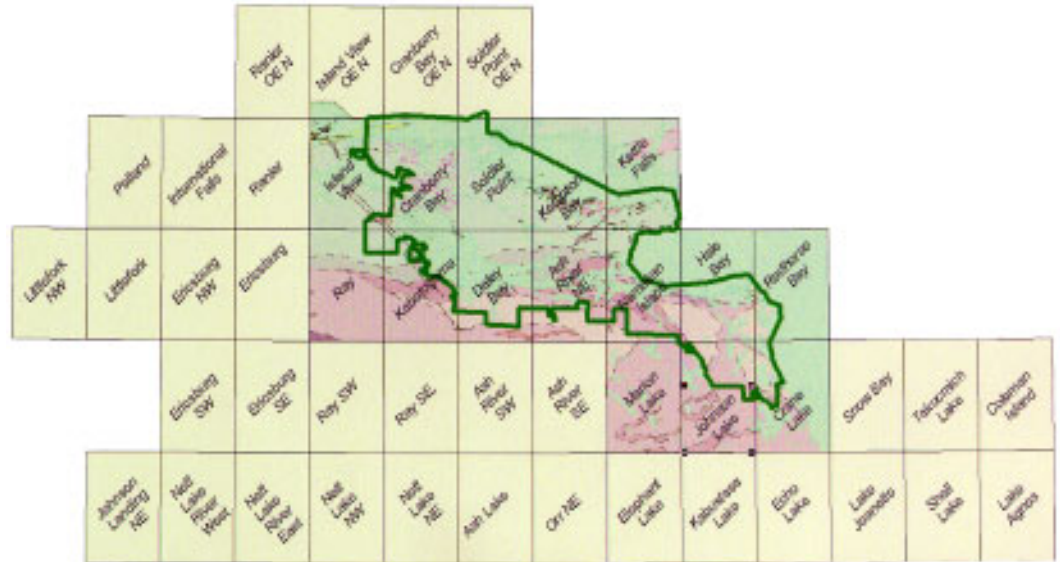
The *Coastal Geology Knowledge Center* was created and developed by Natural Resources Information Division staff, in coordination with the Division's Coastal Geology team. This Web site serves as learning tool to enhance understanding of coastal environments, coastal sediments and transportation, anthropogenic modifications to the coastal zone, coastal hazards and unique cultural and biological resources. The Knowledge Center is designed for public use and classroom instruction. Geology Knowledge Center is located at: http://www2.nature.nps.gov/synthesis/views/KCs/SPE/coastal/coastal_index.htm

A *Coastal Geology Educational Slide Set* is under development for distribution to earth science teachers. This CD-ROM contains photographs and detailed descriptions of coastal features and processes. This product promotes the use of national parks as examples in the classroom.

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Geologic maps provide guidance for park resource managers. This geologic map of Voyageurs National Park was created using ESRI ArcView software. Voyageurs park boundary is in green, quadrangles of interest are in beige, and digital geology is in color.



Geologic Resources Inventory Database Management

By: Tim Connors

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The Geologic Resources Division, in conjunction with the Natural Resource Information Division, Inventory and Monitoring Program, has been developing a Servicewide database to track the status of the Geologic Resource Inventories (GRI). This database is a useful method to manage geologic information for each of the 274 “natural resource” parks. It also serves as a tool to supply data to each park. This user-friendly database easily supplies NPS staff with the status of the GRI in a particular park. The interface is via a Microsoft Access XP platform, and this data will eventually be served over the World Wide Web via a Cold Fusion software interface. However, this aspect is still under development.

- The GRI is responsible for compiling geologic data for the 274 “natural resource” parks. Included in this inventory are the following components:

- Scoping workshops to discuss geologic resources pertaining to the park, such as geologic maps, geologic hazards, and geologic resource management issues;

- Geologic bibliographies (GRBIB) that list all known published geologic information for each individual park (GRBIB is a subset of NRIB);

- A digital geologic map for use in a park Geographic Information System (GIS) (currently the ESRI software format);

- An encompassing geologic report that

summarizes the geologic history of the park, unique geologic features and processes within the park, and issues pertinent to natural resource management.

The information available includes a list of attendees for the scoping session, the date of the meeting, and a summary of how to proceed with the inventory for that particular park. The geologic bibliographies have been assembled from data obtained from the United States Geological Survey (USGS) GeoIndex database, the American Geological Institute (AGI) GeoRef database, and NPS park specific ProCite databases. Once the bibliographies were assembled, separate searches were conducted for geologic maps that cover NPS areas. Then, bounding coordinates of the geologic maps are plotted, and NPS park boundaries and “quadrangles of interest” are overlaid using ArcView software. These were evaluated to examine gaps in geologic data for each park. Screen captures of these images are available in the database and are distributed at each scoping session to NPS staff and cooperators to reveal available geologic maps.

This database also contains a section of primary geologic features, issues and processes occurring in each park. These include mining, oil and gas operations, sand and gravel extraction, abandoned mineral lands, disturbed lands, cave and karst features, geothermal activity, sand dunes, paleontological resources, glacial features, shorelines, volcanoes, and geologic hazards.

Digital Geologic Maps produced through the GRI to date

REGION	NETWORK	PARK NAME	STATE	CLUSTER
Intermountain	Chihuahuan Desert	Carlsbad Caverns NP	NM	Southwest Cluster
		Guadalupe Mountains NP	TX	Southwest Cluster
	Northern Colorado Plateau	Arches NP	UT	Colorado Plateau Cluster
		Black Canyon of the Gunnison NP	CO	Rocky Mountain Cluster
		Bryce Canyon NP	UT	Colorado Plateau Cluster
		Canyonlands NP	UT	Colorado Plateau Cluster
		Capitol Reef NP	UT	Colorado Plateau Cluster
		Cedar Breaks NM	UT	Colorado Plateau Cluster
		Colorado NM	CO	Colorado Plateau Cluster
		Curecanti NRA	CO	Rocky Mountain Cluster
		Dinosaur NM	CO	Colorado Plateau Cluster
		Hovenweep NM	CO	Colorado Plateau Cluster
		Natural Bridges NM	UT	Colorado Plateau Cluster
		Pipe Spring NM	AZ	Colorado Plateau Cluster
		Timpanogos Cave NM	UT	Colorado Plateau Cluster
	Rocky Mountain	Florissant Fossil Beds NM	CO	Rocky Mountain Cluster
		Great Sand Dunes NP	CO	Rocky Mountain Cluster
		Rocky Mountain NP	CO	Rocky Mountain Cluster
	Sonoran Desert	Saguaro NM	AZ	Southwest Cluster
	Southern Colorado Plateau	El Malpais NM	NM	Colorado Plateau Cluster
		Mesa Verde NP	CO	Colorado Plateau Cluster
Navajo NM		AZ	Colorado Plateau Cluster	
Sunset Crater NM		AZ	Colorado Plateau Cluster	
Southern Plains	Bent's Old Fort NHS	CO	Rocky Mountain Cluster	
Midwest	Great Lakes	Voyageurs NP	MN	Great Lakes Cluster
	Northern Great Plains	Theodore Roosevelt NP	ND	Great Plains Cluster
National Capital	National Capital	Chesapeake & Ohio Canal NHP	MD	National Capital Cluster
		Harpers Ferry NHP	WV	National Capital Cluster
Pacific West	Klamath	Whiskeytown NRA	CA	Pacific Great Basin Cluster
	Northern Semi- Arid	Craters of the Moon NM	ID	Columbia Cascades Cluster

Maps are available for download at <http://science.nature.nps.gov/nrftp/> as ESRI ArcView and ArcInfo file format.

Professionalization



Redwood National Park. NPS photo.



Oil and gas well in Padre Island National Seashore. Photo by Pat O'Dell.

Guidance Document Released for Oil and Gas Development in NPS Units

By: Lisa Norby

In 2002 the Division prepared the first NPS guidance for those wanting to develop nonfederal oil and gas rights within units of National Park System: the *Operator's Handbook for Nonfederal Oil and Gas Development in Units of the National Park System*. Nonfederal mineral rights occur where entities other than the federal government, such as individuals, corporations, state or local governments, Indian tribes, or native corporations, own the rights to extract the oil and gas. In some cases, the holder of oil and gas rights on a tract of land in an NPS unit may own both the surface and subsurface (mineral) estate. Usually when a park is established the federal government acquires only the surface estate, while the mineral estate is left in private or state ownership.

The development of the Handbook was a collaborative effort among the Division staff, the Intermountain Region minerals coordinator, and park staffs who oversee oil and gas operations. The Handbook was developed to: (1) assist nonfederal oil and gas operators in understanding the NPS nonfederal oil and gas regulations at 36 CFR Part 9 Subpart B; (2) help the operators prepare a plan of operations for oil and gas development in a park or for directional drilling from a location outside a park; (3) conduct operations in NPS units in a manner that protects park resources and values;

and, (4) outline the approval process for plans of operation. The Handbook provides an overview of the NPS oil and gas regulations and permitting process, followed by plan of operations information requirements for each type of oil and gas operation, with sections covering performance bonds, spill control plans, and operator liability. Supporting information attached with the Handbook includes a reprint of the NPS oil and gas regulations; an overview of relevant laws, regulations, and policies; sample letters for use by the oil and gas operator; guidelines for the detection and quantification of contamination at oil and gas sites; and, a list of NPS oil and gas contacts.

The Handbook has been released as a “working draft” for one year in order for oil and gas operators to evaluate and comment on its content and usefulness. The Handbook has been distributed to the staffs of parks having oil and gas operations and, upon request, to oil and gas operators in those parks. After this one-year review period, the NPS will finalize the document and distribute it to all oil and gas operators conducting operations in park units. The feedback received so far has been positive, oil and gas operators and park staffs have noted that it clarifies their roles and responsibilities in preparing a plan of operations and conducting oil and gas operations in NPS units.

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Nonfederal Oil and Gas Workshop Held at Padre Island National Seashore

By: Lisa Norby

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In an ongoing effort to provide assistance to parks with nonfederal oil and gas operations, the Division held a nonfederal oil and gas workshop in April 2002 at Padre Island National Seashore. Fifteen people representing seven parks with ongoing oil and gas operations, three regions, the NPS Water Resources Division, and a representative from the Washington Solicitor's Office attended the workshop. The purpose of the workshop was to:

- Provide training for park staff who deal with oil and gas issues to effectively evaluate a proposed project with an oil and gas operator;
- Visit an active drilling operation;
- Discuss remediation strategies at contaminated oil and gas sites in the park; and
- Provide an open dialogue of current NPS oil and gas management issues and challenges.

Sue Jennings, Acting Regional Environmental Coordinator for the Midwest Region began the workshop with a presentation on the scoping requirements of the National Environmental Policy Act (NEPA). The group discussed how NPS staff can best integrate NEPA project scoping for oil and gas operations with the NPS nonfederal oil and gas regulations at 36 CFR Part 9 Subpart B (9B regulations). The consensus of the group was that effective project scoping can streamline the permitting process for a nonfederal oil and gas operation while protecting park resources and values. During the afternoon, the group looked at a case study for a proposed drilling operation in the park.

Course participants take a break between discussions of oil and gas operations in their parks to enjoy the scenery at Padre Island National Seashore. Photo by Pat O'Dell.



On the second day of the workshop, meeting participants observed operations at the Dunn-Murdock #1 well, an active exploratory drilling operation on the beach in the park. The operator (BNP) described all phases of the drilling operation, from well permitting through drilling, plugging, abandonment and reclamation. It was evident during the fieldtrip that BNP strives to work cooperatively with the NPS during the planning and conduct of oil and gas operations in a manner that eliminates or minimizes adverse impact to park resources and values. The group also visited several oil and gas sites that are in various stages of remediation to see how Padre Island staff are creatively dealing with contamination issues in their park.

During the last day of the workshop, the group participated in lively discussions about nonfederal oil and gas management issues facing the NPS. The group also provided feedback on oil and gas guidance documents that are being prepared by the Division. Overall, the group identified what assistance is needed from the Division.

Funding – parks need assistance in preparing PMIS funding requests, and are seeking funds to inventory oil and gas operations on parklands and to plug, abandon, and reclaim wells that have no known responsible party.

Operations Guidance - The Division should finalize the oil and gas operator's handbook and the NPS procedures manual, update the minerals website, and distribute example NEPA documents for oil and gas operations.

Policy Direction – Several legal and policy questions arose, including clarification of permitting for trans-park pipelines, cost reimbursement for the preparation of oil and gas NEPA documents, revision of bond limits, and development of criteria to plug orphaned oil and gas wells in the parks.

Overall, the workshop was successful in fostering communication between Division staff and staff from parks with oil and gas operations. Also, it renewed the ongoing commitment by the Division to provide timely assistance to parks that oversee nonfederal oil and gas operations.

New Training in Fossil Resource Protection

By: Vincent Santucci

An Albright Wirth Grant was awarded in 2002 to support the development of formal paleontological resource protection training for NPS employees. This project involved a partnership between the Federal Law Enforcement Training Center (FLETC) and the Horace Albright Training Center (HOAL) in order to promote the stewardship of non-renewable fossil resources preserved in the National Parks. The grant supported a detail assignment for the Chief Ranger at Fossil Butte National Monument, Vincent Santucci, to develop training modules, handouts, and audio-visual presentations that would be congruent with the existing NPS training program.

As part of the detail, Santucci evaluated the existing course curricula for the current NPS law enforcement training, including Seasonal Law Enforcement Training, Permanent Law Enforcement Training, the Annual 40-hour Law Enforcement Refresher Training, and Natural Resource Protection Training. Through consultation with training specialists within the NPS, Santucci determined the appropriate training format (e.g., formal presentations, web-based training, etc.) and developed training modules adaptable to each of the existing training courses.

The result was the development of four separate training modules (lasting one, two, four, and eight hours) for paleontological resource protection. Using funds from the Albright Wirth Grant, Santucci presented the various modules to 135 NPS employees in 2002.

The one-hour, two-hour, and four-hour paleontological resource protection training modules provide an introduction to paleontological resource management and protection through power point presentations and handouts. In June 2002, the one-hour module was presented at the 40-hour Law Enforcement Refresher Course hosted in Santa Fe, New Mexico. The two-hour module was presented twice at FLETC, initially in August 2002, and again in November. The four-hour module was presented to the rangers at Death Valley National Park in October 2002.

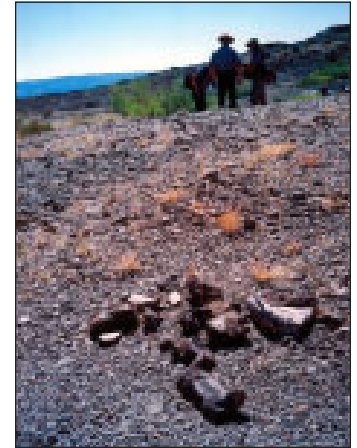
The eight-hour paleontological resource protection training module combines the four-

hour classroom module with a four-hour practical field exercise. Santucci presented this module to the rangers at Big Bend National Park in September 2002. The field exercise involved issues of paleontological resource theft and vandalism and consisted of mock paleontological resource theft site scenarios where participants are provided the opportunity to investigate and manage the crime scene. The exercise addresses all aspects of crime scene evaluation including: assessment of the resource violation, collection of evidence, and development of a case incident report relevant to paleontological resources. The field exercise also provides a venue to demonstrate the field methods and tools commonly employed in fossil collecting.

Participants of the training sessions provided feedback either directly or through course evaluation forms. Two major suggestions emerged from discussions with course participants. The first suggestion is to broaden the course work to include other geological resources at risk. These include issues such as: the theft of rocks (e.g., basaltic lava from Hawaii Volcanoes NP), minerals, and sand, vandalism of fragile cave features from the many cave parks, and damage to delicate landforms such as Delicate Arch in Arches National Park. The second suggestion is to seek funding to support the production of a thirty-minute training video highlighting the issue of fossil poaching, similar to videos available for archeological resource and wildlife poaching.

Santucci produced a final report and an accompanying compact disk (CD) outlining the results achieved through funding from the Albright Wirth Grant. The CD contains training information and power point presentations used during the training modules. Finally, as a follow-up to the participant evaluations, research is underway to compile information related to a wider range of geologic resource threats and case studies. This information will be incorporated into an updated training module focusing on all geologic resources. A funding proposal is also being developed to support the production of a paleontological resource protection training video. These are just the first steps to improve the geological resource protection training in the NPS.

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Rangers at Big Bend National Park participate in a paleontological resource protection training field scenario. The rangers are investigating a mock fossil theft crime scene in a dinosaur bone bed at the park. NPS photo.

It's All in the Details: Division Staff Gain Valuable Park Experience

By: Julia Brunner and Jim F. Wood

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While on detail at Cape Hatteras National Seashore, Julia had the chance to get hands-on park management experience. Here she measures and marks a dead sea turtle for data collection. Photo by Gary Henson.

In 2002, Division staff accepted details in park units in order to gain resource management insight from a park perspective. This insight enhances the effectiveness and credibility of the Division to parks, the NPS Directorate, other agencies, and external partners. In 2002, two Division staff members, Jim Wood and Julia Brunner, served details to the Long Distance Trails Group Office in Santa Fe and to Cape Hatteras National Seashore, respectively.

Jim Wood was selected to serve a three-month detail as acting superintendent of the Long Distance Trails Group Office in Santa Fe, New Mexico. The Office has responsibility for such diverse resources and programs as the Route 66 Preservation Program, Trail of Tears National Historic Trail (NHT), Santa Fe NHT, El Camino Real de Tierra Adentro NHT, and the Old Santa Fe Trail building. This detail gave Jim the opportunity to gain experience in park operations, supervisory skills, and partnership programs. The work proved to be an eye-opening experience as to the number and variety of demands that national and regional programs, interagency work, and partner-based operations can place on park staffs.

Throughout the detail Jim learned from a close working relationship with the historians, trail planners, interpreters, landscape architect, and administrative officer on staff, as well as partners in the trail associations. He was able to offer the group a fresh perspective for approaching some

very challenging issues. The detail benefited the Intermountain Region by having an on-site manager to fill a vacant position, providing a transitional contact for trail partners, and allowing Regional management time to evaluate the program and select a new superintendent. The Region expressed its gratitude to the Division for its support and presented Jim an award for his service.

Julia Brunner worked at Cape Hatteras National Seashore on the Outer Banks of North Carolina during the month of October. A lawyer by training and a seven-year employee of the Division, Julia was eager for a view of the “bigger picture” of park management. For the first two weeks, she shadowed Steve Harrison, the Chief of Natural and Cultural Resources. When Harrison took annual leave, Julia had the opportunity to act in his position for ten days. She participated in the new management inspections and issue identification process in the park, organized two planning-related meetings and assisted park rangers, the park biologist, and an intern in the field. The detail at the Cape Hatteras was short in order to minimize the disruption to her family and her work in the Division, but it proved to be immensely educational.

The Division encourages parks and other program offices to consider details to the Denver office, and to consider temporary staff exchanges. While such efforts can be difficult to plan, the networking opportunities and the improved knowledge of the roles and relationships of other NPS offices are invaluable.

Staff from the Long Distance Trails Office in Santa Fe, New Mexico discuss resource management issues during a site visit to El Camino Real de Tierra Adentro National Historic Trail. NPS photo.



A Summer at the Beach: My Technical Project at Assateague Island National Seashore

By: Melanie Ransmeier

Summer at the beach...that certainly has a nice ring to it! I remember thinking this as a whirlwind of activity began which propelled me to work for Assateague Island National Seashore during the summer of 2001. As a member of the Student Career Employment Program (SCEP), I am encouraged to seek out training and educational opportunities in the Park Service. Working on a technical project for the NPS had the additional appeal of counting toward my graduation requirements for the Master of Science degree in the Geographic Information System program at the University of Denver. This project was funded through the Northeast Region Inventory and Monitoring (I&M) Program and the Geoscientist-in-the-Parks (GIP) program.

The focus of the assignment was to use existing geomorphology data from Assateague Island to develop standards, methods, and procedures that could be applied to the four coastal parks in the Northeast Coastal and Barrier Vital Signs Network Group: Cape Cod National Seashore (NS), Fire Island NS, Gateway National Recreation Area, and Assateague Island NS. Assateague has been collecting data on various geomorphologic features for several years but had not yet created a systematic data management plan to organize the information. This lack of standardization and inconsistent structure has created a major problem, particularly with data analysis. To address the problem, the park created a geomorphology workgroup (G-team) through which I collaborated with park staff to develop and document data management practices. However, before these objectives could be addressed, it was necessary for me to become familiar with the types of data used by Assateague Island for geomorphological monitoring, as well as their

collection and utility. I learned the proper methods and procedures for collecting horizontal shoreline position via an ATV-mounted GPS receiver, and for developing cross-island profiles using traditional surveying methods. These experiences were invaluable as spatial database design and implementation proceeded. By working with park staff on the design and creation of spatial databases and metadata templates, I incorporated the potential problems and questions that the data will need to address. This will facilitate future archival and analysis projects.

As an outgrowth of this project, I am working with Assateague Island park staff to create a geomorphological data management protocol which will document the methods by which data are collected, processed and archived. It is hoped that this thorough documentation will standardize coastal geomorphology data management practices making these data more accessible for use in analytical projects throughout the NPS. Documentation of appropriate quantitative analysis and visualization techniques for Assateague Island geomorphologic data is ongoing and will be completed during the summer of 2003.

I wasn't a lifeguard and I did spend a lot of time in front of my computer. But, overall, a summer at the beach was an extremely rewarding educational and professional experience from which the Northeast Coastal and Barrier Network will benefit for years to come.

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Melanie collects GPS shoreline data during her summer detail at Assateague Island National Seashore. Photo by Mike O'Connell.



Collaboration



Fossil cat tracks at Death Valley National Park. Photo by Greg McDonald.

What Happened to the Paleontological Resources Preservation Act?

By: Julia Brunner, Lindsay McClelland, Greg McDonald

Each federal land-managing agency has its own laws, regulations, and policies that govern the management of paleontological resources. The varying standards can complicate scientific research, confuse the general public, and impede interagency cooperation. In 1998 Congress expressed its concern about this situation and the resulting deterioration and loss of fossils on federal lands. Congress then requested a multi-agency assessment of the need for a uniform federal fossil management policy. In response, eight federal agencies (Bureau of Indian Affairs, Bureau of Land Management (BLM), Bureau of Reclamation (BOR), Fish and Wildlife Service, Forest Service (USFS), National Park Service, Smithsonian Institution, and U.S. Geological Survey) prepared the report, *"Fossils on Federal and Indian Lands"* in May 2000. The report recommended an overarching framework for fossil management, analogous to the Archeological Resources Protection Act of 1979 (ARPA), which would contain provisions on inventory and monitoring, permits, public education, and penalties.

On October 2, 2001, Representative James McGovern (D-MA) introduced H.R. 2974, the Paleontological Resources Preservation Act, which would have implemented many of the recommendations submitted by the agencies. H.R. 2974 eventually garnered 26 bipartisan co-sponsors. S. 2727, a Senate companion bill, was introduced by Senator Daniel Akaka (D-HI) on July 12, 2002.

H.R. 2974 and S. 2727 applied to lands under the jurisdiction of the Departments of Agriculture

and the Interior. The bills required that fossils be collected from those lands pursuant to an agency-issued permit, but would allow "casual collection," the collection of limited amounts of plant and invertebrate fossils without a permit, on certain BLM, BOR, and USFS lands. The bills also sought to discourage fossil theft and vandalism by imposing criminal and civil penalties similar to those used for violations of



The Fossil Resource Protection Bill currently under review by Congress will enhance the ability of the NPS to protect all types of fossils, such as this fossil stump in Yellowstone National Park. NPS photo.

ARPA. They emphasized inventory and monitoring, science-based decision-making, public and amateur paleontologist involvement, interagency cooperation, confidentiality of locality information, and the use of penalty monies for resource restoration or replacement. The bills also required the agencies to curate all fossils collected pursuant to a permit, and store associated data and records in approved repositories.

For nearly a year, the Division worked extensively with others in the NPS, the Department of the Interior, and other affected agencies, to provide technical information requested by Congress and to assist with the testimony. On November 20, 2002, the Senate passed S. 2727. However, the House adjourned on the following day without taking up H.R. 2974.

The bills may be reintroduced in the 108th Congress. In the meantime, the Division will strive to help parks utilize the best available science and existing legal authorities, regulations, and policies to preserve and manage their fossils as effectively as possible.

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Collaborating with State Geological Surveys

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The Division continued its long-term relationships with various state geologic surveys. Using Geologic Resource Inventory (GRI) funds for cost-sharing, the North Carolina Geological Survey conducted geologic mapping in the Blue Ridge Parkway, and the South Carolina Geological Survey conducted mapping at King's Mountain National Military Park. These geologic maps will be used by park staff for resource management and for interpretation. The maps will also provide each state with additional geologic information.

Geologic mapping along coastal areas is a departure from traditional mapping in that it must address a dynamic physical environment presently undergoing erosion and sedimentation. Shoreline processes are also of great interest to coastal states because of the potential infrastructure, resource, and economic impacts associated with a changing coastline. The North Carolina Geological Survey, in partnership with the Geologic Resources Division, the United States Geological Survey (USGS), and academic institutions, is developing geomorphic shoreline maps for Cape Hatteras National Seashore, Cape Lookout National Seashore, Fort Raleigh National Historic Site, and Wright Brothers National Memorial. The mapping protocols that have been developed can be used by other eastern coastal parks as a predictive and preservation tool.

State geologic surveys from Montana, Washington, Missouri, Pennsylvania, North Dakota, and South Dakota participated in GRI scoping meetings in NPS units in their respective states. Separate meetings on map coverage were held in several parks. Proposed future collaborative mapping work has been proposed for Padre Island National Seashore (with the Texas Bureau of Economic Geology), Theodore Roosevelt National Park (with the North Dakota Geological Survey), and the Black Hills area (with the South Dakota Geological Survey).

Several years ago, the Utah Geological Survey, supported by GRI funds, prepared a volume dedicated to the geology of all the NPS units in the state. This publication has been wildly popular and is now in its second printing. Following that success, both the New Mexico Bureau of Geology and Mineral Resources and the Wyoming Geological Survey have proposed

similar publications for the NPS units in those states. The information contained in those documents will be helpful for GRI geologic reports in the NPS units in those states, so GRI fund may be used to assist with those efforts.

A program to produce a revised National Karst Map is being coordinated by the USGS and the NPS National Cave and Karst Research Institute. USGS is working with the states to establish standards and consistent digital products that will facilitate the digital compilation and production of the national karst map. The Institute is establishing a web-based network of karst information that USGS will use to build the national map and is providing some funding to support the effort at USGS and in some states. This work is critical for park units with cave and karst resources.

In addition to collaborative projects for geologic mapping, Division staff participated in the Association of American State Geologists (AASG) Annual Meeting in New Harmony, Indiana, held in July 2002. Division staff presented NPS geology programs to the representatives from state geological surveys, identifying the opportunities for collaborative work. Of particular interest to the meeting participants, was the geologic mapping at Glacier National Park, Grant-Kohrs Ranch National Historic Site, and the NPS units in Michigan. The South Dakota Geological Survey is interested in working together on an interpretive product for the geology of the Black Hills. The State of Montana has already produced a superior set of interpretive displays on the geology of Big Horn Canyon, which they shared with the Division. They are interested in producing similar products for other National Parks in Montana.



Fire Island National Seashore staff helped the U.S Army Corps of Engineers recognize the value of utilizing natural dune restoration in its Storm Damage Reduction Environmental Impact Statement. Photo by Rebecca Beavers.

Working with the U.S Army Corp of Engineers to Reduce Impacts in Coastal National Parks

By: Rebecca Beavers and Julia Brunner

The U.S. Army Corps of Engineers (the Corps) builds and operates hundreds of flood control, environmental protection, and other civil works in and adjacent to units of the National Park System. Totalling millions of dollars, these projects include dredging of navigation channels, disposal of dredged sediments, replenishment of beach sand, construction of structures such as riprap and jetties, and increasingly “ecosystem restoration.”

Some of these projects are completed upon the request of an NPS unit in order to benefit park resources. For example, the Corps is using a combined approach of rip rap, sills, and created wetlands along selected segments of 17 miles of Jamestown Island’s shoreline to stop riverbank erosion and protect archeological resources at Colonial National Historic Park. Similarly, the Corps has replenished the beach within Gulf Islands National Seashore to protect cultural resources at Fort Massachusetts. At Jean Lafitte National Historical Park and Preserve, the Corps is helping the park to protect thousands of acres of globally rare, floating estuarine marshes from erosion.

Formerly, some Corps projects have resulted in adverse effects on NPS units. Previously at Cape Hatteras National Seashore, for example, the

Corps deposited dredged material beyond the littoral (sediment) system, which hastened beach erosion and affected visitor enjoyment, infrastructure, and cultural resources. Additional erosion problems attributed to Corps-constructed jetties have occurred at Padre Island and Assateague Island National Seashores.

Concerned about these impacts, several NPS units are taking a proactive, two-pronged approach with the Corps. First, instead of simply reviewing documents detailing Corps project proposals in parks, five parks in 2002 sought (and three obtained) “cooperating agency” participation in the planning process in order to elevate concerns about preserving park resources. Second, these parks also require that Corps activities within park boundaries be conducted with NPS permission, typically a special use permit. These parks are not attempting to hinder the Corps’ mission; instead they are allowing Corps activities in parks to proceed subject to the terms and conditions necessary for protecting park resources, values, and visitor safety.

The results of this new relationship have been positive. Fire Island National Seashore, working as a cooperating agency, helped the Corps recognize the value of utilizing natural dune

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restoration in its Storm Damage Reduction Environmental Impact Statement. At Jean Lafitte's Barataria Preserve unit, the Corps agreed to abandon plans for bankside disposal of dredge spoil from a channel maintenance project, and will instead pump the material into a park-designated area, restoring 50 acres of marsh lost to erosion. On the other flank of the Barataria Preserve, where the Corps is constructing a hurricane protection levee for the suburbs of New Orleans, it redesigned borrow pits to enhance wildlife habitat and minimize impacts to hydrological function and the cultural landscape. Likewise, the input of Cape Hatteras National Seashore in a Corps dredging project mitigated impacts to a wetland. Assateague Island National Seashore is collaborating with the Corps to mitigate the impacts of the Ocean City inlet by restoring the natural sediment budget. Based on the response of the first phase

of the project to several mild storms, the restoration effort appears to be performing exactly as planned. Gulf Islands National Seashore's input on two dredging and restoration projects may increase the scope of alternatives. Finally, Golden Gate National Recreation Area is working closely with the Corps, the City of San Francisco, and other entities to ensure consideration of park resources and values in plans for protecting vulnerable municipal infrastructure along the eroding shoreline of Ocean Beach.

Like any new strategy, this one will take time to implement effectively throughout the National Park System. Clearly, the new NPS approach is stimulating better Corps project design and implementation and enhancing protection of NPS coastal resources. The Division can help NPS units lacking staff or expertise to adopt this approach elsewhere.

The NPS and the U.S Corps of Engineers are working together to protect coastal resources at Padre Island National Seashore. Photo by Rebecca Beavers.



Natural Resources Partnership Program Continues to Develop

By: Diana Maxwell

The Natural Resources Partnership Program began in late 2000 as a result of the growing need to bring additional fiscal and human resources to the diverse natural resource field programs. The Program Coordinator is cooperatively funded by five divisions in the Natural Resources Program Center (NRPC). The Air, Biological, Geologic, Natural Resource Information, and Water Resources Divisions already had numerous successful partnerships in place and many NRPC staff had already collaborated on projects with the parks, including the growing Geoscientist-in-the-Parks Program. The need for a formalized partnership effort evolved as the Natural Resource Challenge and technical assistance call demonstrated a clear need from NPS units for greater assistance in accomplishing important natural resource projects. The goal of the program is to develop new and enhanced partnerships that will expand the NRPC base and support increased natural resource projects in parks.

The Natural Resource Partnership Program has evolved in scope by forming partnerships with new organizations. This year proved to be successful for beginning new programs and for making progress with 'maturing' projects.

The Partnership Program teamed up with the Sonoran Institute, Bureau of Land Management,

Colorado Rural Development Council, U.S Fish and Wildlife Service, USDA Natural Resources Conservation Service, the U.S Forest Service, and Partnership Architecture LLC to develop a website for the federal employees and the public to find new research and funding opportunities. The Conservation Assistance Tools (CAT) website is a user-friendly method to easily search many databases for grant information. These partners have also produced a new brochure,

describing the benefits of the website. The long-term goal is to find additional funding and expertise to move CAT to the next level and ultimately to have the site be of great assistance to park managers who need financial support for natural resource projects. The CAT website can be accessed at: www.sonoran.org/cat.



NPS partners discuss natural resources issues near Lake Mead Natural Recreation Area. Photo by Diana Maxwell.

Environmental Alliance for Senior Involvement (EASI.) The new program, named the Natural Resource Laureate Program, will place experienced natural resource professionals in NPS units to accomplish needed scientific work that might not otherwise be produced. An announcement for a pilot test of the Laureate Program was included in the 2002 Natural Resource Technical Assistance Call. Plans call for initial placement efforts to begin by September 2003. Forty-one requests were submitted by NPS units for this program.

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Pinnacles National Monument. NPS photo.

Geological Society of America Convention: Forum for Geological Knowledge

By: Bruce Heise and Jim F. Wood

The Geological Society of America Annual Meeting & Exhibition is one of the largest congregations of earth science professionals in the world. Nearly 6300 attended the 2002 annual meeting in Denver. As it has for the past six years, the Division had a visible role in the proceedings. The Division staffed a booth that provided information on local NPS units, NPS programs, GRD programs, and nearby geologic landmarks. The booth provided an opportunity for NPS staff to network and exchange information with students, faculty, and geology professionals. While it is difficult to determine an exact number of visits to the booth, it was rarely vacant. The most frequent questions were related to employment in the parks, research permits, geologic programs, and the Geoscientist-in-the-Park (GIP) program.



Division staff field questions at the booth at the 2002 Geological Society of America conference held in Denver. Photo by Rebecca Beavers.

Division staff chaired a general session on park geology. Over 45 papers were submitted for 32 slots, resulting in excellent and well-rounded sessions. The presentations were grouped into blocks on geologic mapping, caves and karst, shoreline issues, geologic hazards, education and interpretation, and surface and groundwater

quality. Attendance ranged from 12 to 150 people for each session, including coverage by the local press for a USGS paper on the bathymetry of Yellowstone Lake.

Division staff also chaired a session on paleontology in the National Parks. Ten presentations addressed paleontological issues in Petrified Forest NP, Scotts Bluff NM, Badlands

NP, Big Bend NP, Pu'uhonua O Honaunau NHP, Yellowstone NP, and Grand Canyon NP. Session attendance ranged from 10 to 50 people; a large turnout for a session dedicated to a single discipline.

In addition to staffing the booth and chairing sessions, Division staff were active contributors to other aspects of the

convention. Division staff gave presentations on geologic mapping and paleontological resources and presented a poster on coastal park mapping. Staff led a field trip of nearly 40 people to Dinosaur Ridge, a nationally renowned local geologic landmark. Division staff also represented the NPS at the GSA annual Government Luncheon, where nearly 250 geology students heard a presentation on geologic opportunities in the Federal Government.

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A new fact sheet, "Geologic Research Opportunities in the Parks," is now available online to facilitate research in the parks. This brochure details the NPS Research Permit and Reporting System, potential funding sources, general research guidelines and considerations, NPS research programs, and NPS research publications. It can be accessed at: http://www2.nature.nps.gov/grd/fact_brochure.htm.

NPS Geologists Meet in Denver

Taking advantage of Geological Society of America (GSA) meeting in Denver, the Geologic Resources Division hosted an NPS meeting for all geoscientists in the Park Service. The meeting took place October 31, the day after the GSA meeting ended. The objective of the meeting was to exchange technical and programmatic information, and to improve communication and cooperation among NPS staff involved with geologic resources management. Topics at the meeting include the Geologic Resources Action Plan, Geologic Resources Inventory and Mapping, Natural Resources Information Services, Earthscope, and Park Vital Signs and Monitoring. In the afternoon three break-out sessions were held on specific subject areas: Geologic Education, Interpretation and the GIP program, Caves and Karst, and Paleontology. There were twenty-nine attendees, not including Geologic Resources Division staff.

Views Project Looks at Park Geology

By: Bruce Nash and Jim F. Wood

bruce_nash@nps.gov, Project Manager, Natural Resource Information Division

jim_f_wood@nps.gov, Geologist

Views Key Contacts

·Bruce Nash, Project Manager, Natural Resource Information Division

·Dave Krueger, IT Specialist, Natural Resource Information Division

·Erica Matteo, IT Specialist, Natural Resource Information Division

·Jim F. Wood, Geologist, Geologic Resources Division

·Rebecca Beavers, Coastal Geologist, Geologic Resources Division

·Greg McDonald, Paleontologist, Geologic Resources Division

·Hal Pranger, Geomorphologist, Geologic Resources Division

The geologic story of National Parks is becoming a part of “views of the National Parks.” The Views project presents National Park information as multimedia educational modules in electronic format. Views material may be integrated into park computer kiosks and websites for visitors, or distributed to classroom teachers on CD ROM. In 2002, the Geologic Resources Division teamed up with the project coordinators in the Natural Resource Information Division, and with parks and others to help prepare geologic materials for Views.

“Views” consists of two complementary components: knowledge centers and virtual experiences. Knowledge centers present general information and scientific principles on a variety on natural resource themes. Geology-related themes have been designed in the past year include: volcanism, glaciers, paleontology, and coastal geology. In addition, sub-modules that present unifying scientific or ecosystem concepts have been designed for the hydrologic cycle and for the Malankovitch cycle (variations in climate due to the orbit and attitude of the earth). The thematic geology modules prepared in Views become building blocks that any park can use as a starting point to tell it’s own unique geologic story.

The second component of Views is the virtual experience. Virtual experiences take the user to a park through multimedia presentations and interactive educational units. Together with the knowledge centers, they will help to ensure that park programs reach a greater number of people, including those who are unable to visit park sites or attend a ranger-led program. Geology-related virtual experiences have been prepared for Pu’uhonua o Honaunau National Historic Park and Timpanogos Cave National Monument. Several others are being prepared including, Florissant Fossil Beds fossil mysteries and Grand Canyon river-to-rim geology.

Staff in the Natural Resource Information Division coordinate the Views project. In order to ensure high-quality geology information, subject matter experts from the Geologic Resources Division, the USGS, and parks help to design, write, and review materials for Views knowledge centers and virtual experiences. To see the projects discussed in this article, you can visit the Views of the National Parks website at <http://www2.nature.nps.gov/synthesis/Views> or contact david_krueger@nps.gov to request to have a CD-ROM sent to your park.

Right: Four separate geoscience disciplines are highlighted by the Views project. NPS screen capture.



Cave Outreach Programs

By: Ronal Kerbo

Ron Kerbo, Division cave specialist, and Zelda Bailey, National Cave and Karst Research Institute Interim Director, gave several programs this year in both government and general public forums dealing with cave and karst protection, conservation, and general overviews of caves and karst.

In August, the U.S. Geological Survey Karst Interest Group met in Shepherdstown, West Virginia. Kerbo and Bailey gave a presentation entitled "Conservation and Protection of Caves and Karst in the National Parks." This presentation focused on the diversity of caves Servicewide and on the NPS policies and guidelines designed to protect, conserve, interpret, and manage caves.

Also in August, Kerbo was asked to give a presentation during the showing of the IMAX film "Journey into Amazing Caves," at Denver

Museum of Nature and Science. His program, entitled "Stone Wilderness: Visiting the Great Cave Areas of the World," was a slide presentation about caves in NPS units and around the world. The program featured a variety of photographs of caves and cave features

ranging from lava tube caves in the middle of the Atlantic Ocean to Lechuguilla Cave in Carlsbad Caverns National Park, the deepest limestone cave in the United States.

On October 15, Kerbo also gave a program at the Denver REI Flagship store. The presentation, entitled "The Hidden Caves of

the World," was part of the *Talks in Celebration of Earth Science Week, Adventure Geology* series.

The program was a slide presentation, featuring National Park caves including Mammoth Cave in Kentucky, Carlsbad Caverns in New Mexico, and Hawaiian lava tube caves of Hawaii Volcanoes National Park.

ron_kerbo@nps.gov, National Cave Management Coordinator



One of the world's hidden caves. Photo by Ron Kerbo.

Minerals and Geology Information on InsideNPS

Information about NPS minerals and geologic resource management programs is now available to all park personnel on the official Park Service intranet site, InsideNPS. The Division maintains these pages which are located under the program site for Natural Resource Stewardship and Science. The InsideNPS pages are a convenient way to look up program information, retrieve documents, and find out who to contact for assistance. We also maintain an intranet website linked to InsideNPS for collaborative projects, references and toolboxes, raw documents and photos, and testing of new webpages.

To find minerals and geology information on InsideNPS, navigate to www.INSIDENPS.gov, then go to Programs > Natural Resource Stewardship and Science > Geologic Resources Division. Our website for collaborative projects, <http://www2.nrintra.nps.gov/grd>, is linked to InsideNPS at the Division homepage. As we continue to add to these pages, we hope to provide useful tools to resource managers and improve our ability to serve park needs. Comments and suggestions for our websites are welcome and should be sent to jim_f_wood@nps.gov.

Park Assistance



Death Valley National Park. NPS photo.

Division Park Assistance: Listing Support Provided to Regions, Parks, and Other NPS Organizational Units (see also GIP listing)

Alaska Region

Cape Krusenstern National Monument

- Reviewed the Draft Operating & Maintenance Plan for the Delong Mountain Transportation System (Red Dog Mine haul road).
- Assisted in the review of the TeckCominco Hard Surfacing Test Plan for the Delong Mountain Transportation System.
- Provided technical review of the Supplemental Road Sampling and Surface Material Removal Verification Report (testing and removal of Pb/Zn contamination along the haul road).
- Provided technical review of the Draft 2001 Fugitive Dust Data Report.
- Assisted in drafting letters and procedures for the revision of the 1991 Operation Plan for the Delong Mountain Transportation System (Red Dog Mine haul road).

Denali National Park and Preserve

- Parkwide Gravel Acquisition Plan - Conducted field visits, development of site extraction / restoration plans, and guidance to park on overall planning and compliance process.
- Mapped 34 Liberty and Rainy placer claims (approximately 637 acres along 8.24 miles of stream channel) to determine need for further validity work.

Klondike Gold Rush National Historical Park

- Provided recommendations to stabilize Taiya River and protect the historic town of Dyea.

Wrangell-St Elias National Park and Preserve

- Completed technical review of Butte Creek mineral appraisal for land office.
- Completed technical review of the Kennecott donation mineral rights appraisal.
- Completed technical review of the Cole Bench Patented Placer mineral appraisal.
- Completed technical review of the Rex Creek mineral appraisal.
- Completed technical review of the Iowa/Chiti mineral appraisal.
- Completed technical review of the revised Kennecott donation mineral rights appraisal.
- Completed technical review of the Kotsina mineral appraisal.
- Completed technical review of the Kuskulana mineral appraisal.
- Completed a revision of the Clear Creek mineral appraisal.

- Completed technical review of the Contact Lode mineral appraisal.

- Provided technical assistance on disposal of calcium carbide at abandoned mine site.

- Assisted on ROW Special Use Permit requirements – Nabesna Road inholding development proposal.

- Digitized surficial geologic maps of numerous McCarthy quadrangles.

- In response to request by park and Solicitor's office, provided input and relevant case law concerning a mining claimant's right of access to patented mining claims.

Intermountain Region

Agate Fossil Beds National Monument

- Scoped the park's geomorphic and soils issues.

Arches National Park

- Reviewed apparent increases in oil and gas activity near Canyonlands and Arches National Parks, in response to NT Times articles dated 2/8/02 and Denver Post article dated 2/26/02. Site visit to Western Geophysical seismic survey to assess impacts to resources adjacent to park(s).
- Worked with park on planned excavation of dinosaur.
- Completed Digital Geologic Map of park through Geologic Resources Inventory.

- Conducted Geologic Processes & Human influences scoping meeting.

Aztec Ruins National Monument

- Conducted site visits of oil and gas operations and met with operators. Provided a trip report documenting current status of oil and gas operations along with management recommendations.

Big Bend National Park

- Conducted Geologic Resources Inventory scoping session.
- Conducted Geologic Processes & Human influences scoping meeting.

Big Thicket National Preserve

- Reviewed and commented on the Davis §9.32(e) application and environmental assessment to drill the #1 Kaimu – Johnson well.
- Reviewed and commented on the Century Resources Land LLC Blackstone Minerals #3 well Application and environmental assessment.
- Assessed four proposals to directionally drill underneath the

park from surface locations outside the Preserve to determine if the proposals qualified for a waiver of regulatory provisions. These included the Penwell Vastar-Pica No. 1, Century Blackstone Minerals No. 3, and Davis Brothers Vastor-Johnson and Kaimu-Johnson wells.

- Reviewed and provided recommendations for Buford-Curtis Plugging Program.

Bighorn Canyon National Recreation Area

- Reviewed geologic wayside exhibits produced in conjunction with Montana Bureau of Mines and Geology.

Black Canyon of the Gunnison National Park

- Performed park-wide disturbed land site and AML inspections, compiled inventories and developed restoration recommendations.

Capitol Reef National Park

- Coordinated and participated in joint USEPA/Utah/NPS comprehensive site characterization of Rainy Day and Duchess Uranium Mines.

- Provided park with policy/regulatory advice for directing a mineral operator around, rather than through, the park.

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

- Conducted Geologic Processes & Human influences scoping meeting.

Canyonlands National Park

- Conducted Geologic Processes & Human influences scoping meeting.

Carlsbad Caverns National Park

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Colorado National Monument

- Reviewed and commented on the project agreement for the GMP.

- Conducted a reconnaissance evaluation of flooding and erosion along the park's eastern boundary.

- Worked on Abandoned Mines Mitigation.

- Worked with park on developing partnerships for paleontological surveys.

- Conducted Geologic Processes & Human influences scoping meeting.

Curecanti National Recreational Area

- Completed a summary on the Dickerson mineral rights acquisition problems.

- Developed mining scenarios and volume calculations in support

of the Dickerson Pit, Mineral Appraisal.

- Performed mine site inspections at the Dickerson Pit.

- Researched the meaning of the unusual deed language which reserved the mineral rights at the Dickerson Pit.

- Performed park-wide disturbed land and AML site inspections, compiled inventories and developed restoration recommendations.

- Worked with park to develop partnership for preparation of dinosaur by Garden Park Paleontological Society.

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Devil's Tower National Monument

- Conducted Geologic Resources Inventory scoping session.

Dinosaur National Monument

- Advised park personnel on in-park gravel planning issues and process.

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

El Malpais National Monument

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Florissant Fossil Beds National Monument

- Oversaw the restoration of five dams by the U.S. Army Corps of Engineers contractor.

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Fort Union Trading Post NHS

- Evaluation of Abandoned Mineral Land.

Fossil Butte National Monument

- Oversight of NRPP proposal for new geologic investigations related to Fossil Basin large-scale geologic mapping.

- Conducted Geologic Resources Inventory scoping session.

Glacier National Park

- Conducted Geologic Resources Inventory scoping session.

- Conducted Geologic Processes & Human influences scoping meeting.

Glen Canyon National Recreational Area

- Technical assistance to SOL on mineral acquisition of Indian uranium mine/State of UT.

- Assisted park managers in their response to Viking Exploration nomination of oil and gas leases inside Glen Canyon.

- Provided assistance and review of NEPA documentation for White Canyon / Blue Notch Mine closures.

- Consulted on land ownership issues and arranged for closure of Whirlwind Mine.

- Provided on-site technical oversight on White Canyon and Blue Notch mine closures.

Grand Canyon National Park

- Reviewed Canyon video and write synopsis for web page site.

- Developed a restoration priority matrix for the park.

- Consulted with CERCLA group on Orphan Mine investigation.

- Provided park with policy-based advice about proposed “Trail of Time” interpretive site.

Grant-Kohr’s Ranch National Historic Park

- Conducted Geologic Resources Inventory scoping session.

Great Sand Dunes National Monument

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Guadalupe Mountains National Park

- Digitized Geologic Maps through Geologic Resources Inventory.

Lake Meredith National Recreation Area

- Reviewed Oil and Gas Management Plan in-house draft of FEIS. Assisted Linda Dansby in preparing the FEIS.

- Reviewed and provided comments on the Record of Decision and final O&GMP.

- Provided technical review and comments for Pantera Energy plan for reentering Cecil No. 1 well.

Mesa Verde National Park

- Arranged and conducted joint inspection of Horse Trap Coal Seam Fire with Colorado Division of Mines and Geology.

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Padre Island National Seashore

- Prepared list of substantive comments received on the first draft of the BNP Lemon and Lemonseed #1000S and #1008S wells EA. Reviewed and commented on the plan of operations and revised environmental assessment for the BNP Lemon and Lemonseed #1000S and #1008S wells.

- Reviewed and commented on the BNP Plum §9.32(e) directional drilling application.

- Provided technical review and comments for Mustang Island Gathering Company, LLC Plan of Operations for installation of compression on existing pipeline operations.

- Provided technical review and comments for 4 new wells (Dunn-Murdock No. 1, Lemon No 1, Lemon Seed No. 1, and Plum No. 1).

- Prepared response to mineral owner’s (Dunn-McCampbell) claims against NPS related to oil and gas management at Padre Island.

- Drafted letters on behalf of park to the U.S. Army Corps of Engineers concerning the Corps’ plans to dredge the Intracoastal Waterway adjacent to Padre Island National Seashore and deposit some of the dredged sediment within the park.

- Prepared briefing for Associate Director of Natural Resources Stewardship and Science about the use of off-road vehicles at the park.

Pipe Spring National Monument

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

- Oversaw NRPP proposal for new geologic investigations related to Pipe Spring drying up. Involves new subsurface investigations to understand hydrogeological processes in the park.

Rocky Mountain National Park

- Provided historical abandoned mine land information to park staff.

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Saguaro National Park

- Provided technical report reviews and oversight on Wildhorse Mine bat gate experiment.

- Conducted underground inspection and participated in CERCLA scoping meeting on Old Yuma Mine.

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Salinas Pueblo Missions National Historic Park

- Advised the park regarding mineral inholdings and adjacent clay mining issues.

Sonoran Desert Network Tonto National Monument

- Completed a field inspection and report of the geohazards at the Upper and Lower Ruins.

Washita Battlefield National Historic Site

- Developed a restoration plan for an abandoned railroad grade.

White Sands National Monument

- Conducted Geologic Processes & Human influences scoping meeting.

Yellowstone National Park

- Reviewed CSM Engineering study for potential inline

hydroelectric power generation.

- Scanned Surficial Geologic Maps of park through Geologic Resources Inventory. These will eventually be digitized for park management use.

Zion National Park

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

Midwest Region

Apostle Islands National Seashore

- Helped park apply minerals- and wilderness-related NPS Management Policies during development of park general management plan.

Badlands National Park

- Assisted Denver Service Center with mineral rights, development and sand and gravel issues for park GMP.

- Assisted Denver Service Center in developing impact thresholds for paleontological resources for park GMP.

- Conducted Geologic Resources Inventory scoping session.

- Completed partial Digital Geologic Map of park through Geologic Resources Inventory.

Buffalo National River

- Coordinated with park on state funding of bat gate mine closure initiative.

Cuyahoga Valley National Park

- Assisted park staff in response to issues related to oil and gas operations on Boy Scout property inside the park.

Jewel Cave National Monument

- Conducted Geologic Resources Inventory scoping session.

Mount Rushmore National Memorial

- Conducted Geologic Resources Inventory scoping session.

Ozark National Scenic Riverways

- Interdisciplinary development of a disturbed lands (particularly roads and river crossings) restoration plan.

- Conducted Geologic Resources Inventory scoping session.

- Conducted Geologic Processes & Human influences scoping meeting

Theodore Roosevelt National Park

- Provided technical assistance on 5150-acre mineral appraisal for Trust for Public Lands.

- Reviewed and consolidated GRD's comments for the Boundary Expansion Study / EA.

- Conducted Geologic Resources Inventory scoping session.

Wind Cave National Monument

- Conducted Geologic Resources Inventory scoping session.

National Capital

Chesapeake and Ohio Canal National Historic Park

- Sent geohazard risk assessment options to park contact.

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

George Washington Birthplace National Historic Site

- Conducted Geologic Processes & Human influences scoping meeting.

George Washington Memorial Parkway

- Conducted Geologic Processes & Human influences scoping meeting.

Harpers Ferry National Historic Park

- Completed Digital Geologic Map of park through Geologic Resources Inventory.

National Capital Parks East

- Conducted Geologic Processes & Human influences scoping meeting.

Northeast Region

Acadia National Park

- Developed strategies to restore disturbed areas at the Schoodic Navy Base and Summit of Cadillac Mountain.

Allegheny Portage Railroad National Historic Site

- Completed a technical review of the acid mine drainage remedial study.

Assateague Island National Seashore

- Provided technical assistance for Corps ecosystem restoration project to raise elevation of northern portion of island.

Delaware Water Gap National Recreation Area

- Conducted Geologic Resources Inventory scoping session.

New River Gorge National River/Gauley River National Recreation Area

- Provided assistance to park staff for initiating a strategy to plug exhausted gas wells in the two parks including onsite visits and meetings with an operator and a state oil and gas inspector.

- Visited park to assess impacts from multiple gas wells. Met with staff from Equitable Oil Company to discuss proposed plugging operation at GARI.

Pacific West Region

Death Valley National Park

- Provided comments on Abandoned Mine Lands Management Plan.

- Worked with park on investigation of possible theft/vandalism of fossil track site.

- Developed monitoring protocols.

- Conducted Geologic Resources Inventory scoping session.

- Helped park address mine operator's request for access across the park.

Devils Postpile National Monument

- Conducted Geologic Resources Inventory scoping session.

Ebey's Landing National Historic Site

- Conducted Geologic Resources Inventory scoping session.

Golden Gate National Recreation Area

- Provided restoration or stabilization options for nine disturbed lands sites.

- Evaluated five disturbed highway/road/trail sites.

- Drafted comments on the U.S. Army Corps of Engineers' (San Francisco District) analysis of the Ocean Beach Shoreline Protection proposal, emphasizing the need for the project to be consistent with all applicable NPS authorities.

Joshua Tree National Park

- Performed gravel Pit Inventory and Restoration Recommendations – inventoried 19 in-park gravel pits, conducted Total Station surveys, developed Parkwide Restoration Recommendations Report.

- Provided comments on Abandoned Mine Lands Safety Plan.

- Conducted pre- and post-closure surveys of 32 mine workings.

- Facilitated partnership of park with San Bernardino County Museum for paleontology survey of the Pinto Basin.

Lake Mead National Recreation Area

- Conducted Geologic Resources Inventory scoping session.

Lake Roosevelt National Recreation Area

- Conducted Geologic Resources Inventory scoping session.

Lassen Volcanic National Park

- Performed Dream Lake dam assessment, stream restoration survey and restoration recommendations report.

Manzanar National Historic Site

- Assisted in the assessment of causes of erosion and recommendations of remedial actions.

Mojave National Preserve

- Assisted the park hydrologist with groundwater monitoring and closure requirements at the Collusseum Mine.

Mount Rainier National Park

- Conducted Geologic Resources Inventory scoping session.

North Cascades National Park

- Conducted Geologic Resources Inventory scoping session.

Olympic National Park

- Reviewed 21 page appeal decision for Solicitor's Office on Shi Shi Beach sand and gravel ownership.

- Participated in teleconference on Shi Shi Beach strategy with park management and Solicitor's Office.

- Provided mineral sampling protocol to park staff.

- Assisted in the development of Finley Creek extraction / restoration planning and identification of GMP alternatives for the Finley Creek Bridge.

- Conducted Geologic Resources Inventory scoping session.

Oregon Cave National Monument

- Worked with park staff on paleontological issues in cave passages.

Point Reyes National Seashore

- Provided recommendations to remove three impoundments.

- Reviewed and edited the Glenbrook Dam removal implementation plan.

- Provided comments to park about the U.S. Army Corps of Engineers' proposal to dredge approximately 1.4 million cubic yards of sediment from Bolinas Lagoon, which is partially located within park boundaries, and dispose the sediment in the deep ocean offshore.

San Juan Island National Historical Park

- Conducted Geologic Resources Inventory scoping session.

Sequoia-Kings Canyon National Park

- Conducted Geologic Resources Inventory scoping session.

Whiskytown-Shasta-Trinity National Recreation Area

- Advised park personnel on disturbed land inventory process and legal issues regarding the disposal of a Bureau of Reclamation water tunnel spoil pile.

Yosemite National Park

- Conducted field inspection, mapped, and forwarded mitigation recommendations on El Portal Mine.

- Conducted Geologic Resources Inventory scoping session.

Southeast Region

Big Cypress National Preserve

- Continued to provide assistance to Preserve in understanding the potential oil and gas resources and how their occurrence could translate into activity and/or market value for an acquisition

strategy. Activities included a meeting in Metairie with USGS and MMS geologists and follow-up trip report, and an estimation of potential range of values for Collier's mineral estate.

- Participated in Oil and Gas Management planning.

Big South Fork National Recreation Area

- Provided an adequacy and technical review of 1 proposed plans of operations for reactivating idle wells (Tennessee Eastern).

Cape Hatteras National Seashore

- During a one-month detail, worked at park as staff and acting chief of the resources management division.
- Helped park develop comments on the U.S. Army Corps of Engineers' Final Supplemental Final Environmental Impact Statement analyzing the Corps' proposed jetty project in the park.
- Helped park develop a memo to NPS Director Mainella about the status of the Corps' NEPA documentation for the proposed jetty project.
- Helped park analyze whether Corps adequately addressed the impact of the proposed jetty project on NPS wetlands and the costs of wetland mitigation.
- In response to request by the Council on Environmental Quality, worked with the park and the National Oceanic and Atmospheric Administration to develop a memo addressing several issues about the proposed jetty project.

- Drafted request, on behalf of the park, for legal opinion from Southeast Regional Solicitor's Office about three coastal jurisdictional issues.

- Helped park work as a cooperating agency with the Corps in preparing an Environmental Assessment analyzing the Corps' proposed dredging operations for 2002. Helped park prepare the NPS Finding of No Significant Impacts and related documents.

- Worked with park and U.S. Fish & Wildlife Service to draft comments on the General Accounting Office's draft report analyzing the economic and environmental issues associated with the proposed jetty project.

- Helped park initiate development of a programmatic Environmental Impact Statement for long-term channel maintenance and resource protection at Oregon Inlet.

Everglades National Park

- Completed technical review of the East Extension mineral rights contract.
- Completed a paneled ranking of 4 contracts for the East Extension mineral acquisition.

Great Smoky Mountains National Park

- Provided closure recommendations and draft PMIS proposal for Eagle Creek and Sugar Fork Mines.

Gulf Islands National Seashore

- Drafted a comment letter to the U.S. Army Corps of Engineers concerning the Corps' proposed Preliminary Restoration Plan, which would involve dredging 1.4 million cubic yards of sediment from a spoil island within park boundaries and depositing the sediment elsewhere within or close to the park.

Jean Lafitte National Historic Park and Preserve

- Provided documents to park staff to assist in communicating NPS permitting process to interested parties.
- Evaluated the active restoration of abandoned oil and gas canals in the Barataria Reserve.

Obed Wild and Scenic River

- Conducted site visit to assess necessary actions to remediate damage caused from oil well blow-out that occurred in July 2002.
- Assist park in developing an approach to plugging the Hawn No. 1 well.

- Provided assistance to park in their response to the Howard-White No. 1 well blowout just outside the park boundary, and their participation as a member of EPA's emergency response team.

Networks

National Capital Parks Network

- Convened Geologic Processes Monitoring scoping workshop.

North Coast and Cascades Network

- Conducted Geologic Resources Inventory scoping session.

Northeast Coast and Barrier Network

- Assisted with development of shoreline change monitoring protocols.

Northern Great Plains Network

- Conducted Geologic Resources Inventory scoping session.

San Francisco Bay Network

- Participated in vital signs scoping meeting for GOGA and PORE.
- Convened Geologic Issues scoping workshop.

Mediterranean Coast Network

- Participated in vital signs conceptual model workshop.

Greater Yellowstone Area Network

- Provided input through the Dilphi Process on geologic monitoring.

Sierra Network

- Conducted Geologic Resources Inventory scoping session.

Servicewide

Disturbed Lands Restoration and Abandoned Mineral Lands Programs

- Developed PMIS proposal and Issue Paper on Restoration of Natural Landscapes – NPS maintenance operators restoration training and certification program.

- Prepared Bat Gate Proposal under Cooperative Conservation Initiative (PMIS 98201) in cooperation with Biological Resources Management Division.

Interagency Coordination and Collaboration

- Provided technical assistance to Trust for Public Lands on 3,000-acre Idarado/USFS appraisal.

- Provided technical assistance to EPA on Coal Bed Methane Report to United Nations.

- Provided technical assistance to National Academy of Science on Coastal Mapping and Charting Needs.

Policy and Regulatory Assistance

- Conducted Oil and Gas Workshop for NPS employees.

- Published Operator's Handbook for conducting oil and gas operations.

Minerals Program

- Initiated GIS project to identify/display NPS units in, or near, areas of high mineral potential, therefore facing increased pressure to develop.

- Developed PMIS proposal and Issue Paper on funding of sand and gravel planning efforts.

Validity Program

- Worked as part of BLM Mineral Examiner Certification Panel reviewing controversial Glamis Imperial Mineral Report.

- Worked as part of BLM Mineral Examiner Certification Panel re-writing BLM Handbook H-3890-1: Handbook for Mineral Examiners.

Coastal Program

- Convened workshop to develop coastal geologic inventory protocols for Atlantic and Gulf Coast parks.

- Began conducting Vulnerability Assessments with USGS in coastal parks to assess sea-level rise impacts; published joint NPS-USGS Fact Sheet on project.

Geologic Resources Inventory Program

- Conducted numerous Geologic Resources Inventory scoping session.

- Completed digitization of numerous geologic maps, and bibliographies.

- Developed servicewide database for tracking the geologic inventories for 274 parks.

Paleontological Program

- Researched and provided informal technical comments and suggested amendments to Congressional staffers about the proposed Paleontological Resources Preservation Act. Provided input into Department of Interior testimony for the bill.

Other

- Provided mineral appraisal technical assistance to Jeffco Open Space Council acquisition.

- Taught Earth Science Class (Mining & Environment) at Green Mt. High School.

- Provided technical assistance to DOI (Kit Kimball) on Baca Ranch buyout.

- Sent gold mining information to 8th grade science student from web request.

- Participated in Colorado Mine Land Reclamation Council Meeting in Silverton, CO.

- Wrote and released Operators Handbook for Nonfederal Oil and Gas Development in Units of the National Park System, distributed to NPS regional mineral coordinators, park resource protection staff, and oil and gas operators.

- Developed NRPC working group to discuss ways that NRPC can assist the DSC in their GMP planning efforts. Met with DSC staff and planning management to discuss proposed planning assistance and ways to improve the content of the GMPs. Participated in DO-2 revision meetings. Presented NRPC's functions and roles in GMP planning process to DSC staff planning staff.

- Participated in workgroup to improve DSC construction guidance by adding resource protection guidelines and NRPC contacts.

- Developed of NPS report "The Geothermal Steam Act and the National Park Service."

- Provided staffing assistance in Albright Natural Resource Fundamentals II course after Bob Karotko departed. Led subsequent field trips to Zion NP, Bryce Canyon NP, and Pipe Springs NM to view park natural resource issues.

- Traveled to Albright Training Center and presented a one-day session on Division programs and current issues to trainees enrolled in the NPS Fundamentals for Natural Resource Management course. Division presentations included staffing and available skills, key Division contacts, and overviews of the NPS geologic resource management, minerals management and disturbed lands restoration programs. Both technical and policy/regulatory components of the presentations were supported with park case studies.



Division Staff Profiles

Lindy Allen - Division Secretary

Lindy joined the Division this year and is new to the NPS. As Division Secretary, she provides administrative support to the entire Division. She serves as the main contact for meeting planning, logistics, and travel. Lindy holds a B.A. in journalism and political science from Indiana University. Phone: 303-969-2090; e-mail: lindy_allen@nps.gov.

Zelda Chapman Bailey - Interim Director, National Cave and Karst Research Institute

Zelda's duties as the Interim Director of the National Cave and Karst Institute include moving forward with NPS efforts to establish the Institute by defining the scope of operation, designing an organizational structure, forming partnerships, finding funding sources, and defining research needs. Her previous work experience includes various positions with the USGS, including Assistant District Chief for Operations in the Caribbean District, Associate District Chief for Hydrologic Studies in Colorado, and Acting District Chief for Colorado and Wyoming. Zelda has a degree in geology from Indiana University. Phone: (303) 497-7000; e-mail: zelda@boulder.nist.gov.

Rebecca L. Beavers - Coastal Geologist

Rebecca is responsible for marine resources, coastal geomorphology, coastal processes, and resource management related issues. She has worked with the U.S Geological Survey and the U.S Army Corps of Engineers on a variety of coastal and nearshore research projects since 1993. Rebecca has worked for the Division since 2000. She holds a B.A. in biology and geology from Williams College and a Ph.D in geology from Duke University. Telephone: 303-987-6945; e-mail: rebecca_beavers@nps.gov.

Julia Brunner - Policy and Regulations Specialist

Julia works on regulatory and policy issues related to mining claims, nonfederal mineral operations, geologic resources (particularly geohazards and coastal issues), paleontological resources, mining-generated solid waste, wilderness, and disturbed land restoration. Before joining the Division, Julia clerked at a law firm and for the Idaho Supreme Court. Julia holds a B.A. in biology with an ecology emphasis from Dartmouth College and a J.D. from the University of California-Berkeley-Boalt School of Law. Phone: 303-969-2012, e-mail: julia_f_brunner@nps.gov.

John E. Burghardt - Geologist/ Certified Mineral Examiner

John's duties are split evenly between coordinating the Mining Claim Validity Program and participating in the Abandoned Mineral Lands segment of the Disturbed Land Restoration Program. John provides mine safety instruction to federal and state agencies and participates in bat conservation initiatives as they relate to bat habitat in abandoned mines. John represents the NPS on the Bureau of Land Management's National Mineral Examiner Certification Panel, and on the Colorado Advisory Board of the Western States Bat Working Group. He worked for 10 years as a miner, surveyor, and engineer for Amax, Inc. (now Phelps Dodge) at Henderson Mine. He received a B.S. in geology from Colorado State University in December 1976. Phone: 303-969-2099, e-mail: john_burghardt@nps.gov.

Philip Cloues - Mining Engineer/ Mineral Economist

Phil provides expertise for the Division in mining and exploration plan evaluation, environmental mitigation, regulation analysis for leaseable, locatable, and mineral material development, mineral appraisal, economic feasibility analysis, mineral royalties, equipment selection, mine restoration, and geohazard assessment. Phil worked for four years in the private sector, spent two years with the Peace Corps (Ministry of Mines in Venezuela), and 32 years with DOI (USGS/10, MMS/2, BLM/6, and NPS/14). He holds a M.S. Mineral Economics & EM Mining Engineering/Colorado School of Mines. Phone: 303-969-2148, e-mail: phil_cloues@nps.gov.

Tim Connors - Geologist

Tim's major duties include oversight of the Geologic Resources Inventory as well as general computer support, database development, and providing Geographic Information Support (GIS) to the Division. He has been with the NPS and GRD for four years. Tim's educational background includes an M.S. in Geology (1996, University of Toledo, Toledo Ohio) and a B.S. in Geology (1991, University of Toledo, Toledo Ohio). Phone: 303-969-2093, e-mail: tim_connors@nps.gov.

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Sid is the Division contact for geothermal resources, aeolian processes and geologic input for park planning documents. He is also a Certified Mineral Examiner. Sid has worked for private industry as an exploration geologist, production geologist, and a Land Reclamation Superintendent. He was also an Assistant Professor of Geology and Mathematics at Colorado Mountain College. Sid's government service includes duties as a mineral examiner with the U.S. Forest Service, and a coal and petroleum geologist with the U.S. Geological Survey. Sid holds an M.S. in geology from Florida State University. Phone: 303-969-2154; E-mail: sid_covington@nps.gov.

Diane Diedrichs - Program Analyst

Diane tracks the budget for the Division. She is responsible for obligating and transferring funds for each separate program. Diane began her career at the NPS 16 years ago, and has worked as the Program Analyst for the Division for 6 years. Phone: 303-969-2070; e-mail: diane_diedrichs@nps.gov.

Judy L. Geniac - Environmental Protection Specialist

Judy manages the Natural Resource Program Center's GeoScientist-in-the-Parks Program. She helps parks identify physical and associated ecological resource projects, the type and level of expertise needed, and funding sources and individuals to do the work. Previously, she worked for the U.S. Fish and Wildlife Service, Bureau of Land Management, Corps of Engineers, and other NPS offices: Everglades NP, Big Cypress NP&P, Colorado NM, and the Water Resources Division via the Colorado State University. Judy has a B.A. in biology and masters credits in environmental management. Phone: 303-969-2015; e-mail: judy_geniac@nps.gov.

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Deanna works with the Division's Disturbed Lands Restoration Program where she serves as a Servicewide technical expert on physical restoration and resource management, protection and mitigation. She has previously worked with the U.S. Army Corps of Engineers and the Bureau of Land Management. Deanna holds a degree in Geology from the University of Arkansas. Phone: 303-969-2351; e-mail

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Bruce Heise - Geologist

Bruce is responsible for administering the Inventory and Monitoring Program's Geologic Resource Inventory. He coordinates partnerships between the NPS and a variety of earth science organizations and also serves as the NPS liaison with the USGS Central Region Geologic Division. Bruce's previous work experience includes two years experience with the USGS and ten years in the oil and gas industry. He holds a B.S in geology from the University of Massachusetts, and a M.S in geology from the University of Montana. Phone: 303-969-2017; e-mail: bruce_heise@nps.gov.

Robert D. Higgins - Chief, Science and Technical Services Branch

Bob is responsible for Servicewide geologic programs, supporting NPS geologic research, planning, resource protection, education, interpretation, I&M, and information transfer. Bob has over 30 years experience in geologic resource management including minerals exploration and leasing, crystallographic research, oil and gas exploration and reserves engineering, and earthquake research. He holds a B.S in geology from the University of Arizona and a M.A in engineering administration from George Washington University. Phone: 303-969-2018; e-mail: bob_higgins@nps.gov.

Louise D. Hose - Director, National Cave and Karst Research Institute

Louise manages the National Cave and Karst Research Institute located in Carlsbad, New Mexico. Louise is new to the Division and the NPS. Her previous experiences include many years of speleological research in the United States, Mexico and Oman, with work sponsored by the National Geographic Society, National Science Foundation, and National Speleological Society. Over the past 17 years, she taught at Louisiana State University, University of Colorado in Colorado Springs, Westminster College (Missouri), and Chapman University. Louise holds a B.A. in education from Arizona State University and a Ph.D. in geology from Louisiana State University. Phone: 505-234-5561.

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Edward Otto Kassman, Jr. - Regulatory Specialist

Ed has been a policy and regulations specialist with the Division since 1993. He is the Division's point of contact for regulatory/policy issues related to the exercise of nonfederal oil and gas rights, federal mineral leasing, nonfederal mineral operations, external threats to park resources, and in-park administrative use of mineral materials. Ed holds a B.A. in history from the University of Colorado in Boulder and a J.D. from Suffolk University Law School. Phone: 303-969-2146; e-mail: edward_kassman@nps.gov.

Ronal C. Kerbo - National Cave Management Coordinator

Ron coordinates a Servicewide program to protect cave and karst resources, provides advice and consultation to the Washington office, Regions, and Parks in the development and implementation of cave related resource management programs. He has been a cave specialist for the NPS for 27 years, caving and diving for over 40 years. Ron is an honorary life member and Fellow of the National Speleological Society, member of Cave Research Foundation, Honorary Director of the American Cave Conservation Association, and a Director of the Karst Waters Institute. Phone: 303-969-2097; e-mail: ron_kerbo@nps.gov.

Diana Madden Maxwell - Natural Resource Program Center Partnership Program Coordinator

Diana works with each division within the NRPC by creating partnerships that will provide assistance to the entire natural resource network in NPS units. She also assists with education and marketing efforts and, using her Public Affairs background, helps the Center produce materials that better explain our programs and projects. Prior to working with the NPS, Diana ran radio stations in Arizona, worked for Hearst Publications in sales and marketing in New York City, and was the principal therapist in a private Adolescent Family Counseling practice in New York, New Hampshire and Arizona. Her civil service duty began as the Director of Communications for the Pima County Department of Transportation and Flood Control in Tucson for 6 years, followed by 10 years as the Public Affairs Officer/Partnership Manager for the Forest Service in Tucson. She holds a B.A. in Education and Psychology from Goddard College and a M.A in Adolescent Psychology and Counseling from the University of Arizona. Her post graduate work is in design

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Carol McCoy - Chief, Policy and Regulations Branch

Carol manages the Policy and Regulations Branch. She is responsible for the development and application of NPS policies and regulations regarding minerals management and geologic resources, training, litigation support, legislation, input on other agencies' regulations and policies, and assistance on policy matters that span the Natural Resource Program Center. Carol has worked for the federal government on regulatory and policy matters for 24 years: first with EPA then the NPS. Carol holds a B.A. in environmental studies from Brown University, a Masters Degree in public policy from the University of Michigan-Ann Arbor, and a J.D. from Georgetown University Law Center. Phone: 303-969-2096; e-mail: carol_mccoy@nps.gov.

Kerry W. Moss - Environmental Protection Specialist

Kerry coordinates Division's external minerals function that focuses on elimination or mitigation of cross boundary impacts to NPS resources from adjacent minerals and energy exploration and development. Kerry specializes in hardrock, placer, and coal mine planning, permitting, environmental compliance and impact mitigation. His past work experience includes 3 years with the Jefferson County (CO) Sheriffs Department, 3 years with Conoco Oil, and 18 years with the NPS. Educational background in Criminal Justice and Environmental Planning. Phone: 303-969-2634; e-mail kerry_moss@nps.gov.

Elizabeth S. Norby - Petroleum Geologist

Lisa's duties include oil and gas planning, technical evaluation of plans of operations, and recommendation of resource protection measures that can be implemented at oil and gas sites. She has worked in the NPS for 8 years as a petroleum geologist and previously as a natural resource specialist doing resource planning and NEPA compliance. She has also worked for 12 years as a Geophysicist and Geologist with Mobil Oil Corporation. Lisa holds a B.S. in geology (Ohio University), M.S. in geology (Idaho State University), and Masters in environmental planning and management (University of

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Patrick O'Dell - Petroleum Engineer

Pat is the point of contact for oil and gas development issues in and near parks. He is responsible for assessing impacts of oil and gas activity in and around parks, and developing measures to minimize or remove such impacts. Pat's prior work experience includes work in California and Alaska on environmental and safety compliance and 10 years with Marathon Oil Company working with well workover and production operations as well as field development planning, reserve determination, and property evaluation for purchase or sale. Pat has a B.S in petroleum engineering from Montana College of Mineral Science and Technology (1982) and is a registered professional petroleum engineer. Phone: 303-969-2013; e-mail: pat_o'dell@nps.gov

Anne Poole - Physical Scientist

With a background in geology and GIS, Anne joins the Division this year. She is responsible for digitizing geologic maps for the Geologic Resource Inventory. For the past three years, Anne has been working with the Geologic Resources Inventory at other locations, including Mesa Verde and the Albuquerque Intermountain Support Office. She now joins the Geologic Resources Division in Denver in order to work with the rest of the Inventory team more efficiently. Anne has a B.A in geology from Bryn Mawr College in Pennsylvania and a M.S in geology from Rice University in Texas. Phone: 303-969-6954; e-mail: anne_poole@nps.gov.

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Hal works as a geomorphologist, serving primarily as a technical expert on the restoration of disturbed lands such as deteriorating stream channels, gravel pits, ponds and roads. He also evaluates the impact of natural geologic processes on park natural resources, cultural resources, infrastructure and visitors. Previously, Hal worked three years as a geomorphologist for consulting firms in Colorado and Oregon, two years as a hydrologist for the state of Wyoming coal regulatory program, and nine years as a hydrologist for the U.S. Office of Surface Mining. Hal holds geology degrees from Colorado State

For a complete listing of Natural Resource Program Center employees, please visit our directory at <http://www1.nrintra.nps.gov/directory/>

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Melanie V. Ransmeier - Natural Resource Specialist (SCEP)

Melanie began working for the Division in 2000 as a University of Denver student intern and joined the NPS as a participant in the Student Career Employment Program (SCEP). Melanie is a graduate student studying the application of GIS in natural resource management. She has been involved in the Division's educational web design and outreach efforts. Melanie has also worked on special projects for both Timpanogos Cave National Monument and Assateague Island National Seashore. Melanie holds a B.S. degree in environmental science and is working toward an M.S. degree in geographic information science from the University of Denver. Telephone: 303-969-2315; e-mail: melanie_ransmeier@nps.gov.

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Dave is responsible for the Division's overall management and program direction. Dave has 27 years of federal policy, regulatory, and management experience beginning with U.S. Environmental Protection Agency in 1976. He came to the NPS Air Quality Division in 1979, and served as manager of the NPS minerals management office from 1983 to 1995, when the office function was broadened to geologic resources management. Dave has a B.S. in economics from the University of Minnesota, a M.S. in environmental science from the University of Wisconsin, and a J.D. from Georgetown University Law Center. Phone: 303-969-2094; email: dave_shaver@nps.gov.

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Dave is the Program Manager for the Servicewide Disturbed Lands Restoration and Abandoned Mineral Lands Reclamation programs. He serves as a technical consultant on issues relating to surficial geologic features and processes, including serving as Servicewide contact on restoration and performance management implementation. Dave has worked for the NPS for 16 years as a geologist (Redwood NP, GRD) and has over 17 years experience in geomorphology and landscape restoration and analysis. He holds M.S. (California State Univ.,

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Jim F. Wood - Physical Scientist

Jim is the Education Specialist for the Division. He coordinates NPS geologic educational goals with external partners and works with parks to develop educational programs, general interest geology publications, and Internet sites. Jim began his NPS career at Redwood National Park in 1986 and has also worked at Yellowstone National Park, Mojave National Preserve, and the Long Distance Trails Group Office in Santa Fe. Jim holds a B.S. in physical science and an M.A. in environmental education. Phone: 303-969-2149; e-mail: jim_f_wood@nps.gov.

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Jim supervises the Division's Mineral Operations Branch and is responsible for the technical evaluation of proposed mineral development inside parks, on-site inspection of mineral operations, park minerals management planning, and development of NPS sand and gravel extraction plans. He also provides guidance documents for mineral operators in parks, and is a technical liaison on site specific minerals development proposals external to parks. Jim has worked for the NPS for 24 years as a natural resource and minerals management specialist in parks (Padre Island NS and Big Thicket NP) and in the Division. Jim has a B.S. in marine biology (Texas A&I University at Corpus Christi). Phone: 303-969-2635; email: jim_c_woods@nps.gov.

Mark Sandy Ziegenbein - Mining Geologist

Mark is the Division contact for in-park mining and sand and gravel extraction issues. He is also a Certified Mineral Examiner and assists parks with disturbed land inventory, restoration design and implementation. Mark has over 20 years of combined experience working on mining, environmental, and disturbed land restoration projects for Bechtel Inc., the Bureau of Land Management, Dames and Moore, Santa Fe Mining Inc. and the NPS. He holds B.S. in Geology from California State University in Sonoma. Phone: 303-969-2957; e-mail: mark_ziegenbein@nps.gov.

Geologic Resources Division

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