

National Park Service  
U.S. Department of the Interior

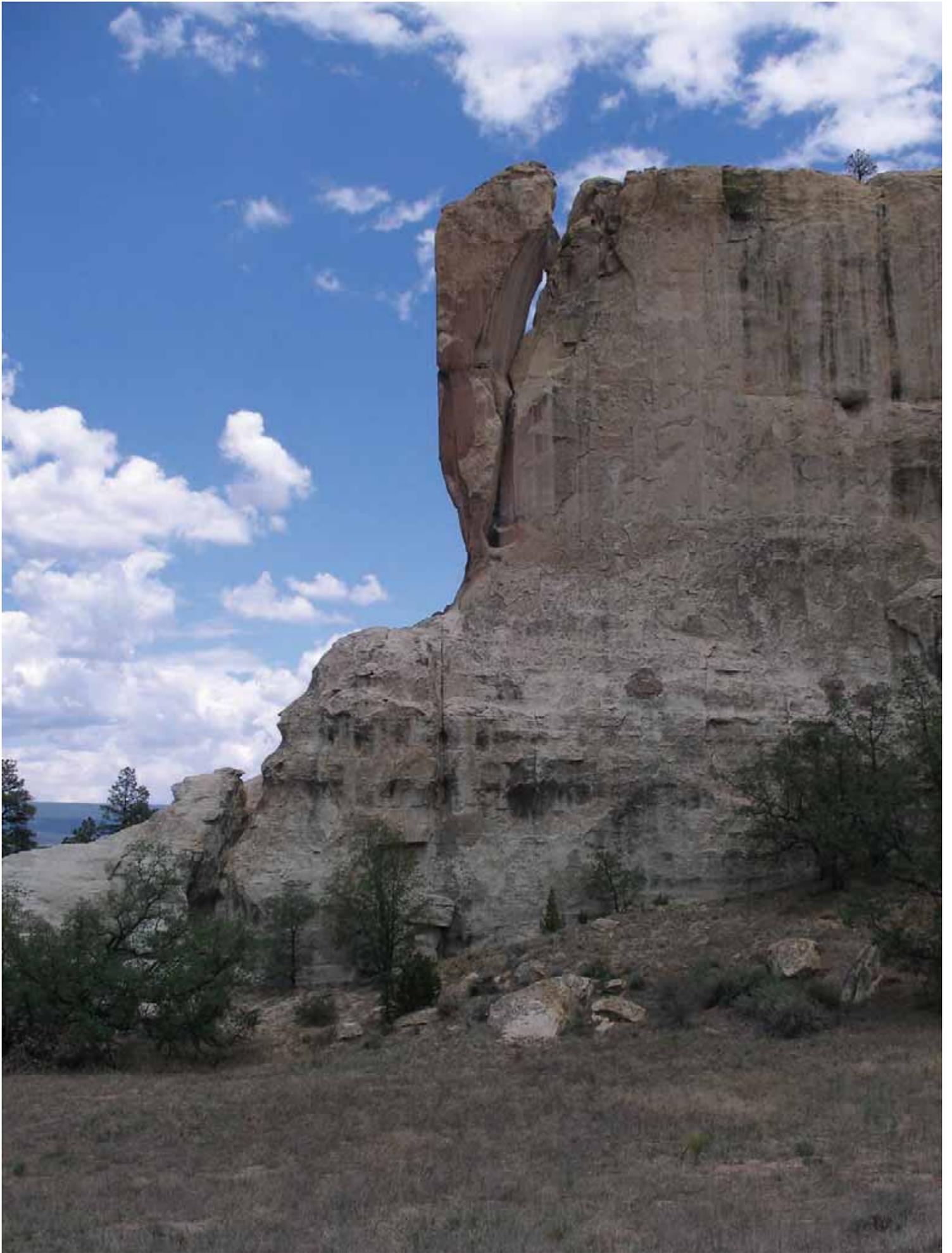
Geologic Resources Division  
Denver, Colorado



# Geologic Resources Division

## 2006 Annual Report





---

# **Geologic Resources Division**

## 2006 Annual Report

Geologic Resources Division  
Denver, Colorado

U.S. Department of the Interior  
Washington, D.C.



Keweenaw National Historical Park, Michigan

# Executive Summary

The Geologic Resources Program provides support to parks and the Directorate on a broad range of geologic science and minerals management activities. It coordinates Servicewide functions and provides park managers with geoscience and regulatory expertise related to cave and karst systems, coastal and surficial geologic processes, disturbed land restoration, fossil resources, geologic hazards, soil resources management, environmental effects of mineral extraction, mineral extraction technology and engineering, and associated NPS policy and legal authorities to enhance resource management decisions. Since its inception in 1995, the program has had limited travel and project support funding with base budget essentially limited to professional staff personnel costs. In 2000, the program received a Natural Resource Challenge increase of \$695,000 to add six geologic specialists.

The Geologic Resources Division has 28 permanent staff engaged in providing geoscience technical assistance and policy and regulatory support to park managers, as well as presenting NPS geologic education and outreach to the public. Through its professional staff and partnerships with the professional geoscience community, the program guides NPS endeavors to address geologic processes and features in park resource management and operations. Geologic and soils mapping and associated resource evaluations provide parks with key information for resource management. Other program efforts help parks to restore lands and remediate resource damage caused by previous human activities, included abandoned mineral operations, and to avoid or mitigate potential adverse effects from mineral development in and around parks. The Division also leads NPS involvement in the National Cave and Karst Research Institute. Eight partner employees as well as numerous student interns and volunteers work directly with the division to augment support to parks. The Division accomplishes many of its projects by utilizing partnerships with geologic organizations and leveraging funds from other NPS sources, such as the Recreational Fee Demonstration and Natural Resource Preservation Programs (NRPP).

In 2006, the Division was actively involved in park management projects across the National Park System, ranging from coastal management and hurricane response to disturbed lands restoration to fossil resource protection and the permitting of mineral operations. Given the limited internal NPS geoscience capacity, assistance from the broader geologic community is important for supporting park resource management. Fortunately the professional geoscience community has been very responsive to NPS needs. Through Geologic Resources Division staff, the NPS has been able to channel this external professional interest to yield positive results for parks. Partner organizations, such as the American Geological Institute, Geologic Society of America, U.S. Geological Survey, and State Geologic Agencies have facilitated geologic research, education and interpretation efforts and leveraged NPS funds for park resource management projects. These partnerships have led to improved park geoscience information and associated resource management actions and better geologic information sharing by NPS with the public. Many of these partnerships are essential to the Division's progress in accomplishing geologic inventory efforts under both the Geologic Resource Evaluation and the Soil Resources Inventory Programs. The latter activity

relies heavily on its partnership with the Natural Resources Conservation Service in the U.S. Department of Agriculture.

The Geologic Resources Program directly assists NPS in meeting its Strategic Plan goals. Division staff serves as the Servicewide coordinators for the NPS Disturbed Land Restoration and Paleontology goals. The NPS performance in 2006 under GPRA Goal 1a1A – Disturbed Lands Restoration was restoration of 1730 acres (0.4% of 437,150 acres), for a cumulative total of 10,600 acres (2.4% of 437,150) reclaimed since 2004. The NPS in 2006 missed the target of 3% of 437,150 disturbed acres. The 2006 Strategic Plan target for Goal 1a9 - Paleontological Localities was to have 38% of documented paleontological localities in parks in good condition, which the NPS exceeded with parks reporting 49% (1,589 of 3,250 localities) in good condition. The Division also contributes to the NPS Natural Resource Inventory Goal 1b1 by completing park geologic mapping and soil inventories through the Geologic Resource Evaluation initiative and the Soil Resources Inventory, with results reported through the Inventory and Monitoring Program.

Highlights of program accomplishments in 2006 include the following:

- Disturbed land restoration staff managed \$795,000 in Servicewide NRPP restoration project funding for 13 park projects, distributed through five NPS regions. These projects restored nearly 350 acres of severely disturbed land. In addition, Division restoration and reclamation specialists responded to over 25 park requests involving disturbed lands, abandoned mine safety, and geomorphological issues. Staff provided assistance to park restoration efforts through site assessments, safety hazard analysis and mitigation design, geomorphic analyses and landform restoration designs, cost estimates, and project oversight assistance.
- Minerals management staff assisted managers in 30 parks with technical and regulatory support in addressing the often contentious issues associated with private mineral development in and adjacent to parks. This expertise helped NPS managers protect park resources from the adverse effects of past, current, and future mining and drilling.
- Geologic Resources Evaluation Program staff managed a budget of \$1.75 million targeted at enhancing park understanding and access to information related to geologic resources. At the close of 2006, the staff had held scoping meetings for 171 parks to discuss park geologic map needs and geologic resource management concerns with park staff and geologic experts from partner organizations, produced digital geologic maps for 93 parks, and prepared 26 geologic reports that summarize key geologic issues at individual parks and opportunities for integrating geologic information into park decision making. These products are distributed to parks, networks, and regions, and posted at [http://www2.nature.nps.gov/geology/inventory/gre\\_publications.cfm](http://www2.nature.nps.gov/geology/inventory/gre_publications.cfm).

- Division staff played a pro-active role in helping to maintain the resource protection focus of the Service's Management Policies throughout the 2006 revision process.
- Using Recreation Fee Demonstration funds and working with partners, staff is developing a geologic monitoring manual and website. The manual, to be published by the Geological Society of America, will provide overviews and address monitoring techniques for aeolian, caves and karst, coastal, fluvial, geothermal, glacial, hillslope (geohazards), lacustrine, marine, paleontology, permafrost, seismic activity, and volcanic resources. Copies of the manual will be provided to each of the "geologic" parks and made available on the website.
- Collaborating with the Natural Resources Conservation Service, the division manager of the Soil Inventory Program handled a \$2 million budget in 2006 to advance the completion of comprehensive soil resources inventories in parks. At present a total of 100 parks have completed soil resource inventories represented by geospatial databases.
- The Geoscientists-in-the-Parks partnerships placed 31 geoscientists in 20 parks and 1 central office to address geologic resource management, research, and interpretation needs. Partners included the Association for Women Geoscientists, American Geological Institute, Geological Society of America, museums, universities, and park associations, which resulted in NPS receiving expertise valued at over \$600,000 with direct costs of less than \$30,000.
- Division staff helped develop the DOI Report on Activities to Mitigate Desertification, which addressed activities for sustainable land use management, including water, soil, and vegetation in affected areas; use and management of rangelands; launching of revegetation programs; and stepped up soil conservation programs, desertification monitoring and assessment of degraded land and the efficacy of rehabilitation measures.
- Staff worked to strengthen the partnership with the U.S. Geological Survey (USGS) resulting in the bureau Directorates endorsing a series of initiatives to develop more effective links between the agencies proposal processes, facilitate joint project development, and support targeted USGS science in parks. Division staff joined the USGS National Cooperative Geologic Mapping Program's project review panel, which directs about \$2 million annually in USGS funding to geologic mapping in parks.
- Partnership activities with the geologic community continued to be a major focus in 2006. For example, work with the Oregon State University Geology Department provided geology training at eight locations across the NPS, reaching over 300 NPS staff and managers at: Mammoth Cave, George Washington Memorial Parkway, Great Smoky Mountains, Harpers Ferry, Keweenaw, Voyageurs, Kenai Fjords and the Southeast Alaska Area Office.
- Technical support to 6 parks addressed geologic hazards. Staff assessed a rock fall near a popular hiking trail and advised park management on potential future occurrences and safety issues at El Morro National Monument, evaluated several landslides and debris flows resulting from record precipitation at Coronado National Monument, assessed rock fall hazards at cave entrances and safety mitigation recommendations at Carlsbad Caverns National Park and Cumberland Gap National Historical Park, evaluated the potential for persistent rock fall stemming from an earthquake at Acadia National Park, and assessed geologic processes and associated impacts from anthropogenic development factors at Hot Springs National Park.
- Paleontological resources management assistance to 6 parks and 1 national natural landmark included evaluating significant paleontological sites to assess human and natural threats to resources; developing long-term monitoring strategies to properly document changes in resource conditions; evaluating and documenting fossil site condition; training park staff on condition assessment protocols; and providing recommendations to improve paleontological resources preservation, protection and management.
- Coastal geology staff continued to provide support to parks recovering from the series of major storms in 2005, including Hurricane Katrina that made landfall on units of Gulf Islands National Seashore and Jean Lafitte National Historical Park and Preserve. Division staff coordinated with other agencies and university scientists to provide coastal process expertise to park managers, including serving as the NPS primary contact with the USGS on hurricane science, and providing baseline geologic information and remote sensing data to affected parks. Staff also provided extensive coastal geology and policy support to Gulf Islands NS concerning hurricane-damaged road reconstruction alternatives that provide for the continuation of natural coastal geomorphic processes in accordance with NPS policy.
- Cave and karst management staff coordinated the first multi-park, interagency Cave Resources and Stewardship Workshop for parks in Hawaii. The workshop focused on Federal and state cave protection laws; cave resource interpretation; evaluation of biological, hydrological, mineralogical, and cultural resources; cave safety; resource protection and restoration; geocaching; and interagency coordination on cave management issues.
- Division geologists provided technical support to park managers at Hot Springs NP in assessing a potential significant threat to the park's geothermal resources stemming from proposed highway construction near the park, and assisted the preparation of a research proposal for a multi-year study to improve understanding of the nature, extent and characteristics of the park's geothermal system, and to assess the level of threat posed by highway construction in the area. The Arkansas Transportation Department has agreed to provide \$458,700 to fund the three-year interagency project.
- The Division's coastal geology staff coordinated the first Resource Advisor Workshop for Hurricane (All Risk) Response. The workshop provided overviews of the Incident Command System, the National Emergency Response Policies, and the BAER Program, as well as information about hurricane processes and impacts to terrestrial, marine, and cultural resources. The 36 participants were instructed in preparing for assignment to an incident, health issues, and protocol for interactions with an Incident Command Team.

# Geologic Resources Program

## Overview

The NPS established the Geologic Resources Division in 1995 as a component of the Natural Resources Program Center, which was created to coordinate Servicewide resource management programs and provide specialized professional expertise to parks across the System. The Division was formed by redirecting and broadening the responsibilities of the prior Mining and Minerals Branch staff and adding two additional personnel with geology expertise from other offices. No additional funding was available at that time for geologic work. In 2000, the Natural Resources Challenge provided \$695,000 in new funding for geologic resource management programs, which supported six new geoscience specialists in the division in the areas of cave and karst resource management, coastal geology, disturbed land restoration, geologic hazards management, and paleontology, complementing the expertise of existing division staff. That same year, the Division assumed responsibility for establishing the National Cave and Karst Research Institute. The Institute received its initial funding in 2001 through a separate Congressional authorization.

The creation of the Division and advances in NPS resource management resulting from the Natural Resource Challenge have led to an increase in geoscience expertise in the Service. In 1995, when the Division was created, there were less than 70 geology specialists working in the Service. Now there are over 100 geoscientists working across the NPS, with almost 60 in park-based positions. Many of these new geology positions are a direct result of Challenge funding with the remaining positions created through the restructuring of formerly non-geology positions. These geoscience specialists provide unique expertise to manage projects and to collaborate with non-NPS geoscience organizations. This additional expertise has facilitated the NPS understanding of its geologic resources and natural system interdependencies, resulting in improved park management decisions and the provision of better information to the public, as outlined below.

The Division works closely with the external geoscience community (e.g., academia, professional organizations, other federal and state agencies) to develop and nurture partnerships that advance science-based management and understanding of the geologic resources of the National Park System. Because NPS geoscience staffing is likely to remain limited, most of the geologic research, education and interpretation, and many resource management projects need to be done through or funded by external partners. Utilizing the external geoscience interest in parks, NPS staff has developed numerous cooperative ventures that increase the geologic capabilities of the Service and create an awareness of NPS issues in the geoscience community. For example, partner funding has resulted in placing about 500 Geoscientists-in-the-Parks experienced professionals and student volunteers in parks over the past ten years. Presently, external support is limited only by the Service's ability to provide coordinating staff and matching funds to meet the community's offers.

The Division's functions and 2006 accomplishments are summarized below under six broad program areas: Geologic Processes and Features, Geologic Education and Outreach, Disturbed Lands Restoration, Geologic Resource Evaluation, Soil Resources Inventory and Management, and Minerals Management. In addition to these program activities, the

Division is leading NPS efforts to make the National Cave and Karst Research Institute operational. The Division accomplishes many of its projects by utilizing and leveraging funds from other NPS sources and partner organizations.

The across-the-board reductions in 2006 coupled with unreimbursed personnel cost increase, exacerbated the Division's existing base funding limitations. This resulted in the Division relying on over \$65,000 in travel funding from other sources in 2006, including other Natural Resources offices, parks and external agencies to provide critical geologic resources management assistance and support services to parks. In addition, some park requests for technical assistance were not undertaken due limited staff availability.

### Geologic Processes and Features

#### Caves and Karst



Dr. Frank Haworth of the Bishop Museum, Hawaii points out troglotic fauna in Thurston Lava Tube during the Cave Resources Workshop at Hawaii Volcanoes National Park

The NPS manages over 121 parks containing karst and cave features. In 2006, the Division's cave and karst program coordinator continued to support the efforts of cave conservation, management, protection and science throughout the NPS as well as working with the developing National Cave and Karst Research Institute. Technical support highlights for the year include:

- Prepared an assessment of caves and recommendations for cave resources management planning at Glacier National Park, and developed an initial cave search and rescue plan to provide for visitor safety and cave resource protection for Gap Cave at Cumberland Gap National Historical Park, both with the assistance of cave staff from Carlsbad Caverns National Park;
- Coordinated a Cave Resource and Stewardship Workshop at Hawaii Volcanoes National Park attended by four other

Pacific area parks as well as state and other Federal agencies and co-instructed by staff from the Division, BLM, Carlsbad Caverns National Park, Hawaii Volcanoes National Park, the University of Hawaii, the Bishop Museum - Honolulu, and the USGS Hawaii Volcanoes Observatory;

- Provided support to cave resource management planning at Coronado National Monument and Dinosaur National Monument, a proposed lighting project at Carlsbad Caverns National Park, and the inventory and protection of John Brown's Cave at Harpers Ferry National Historical Park;
- Assisted the Geologic Resources Evaluation scoping sessions for parks in Arizona, Kentucky, and New Mexico, and supported development of cave and karst I&M protocols for the Klamath Network parks and Mammoth Cave National Park.



A pool named "Fountain of the Fairies" just off the "Rookery" in Lower Cave, Carlsbad Cavern, Carlsbad Caverns National Park, New Mexico.

The leadership of the Division's national program coordinator was also demonstrated through events such as a keynote address at the USGS Colorado Plateau Biennial Conference seminar on cave and karst resource management, a closing talk at the National Speleological Society Convention, and a presentation at the Geologic Society of America Annual Meeting on the NPS cave and karst program. The program coordinator's expertise was professionally acknowledged when the Karst Waters Institute recognized him at their annual award banquet as "the person who made outstanding contributions to the karst sciences."

Over the later half of 2006, the national program coordinator also served as the acting interim director of the National Cave and Karst Research Institute (NCKRI), dealing with the City of Carlsbad and many other NCKRI partners, attending board meetings, arranging the NCKRI lecture series, and working with day-to-day operations of the Institute.

## Coastal Geology

The Division's coastal geology staff provides technical support and programmatic guidance to the almost 100 NPS units with coastal and lakeshore geologic concerns. Division staff also continued to coordinate the Natural Resource Program Center "coastal team" to enhance communication and consistency across the Center's divisions and improve assistance to parks, regions, and the NPS Directorate.

During 2006, Division staff focused on continuing to help park units respond to and recover from the series of major storms that hit in 2005, including Hurricane Katrina that made landfall on the Mississippi units of Gulf Islands National Seashore and in Jean Lafitte National Historical Park and Preserve. Division staff coordinated with other agencies and university scientists to provide coastal process expertise to park managers, including new funding for coastal change projects at both parks. Staff served as the NPS primary contact with the U.S. Geological Survey on hurricane science and provided baseline geologic information and remote sensing data to affected parks and regions for post-hurricane response decision-making. The Division disseminated information about these storms throughout the NPS, authoring a lead article for the 2006 Natural Resource Year in Review. Additional Fee Demonstration project funding enabled Division staff to help the NPS prepare for future storms by conducting a Hurricane Response meeting in June 2006 which provided 36 employees with Incident Command System and Resource Advisor training. This effort yielded immediate benefits for park protection by enabling Fort Pulaski National Monument staff to more effectively respond to natural and cultural resource impacts when a spill in the Savannah River oiled the park shorelines and marshes in July.

The Division's coastal geology staff also spent a significant portion of 2006 working with Gulf Islands National Seashore on projects addressing both post-storm recovery and broader park management needs. Staff provided extensive technical and programmatic guidance to both the park and NPS upper management on post-hurricane coastal geology resource protection and Santa Rosa Island infrastructure repair and replacement alternatives. Staff also assisted the park in collaborating with the U.S. Navy, the U.S. Army Corps of Engineers, the U.S. Fish & Wildlife Service, and Florida state agencies to develop a plan for disposing of a portion of the sediments that will be dredged from the Pensacola Pass navigation channel and placed on park beaches, consistent with up-to-date science and NPS policies. Staff further helped the park address the environmental and policy implications of the proposed Mississippi coastal improvement project, and also provided information on coastal geologic processes, storm impacts, and relevant legal and policy mandates to the team responsible for spearheading the park's new General Management Plan.

Division staff worked closely with NPS Inventory and Monitoring Networks to define coastal resource monitoring plans and inventory needs. Collaboration with the USGS continues to yield new protocols for integrating coastal geologic maps of submerged marine resources with map coverage of adjacent lands at Kaloko-Honokohau National Historic Park and Dry Tortugas National Park (see Geologic Resources Evaluation section). Review of these products was featured at a Division-hosted workshop with USGS that discussed applications of LIDAR (Light Detection And Ranging) data in coastal and marine management. In 2006,

assessments of vulnerability to sea-level rise were published for four parks as a result of the ongoing USGS-NPS "Vulnerability of Coastal Resources to Climate Change" project, undertaken with NRPP and Recreational Fee Demonstration funds. To assist future park planning efforts, these projects were presented to the NPS Denver Service Center Planning Division in a talk entitled, "Using Coastal Vulnerability Products in Park Planning Documents." Staff also worked with General Management Plan teams for Golden Gate National Recreation Area and Gulf Islands National Seashore to develop science-based elements addressing sea-level rise.

In April 2006, Division staff served as the primary NPS representative at the Ocean Research Priorities Plan Workshop. Staff facilitated a Natural Resource Stewardship and Science session and also edited the plan prior to its release for public comment. In May, staff presented a talk "Adapting to Shoreline Changes in the National Park Service" at the Shoreline Change II Conference. Other specific accomplishments include oversight of the NRPP-funded boat wake study at Boston Harbor Islands National Recreation Area, and the provision of policy/regulatory assistance to coastal parks managing dredging and disposal activities and other beach manipulation proposals. Staff served as the lead author and co-editor of a 10-paper thematic section of the *Journal of Coastal Research*, honoring a lifetime of groundbreaking contributions by the late NPS/USGS coastal geomorphologist James R. (Jim) Allen to many coastal parks including Gateway National Recreation Area, Cape Cod National Seashore, and Fire Island National Seashore.

#### Geohazards

In 2006, Division staff provided technical expertise to six parks concerning the assessment and evaluation of geologic hazards. Staff acquired scientific information about the nature of a park's geologic hazards and the degree of risk they represent, then incorporated that information into the planning process and other park management decisions so that exposure of people and facilities to hazards is minimized. Since the control of naturally occurring geologic processes are generally expensive, often futile, and typically have harmful impacts that can outweigh their benefits, recommendations were provided to assist park management in taking the appropriate actions. Examples of technical support for the year included the assessment of a rock fall near a popular hiking trail at El Morro National Monument, the evaluation of several landslides



A geohazard at Fort Bowie National Historic Site, Arizona

resulting from record precipitation at Coronado National Monument, appraisal of rock fall hazards at cave entrances at Carlsbad Caverns National Park and Cumberland Gap National Historical Park, advice on the possibility of persistent rockfall problems from an earthquake at Acadia National Park, and evaluation of rockcuts and associated hazards and impacts to hydrothermal resources at Hot Springs National Park. In addition to park assistance, Division staff represented NPS at the Association of Engineering Geologists Conference on Mass Wasting in Disturbed Watersheds.



Dinosaur bone discovered on the shoreline of Blue Mesa Reservoir in Curecanti National Recreation Area. Fossils at this locality are threatened by erosion and unauthorized collection.

#### Paleontology

Diverse fossil resources have been documented in 181 parks and include plants ranging from microscopic algae and pollen to leaves and petrified logs, and animals ranging from marine shells to dinosaurs to Ice Age mammals, as well as trace fossils such as vertebrate tracks, burrows and coprolites. Many of these natural resources in parks are of international significance and critical to understanding the history of life on Earth. The Natural Resource Challenge provided funding in 2000 to support a Division paleontologist to develop a Servicewide program to manage fossil resources in the NPS, and to provide technical assistance to parks. In 2005, the incumbent vacated the position and the Division has been unable to rehire due to funding constraints, resulting from increasing personnel costs and across-the-board budget reductions. However, in 2006, the Division was able to fund a paleontology technician to provide Servicewide support on critical issues.

Division staff serves as the Servicewide coordinator for GPRA Goal Ia9 - Paleontological Localities, which measures the



**Thin sandstone slide at Morrison Fossil Area National Natural Landmark resulting in loss of Iguanodon (herbivorous dinosaur) tracks.**

condition of documented paleontological localities (in-situ fossil sites) in parks. In 2006, the Service exceeded its Goal Ia9 target of 1,235 (38%) documented paleontological localities in parks in good condition. Parks reported 1,589 (49%) of the 3,250 baseline localities Servicewide in good condition, meaning that human activity is not adversely affecting the fossil resources, sufficient scientific information on the localities is available for resources management decision-making, appropriate management actions are being taken to protect and preserve resources, and the localities provide opportunities for further scientific research.

The Division received Inventory and Monitoring (I&M) Program funding in 2006 to initiate a project designed to review and compile existing research literature and data on paleontological resources into summary reports for all parks in select I&M networks. This project will ultimately produce summary reports for 19 I&M networks (168 parks) over a three year period, completing such reports for all 32 networks. The establishment of these summary reports is an initial first step to proper management of fossils in parks. Although 181 parks have been identified with paleontological resources, many parks lack inventories of these resources, including studies already available in the literature. In 2006, paleontology literature research and summary reports were initiated on the Chihuahuan Desert, Southern Colorado Plateau, San Francisco Bay, and Pacific Islands I&M Networks comprising 40 parks. In addition, the Division completed and published the Mid-Atlantic I&M Network Paleontological Resources Summary (10 parks), and completed the final draft Gulf Coast I&M Paleontological Resources Summary (8 parks).

The Division also provided technical support to 6 parks and 1 national natural landmark on paleontological resources management issues in 2006. At Curecanti National Recreation Area and Black Canyon of the Gunnison National Park, Division staff conducted field evaluations at 4 significant paleontological sites to assess human and natural threats to the resources, and assisted park staff in the development of specific long-term monitoring strategies to properly document changes in resource conditions. At Bryce Canyon National Park, Division staff documented the current condition of 8 fossil localities, trained park staff on condition assessment protocols, and provided recommendations to improve paleontological resources management in the future. At Golden Gate National Recreation Area and George Washington Birthplace National

Monument, Division staff evaluated resource threats at select fossil localities and provided professional guidance to park managers regarding resource protection and preservation strategies for inclusion in park planning documents. At Carlsbad Caverns National Park, Division staff aided the park in developing a collaborative project to research and design a comprehensive paleontological resource database to improve park natural resources information and interpretive programs in future years. Finally, Division staff assisted the Intermountain Region by evaluating erosion of fossil dinosaur tracks at Dinosaur Ridge, Morrison Fossil Area National Natural Landmark, located near Denver, Colorado, and presenting alternative solutions to mitigate the erosion problem based on physical, geological and geomorphic features and processes at the site.

In 2006, Division staff also served on the planning committee for the 2006 Federal Fossil Conference held in Albuquerque, New Mexico, and coordinated, compiled and edited all professional papers for publication in the conference proceedings. In addition, Division staff authored and presented 3 professional papers at the conference.

### **Geologic Information and Outreach**

Division staff began education and outreach efforts in 1996 to increase park and public awareness of the unique geologic resources in national parks and to engage the professional geology community and earth science educators in assisting parks with geologic resource management and research issues and using parks for teaching geology. Staff activities are



**Dianne Piper, a GIP at Mammoth Cave National Park attended the national Geological Society of America Conference, providing information to geoscience teachers about her experience, opportunities in parks, and a summary report to her support sponsor: the National Association of Geoscience Teachers.**

designed to enhance learning and nurture people's appreciation for significant geologic resources in parks, thereby helping preserve America's heritage. Outreach conveys the knowledge gained through research and resource management to decision makers and the public. While all NPS units have some link to geology, of the 270 "natural" parks in the System, less than 15 percent have a geoscientist on staff. The majority of our National Parks depend on the Division and its expertise for assistance in developing and maintaining high quality geologic education and outreach materials and in partnering with the geoscience community to assist park resource management. In 2004, the most recent data available, 3924 permanent and seasonal interpreters provided 604,928 programs to over 148 million visitors. If only a fraction of this information had geologic content, the education and outreach potential is enormous.

Partnership activities with the geologic community continued to be a major focus of the Division in 2006. Staff coordinated with national geologic organizations including the American Geological Institute, American Geophysical Union, Association for Women Geoscientists, Geological Society of America, National Association of Geoscience Teachers, and the National Park Foundation, and as well as numerous specialized geology organizations such as the Cave Research Foundation, National Speleological Society, and Society of Vertebrate Paleontology.

The Division continued to work with Oregon State University's geology department to provide in-park geology training at eight parks, reaching over 300 NPS staff and managers at Mammoth Cave National Park, George Washington Memorial Parkway, Great Smoky Mountains National Park, Harpers Ferry National Historical Park, Keweenaw National Historical Park, Voyageurs National Park, Kenai Fjords National Park and the Southeast Alaska Area Office. Additional cooperative education efforts include:

- Working with the AGI to provide NPS information and an interactive DVD to 16,000 educators through Earth Science Week mailings, and in designing posters using geologic icons in national parks to convey the intrigue of geoscience;
- Using the Geoscientists-in-the-Parks program partnerships to place 31 geoscientists in parks;
- Helping Earth Science teachers to use NPS examples for illustrating concepts and processes of geology.

The Division website represents the face of geology for the National Park Service, and it is a pivotal component for providing geologic information to the agency as well as being the centerpiece for the public outreach effort. The site highlights geologic program areas and has content ranging from visitor geology tours to scientific knowledge of park and regional geology. The website has numerous useful links to geologic community websites such as the National Science Foundation's Digital Earth Science Library and EarthScope pages, and U.S. Geological Survey and state geological surveys sites. The NPS geology website is dynamic, has very high visitation, and receives frequent inquiries and positive reviews from the public.

The Division continues to present a strong NPS presence at the annual Geological Society of America Conference, which provides a noteworthy setting to present NPS geoscience

programs and project opportunities to a large segment of the geoscience community, with over 6000 participants in 2006. The annual Geology in the Parks session was well attended, with presentations ranging from Big Bend geochemistry to North Carolina shoreline processes. The Opportunities in the Park session was also well attended and often results in participants later working in parks or partnering with NPS geology projects. At the NPS geology booth in the Exhibit Hall, a constant stream of participants discussed projects and research opportunities with Division staff. Hundreds of informational flyers were distributed.

One of the most promising partnership efforts initiated in 2006 was the geologic fundraising efforts with the National Park Foundation (NPF). The first project involved attending the annual American Association of Petroleum Geologist (AAPG) conference to meet with the many philanthropic organizations of the petroleum industry, including the AAPG Foundation. The AAPG Foundation reviewed 21 park geology-related funding needs and selected eight for further evaluation and funding consideration. A second NPF project involved review of NPS coal-related projects by the Foundation Coal Inc., which resulted in two Chesapeake and Ohio Canal proposals identified for further review and potential funding.

Staff continued efforts in 2006 to facilitate geoscience research by working with the scientific community to meet park research needs. Two of the largest projects are funded by the National Science Foundation: EarthScope, where NPS efforts lead to placement of tectonic monitoring equipment at 14 sites in eight parks with 15 additional sites pending; and the Trail of Time, which involves research on the cognitive concept of geologic time and the ability to relate this to stratigraphy in the Grand Canyon National Park.

#### Geoscientists-in-the-Parks

Division staff manages the Geoscientists-in-the-Parks (GIP) partnerships, working with professional geologic organizations and the academic community to meet the large backlog of park geoscience needs. The GIP program accomplishment in 2006 included placing 31 geoscientist participants in 20 parks and one central office, receiving most assistance through volunteer experts and students and other support at greatly reduced cost. These partnerships realized more than a 4:1 direct and in-kind



**At Fossil Butte National Monument in Wyoming, Nicole Reynaud, a GIP supported by Geological Society of America's GeoCorps Program, helped visitors discover and properly extract fossils, as well as log these findings into the park's collection. Visitors made a number of fossil discoveries that were new species to the park.**



David Shean was one of the 23 GIPs supported by the Geological Society of America's GeoCorps Program in 2006. He played a key role in helping Yellowstone National Park study high priority geothermal areas in the park by correlating GPS data with geothermal aerial images, historic photos, and maps.

match to NPS funds, gaining more than \$372,000 worth of expertise with less than \$45,000 in direct NPS funding. GIP's park projects reached an estimated 80,000 visitors with geologic outreach and education programs, and hundreds of thousands more benefited through website visits. Participants in GIP completed more than 50 projects in 2006 and helped parks meet critical needs in natural resource management, research, public safety, and both formal and informal education. Since its inception, GIP participants have helped parks address more than 25 Strategic Plan goals, ranging from Goal Iar-Land Health: Coastal, Disturbed Lands, and Riparian, to Goal Ib-Inventory/Museum Collections, to Goal Iia&b-Visitor Satisfaction/Understanding and Goal IVb -Park Partnerships.

Examples of GIP projects and the collaboration that made them a reality in 2006 include:

- A new partnership with the National Association of Geoscience Teachers supported two local eighth grade teachers at Mammoth Cave National Park and gave them "on the ground" experience in park science. Both teachers have incorporated their experiences into their curricula, thereby enhancing the knowledge conveyed to their students, especially insight to the importance of the park's resources to the local area. The success of this project has resulted in the



On the left, in progress reclamation work at an abandoned cinder pit on the Vulcan Cone, Petroglyph National Monument, New Mexico, and on the right, the recontoured cinder pit eliminated safety concerns with the 60-foot highwall and reestablished favorable conditions for the reestablishment of native vegetation

Association's pledge to increase funding and the number of teachers supported in the future.

- The Association for Women Geoscientists sponsored GIP placements at Golden Gate National Recreation Area to assist development of a bathymetric map and the estimation of sediment storage within Rodeo Lake and Lagoon. This project meshes with another to determine the sediment budget for the area's watershed. The information gathered will be applied to management actions to reduce sediment and restore wildlife and fisheries habitat.
- The Geological Society of America's GeoCorps program, a long-standing partner of the NPS, supported geothermal research at Yellowstone National Park. Specifically, high-accuracy GPS ground control points were established for several high-priority geothermal areas and used to georectify current aerial images and will be used with future images to assess change. In addition, historic aerial photographs and maps were analyzed for changes in geothermal features and a database created for aerial photo flight line index maps. The information will be directly applied to management of the park's sensitive natural resources.
- The long term results of the GIP program are exemplified by recent alumni accomplishments such as: Former GIP Arvid Aase, now a full-time park employee, received the 2006 top national award for his public outreach work at Fossil Butte National Monument; Former GIP Alison Koch, now also an NPS staffer, is helping lead NPS in the use of electronic media to engage park visitors; and Professor Bob Lillie of Oregon State University, a former GIP, is continuing to work with park staff to improve understanding of the dynamic geology in their parks.

#### **Disturbed Land Restoration/Abandoned Mineral Lands Reclamation**

The Natural Resource Challenge provided program funding in 2000 to hire two new geomorphology specialists who greatly enhance the existing capabilities of the Division to provide assistance to parks regarding disturbed lands and surficial geologic issues. The Challenge also established the NRPP Disturbed Lands Restoration fund (\$850,000), which is managed by Division restoration staff. Overall, the Division

provides three primary functions related to restoration and geomorphological issues: park project funding, technical assistance, and Servicewide coordination.

The program annually allocates NRPP project funds to parks based on competitive proposals. Division staff prepares the technical guidance, reviews park work plans for technical adequacy, and provides oversight on cost accounting and accomplishments reporting. In 2006, disturbed land restoration program staff oversaw \$795,000 in NRPP restoration project funding for 13 park projects, distributed through five NPS regions. These projects restored nearly 350 acres of severely disturbed land. Examples include: the restoration of the abandoned Gaylor Pit in Yosemite National Park; restoration of a former landfill at the Bradford Tract in Prince William Forest Park; restoration of stream banks and river corridor in newly acquired lands in Buffalo National River; protecting genetic diversity through prairie restoration on disturbed lands in Saint Croix National Scenic River; land restoration following environmental remediation on the Presidio of San Francisco; removal and restoration of the Old Pinnacles Road in Pinnacles National Monument; restoration of the hydrologic function for fish, wildlife and vegetation on the upper Hoh River in Olympic National Park; and reclamation of the abandoned Ames Mine to protect endangered Virginia Big-Eared bats in New River Gorge National River.

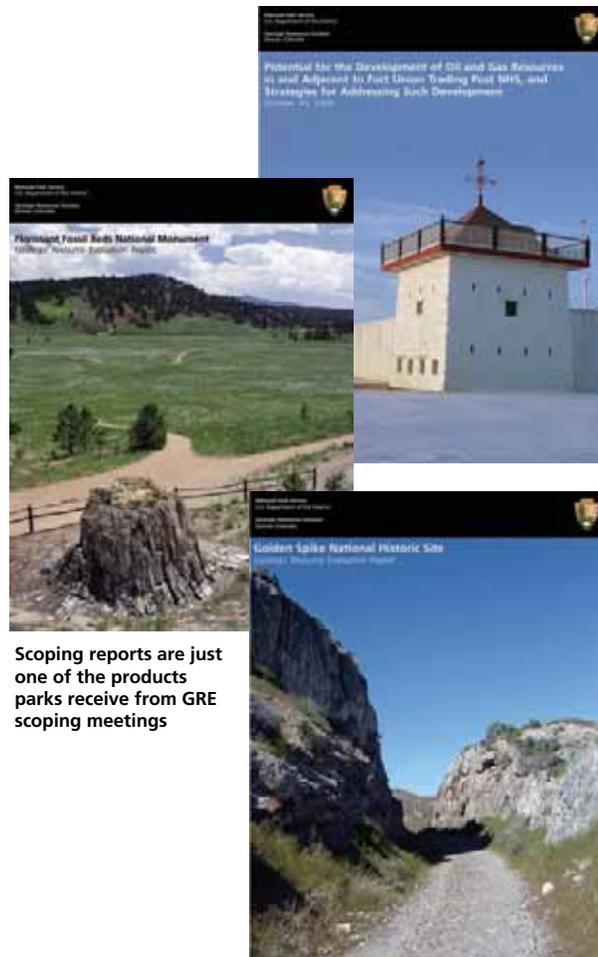
Division restoration and reclamation specialists responded to over 25 technical assistance requests in 2006 involving disturbed lands, abandoned mine safety, and geomorphological issues. Staff provide key technical assistance to park restoration efforts through site assessments, safety hazards analysis and mitigation design, geomorphic analyses and landform restoration designs, materials/equipment cost estimates, and project oversight assistance. Many of these projects will lead to park proposals for project funding to implement the recommended actions. Examples of technical support to parks in 2006 include: assessment and development of final closure plans for the Mantle Mine, Dinosaur National Monument; evaluation of dune movement at Mt. Baldy, Indiana Dunes National Lakeshore; analysis of dune sensitivity to foot traffic, Sleeping Bear Dunes National Lakeshore; appraisal of surface instability and possible remediation measures for the Gap Rehabilitation area, Cumberland Gap National Historical Park; development of recommended options for closing hazardous mines to improve employee and visitor safety and protect bat habitat, Coronado National Memorial; preparation of restoration designs for quarries at Point Reyes National Seashore; assisted restoration projects at Lava Beds National Monument; and installed survey control for restoration design at the Faught Property site, Prince William Forest Park.

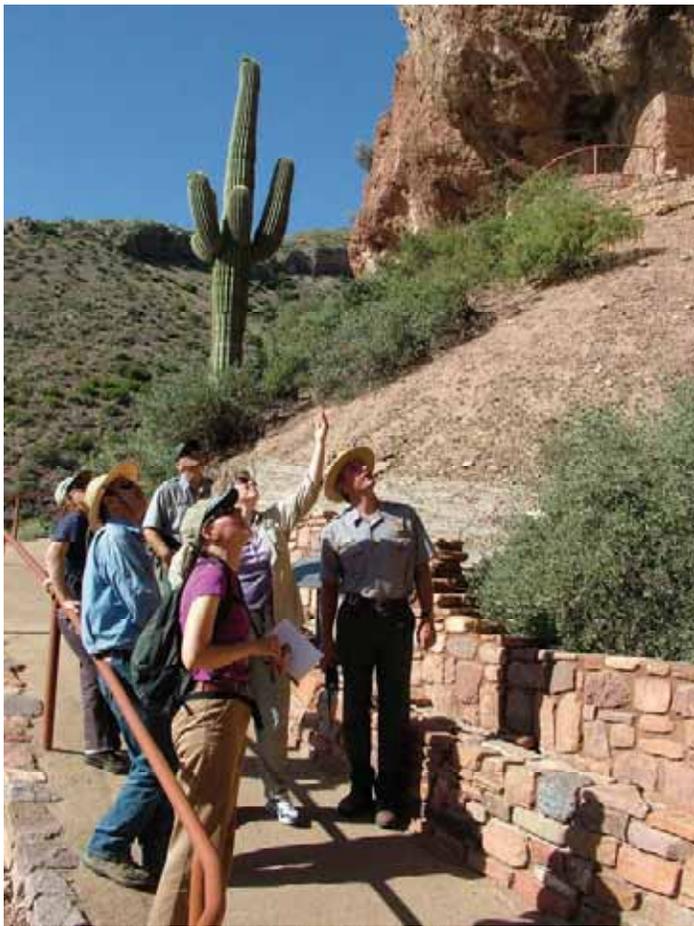
Division staff serves as Servicewide goal coordinators for NPS GPRA goals 1a1A - Disturbed Lands Restoration and the new associated goal 1a1G - land health, mined areas. Since 2004, the NPS has restored a cumulative total of 10,600 acres of disturbed lands. For the current NPS Strategic Plan, staff updated the NPS Technical Guidance and coordinated the definition of new goal attributes and park revisions to goal targets.

## Geologic Resource Evaluation

Division staff manage the Geologic Resource Evaluation Program (GRE), 1 of 12 natural resource inventory efforts funded by the Natural Resource Challenge. In 2006, program staff managed \$1.75 million. The GRE provides digital geologic maps and geology-related information to parks. The Division helps park managers integrate the use of geologic resource information in resource management decisions. These activities directly contribute to the achievement of NPS GPRA goal 1b1 natural resource inventories. The GRE provides parks with three main products: an onsite scoping meeting with park staff and geologic experts to evaluate and discuss the park's geologic resources and related resource management issues, along with investigating existing geologic research and paper maps; a comprehensive digital geologic map; and a comprehensive geologic report.

At the close of 2006, scoping meetings to evaluate park geologic resources and issues had been held at 171 parks in 33 states, 4 territories, and the District of Columbia. In addition to Division staff and park resource managers, knowledgeable geologic experts from the USGS, state geologic surveys, and universities participate in these meetings and provide valuable insights and follow-up information and assistance. Fifteen new geologic reports addressing park geologic resource management issues were distributed to their respective parks, networks, and regions in 2006. The reports have proven quite popular with several parks making follow up requests for additional copies. Of the 270 parks characterized as natural area parks by the NPS Inventory and Monitoring Program, Division staff and partners have completed digital geologic maps for 93 parks, which are served on the NR-GIS DataStore.





Discussing park needs with park rangers at Tonto National Monument in Arizona during a scoping meeting.

Producing a completed digital map for a typical park is a complex process, which entails converting textual data from multiple maps, after first assuring that quality geologic maps are available. The entire digital conversion process is a time intensive and complicated GIS procedure. Our cooperators at Colorado State University are largely responsible for the generation of the data model used for this conversion. Their efforts remain at the forefront of the science and generate GIS products among the most advanced produced by the NPS. To enhance the user-friendliness of the digitized maps, extensive pull down help files are incorporated into the maps.

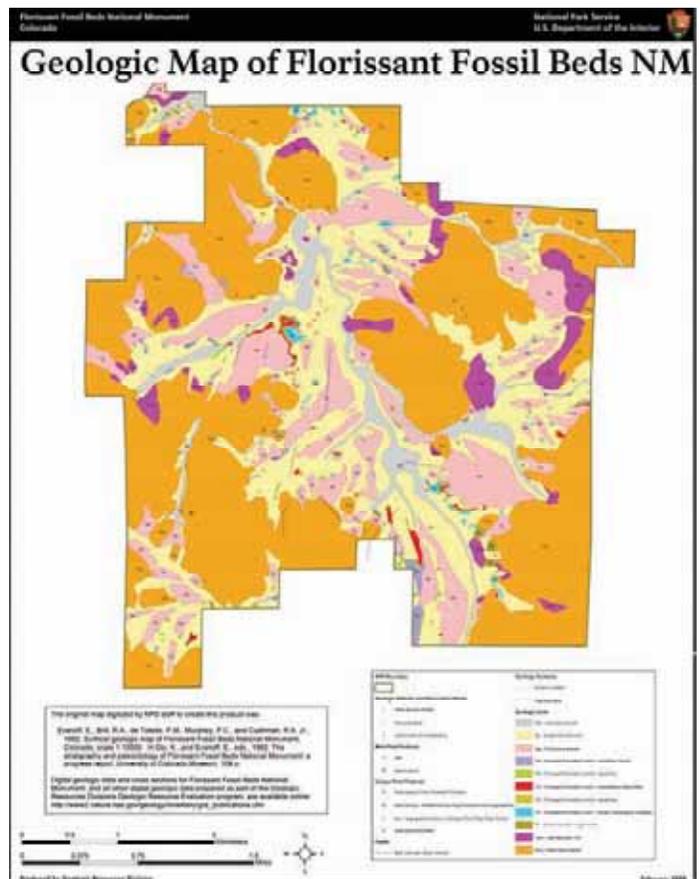
The lynchpin of the GRE remains extensive collaboration with partners. As mentioned above, scoping meetings routinely include participation with other federal, state, or academic geologists. Where gaps in existing geologic map coverage are identified, the Division will team or cost share with one of these scientists to produce a new map. In 2006, NPS partnered with the USGS for mapping in parks in Arkansas, California, Missouri, New Mexico, South Carolina, and Texas; with state surveys for mapping in parks in Idaho, New Mexico, South Carolina, and Texas; and with universities for work in Arizona and Maryland. Additionally, the GRE provided funding for fieldwork by NPS geologists for new mapping in Big Bend, Mt. Rainier, North Cascades, and Olympic National Parks. Since the advent of the GRE effort, new mapping projects by these partners have been initiated in nearly 50 parks.

NPS-GRE support has become a critical selection factor for USGS, state, and academic geologists proposing mapping projects funded by the USGS National Cooperative Geologic Mapping Program (NCGMP); so critical, in fact, that in 2005

the NCGMP identified collaborative work with the NPS as one of its OMB PART goals. GRE and NCGMP team members continue to work on sharing map databases, including enhanced access for the NPS to the USGS map database and direct access to GRE generated maps from the USGS site.

In 2006, the Division continued to support shoreline and marine geologic mapping and the products and benefits are becoming available. Preliminary landform maps for barrier island parks in North Carolina, Florida, Maryland, and Texas have been received and reviewed within the Division and by external experts. Preliminary marine benthic habitat maps, made in partnership with the USGS Coastal and Marine Program, have been produced for parks in Florida, the Virgin Islands, New York, several lakeshore states, and Hawaii. These draft products have already been used by park managers at Canaveral and Cape Hatteras National Seashores to assess storm related damage, and at Kaloko Honokohau National Historic Park in new Coastal Watershed Assessments.

Parks use GRE products and information in three basic ways: to add to the understanding of park geology for scientific, educational, monitoring or interpretive purposes; to help parks contend with geologic processes like landslides and rockfalls for facility siting and human safety issues; and to integrate with non-geologic information to assist in making management decisions on topics as diverse as ground water flow or the location of endangered species. At scoping meetings the Division team provides copies to all participants of the American Geologic Institute's 2004 publication, *Meeting Challenges with Geologic Maps*, an instruction manual for utilizing the maps. Sample applications of GRE products include:



Digital geologic mapping and GIS are pivotal components of GRE efforts

- Onshore and nearshore geologic maps provided new information for coastal park management. For example, new landform mapping has begun at Assateague and Canaveral National Seashores to assess shoreline changes, work was initiated at Gulf Islands National Seashore to study and document Hurricane Katrina impacts, new benthic habitat mapping was aided at Biscayne National Park, as was data acquisition for the National Lakeshores. In 2007, long awaited shoreline maps for Cape Hatteras and Cape Lookout National Seashores are scheduled to be delivered.
- Geologic maps funded through the GRE continue to be a significant tool for hydrologic studies at several parks. In addition to providing the framework to understand groundwater flow, entire karst ecosystems have been identified using the information contained in the bedrock geologic maps. NPS Water Resources Division staff often use the GRE maps for groundwater modeling, such as at Montezuma Castle National Monument, and to identify potential ground water impacts associated with neighboring industrial activity, such as at Monocacy National Battlefield.
- Geologic maps remain the basic tool for identifying and evaluating geologic hazards such as rockfalls, slope failures, and mass wasting. In 2006, there were significant geologic hazard impacts adjacent to Yosemite National Park and Coronado National Monument, where both parks have maps completed or nearly completed for use in restoration efforts.
- Evaluation of external mineral development potential is facilitated by geologic mapping, such as in and around Fort Union Trading Post National Historic Site to help delineate potential oil and gas development and impacts on lands adjacent to the park.
- Critical habitat and wetlands occurrence can be identified with geologic research and mapping of floodplain landforms, as is being done to assist park resource managers at Congaree National Park.
- Park staff is using surficial geologic maps prepared by the Kansas Geologic Survey to determine the potential locations of archeological resources at Tallgrass Prairie National Preserve.

### Soil Resources Inventory and Management

In 2006, Division staff managed \$2 million as part of the Soil Resources Inventory and Management (SRI) Program, 1 of 12 natural resource inventory efforts funded by the Natural Resource Challenge. The program provides digital soil maps and soil resource management information to parks. Soils information including the physical, chemical, and biological properties is essential for park resource management and protection, as well as providing park managers with the ability to predict the behavior of a soil under alternative uses. The natural features and diverse plant and animal communities depend on maintaining soil functions that support plant growth and limit accelerated soil erosion.

The SRI operates extensively through a partnership with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) and the National Cooperative Soil Survey to undertake soil surveys in parks. Through this partnership, the SRI helps parks secure the information needed



**Toby Rodgers, Soil Scientist with the Natural Resources Conservation Service (NRCS), examines a profile of the San Juan soil series, at San Juan Island National Historical Park, Washington**

to manage soil sustainability and to protect water quality, wetlands, vegetation communities, and wildlife habitats. The information also assists the control exotic species and establishment of native communities, as well as management of potentially high-use or developed areas in the park (e.g., visitor centers, campgrounds, trails, access roads). This directly contributes to the achievement of NPS GPRA goal Ibi (natural resource inventories).

The key SRI products are digital maps of the park soils; data about the physical, chemical, and biological properties of those soils; information on the use and management of these soils; metadata; and information products such as a soil survey manuscript, fact sheets, and image galleries. The information is in

sufficient detail for application by park managers, planners, engineers, scientists, and researchers to specific areas of concern. Although these soil resource inventories follow procedures identified by the National Cooperative Soil Survey, the specific work plans are customized by local park personnel to meet their soil resource management needs, as part of local soils scoping sessions.

As of the end of 2006, 100 NPS units have a completed SRI, with an additional 124 parks underway. Soil scoping sessions were initiated for two parks in 2006, and technical assistance was provided to an additional four parks on the use of the completed soil resource inventories for a wide variety of soil resource management issues.

The SRI for San Juan Island National Historic park illustrates how this program helps to advance the achievement of GPRA Goal Ibi. This comprehensive project, completed in 2006, was mapped by NRCS at a detailed scale of 1:12,000 and generated comprehensive descriptions of soil types and their physical, chemical, and biological properties. As an aid to understanding the unique soil forming factors in the area, the soil map integrated geomorphic, climatic, hydrologic, vegetative, and land use history information. In addition to the soil map, park managers received a detailed soil survey report which contains special soil interpretations for a variety of ecological and restoration applications. The park will use the inventory to provide a soil resource baseline to assist in an ongoing prairie restoration project, as well as issues regarding impacts on soil resources from invasive animals and plants, and for information and education purposes.

There are many challenges in completing a soil resource inventory on parklands, and most of our larger parks lack soil maps. Working cooperatively with the NRCS and several universities, the SRI is pursuing the use of new soil mapping technologies to facilitate data acquisition in remote areas, as well as parks where wilderness designation or the presence of cultural landscapes preclude the use of traditional methods.

## Minerals Management

A longstanding major responsibility of the Division is to provide park managers, including the Director's Office, with minerals management expertise. Through a cadre of staff with expertise in mining and oil and gas development technology, regulations, policy, impact mitigation, geology, reclamation, and mining claim validity examinations, the Division helps park managers effectively protect park resources and values from the adverse effects of past, current and future mining inside and adjacent to units of the National Park System. Division assistance in the minerals management arena substantively contributes to the accomplishment of NPS Strategic Goal Ia related to the protection of natural and cultural resources in parks.

Currently, thirty NPS units contain nearly 750 active private mineral exploration or development operations, most of which involve the production of oil and gas. Private entities that hold property rights to oil and gas and other minerals located inside parks must obtain NPS approval of development plans and performance bonds before initiating mineral related activities. In 2006, staff assisted park managers by reviewing 11 new oil and gas proposals covering 16 operations in four parks. The Division review ensures that the operations conform to NPS nonfederal oil and gas regulations, which require operators to use technologically feasible methods least damaging to park resources and to reclaim their sites to prior conditions.

Because mining claims located under the Mining Law of 1872 exist in 18 park units and near many other units, Division staff continued to be engaged in mining claim issues potentially affecting parks. Working with the NPS Office of Legislation, staff analyzed the potential implications of proposed legislative changes to the Mining Law of 1872 that could adversely affect park resources, including one proposal promoted in Congress that would have significantly weakened the standards by which claimants gain ownership interest over federal land. Division work products demonstrated that this proposal would directly and adversely impact management and protection of parks. With a ground swell of opposition, this legislative initiative was abandoned.

Staff also continued to represent the Service on the Department's Mineral Examiner Certification Panel. This BLM led panel develops nationwide guidance on implementing the



Workers respond to a release of oil from a flowline leak at Big Cypress National Preserve, Florida. NPS oil and gas permits include spill prevention and response measures and procedures.



Members of the Oil and Gas Management Plan team visit one of the 324 well sites in Big South Fork National River and Recreation Area, Tennessee, Kentucky

Mining Law of 1872 and determines qualification of individual federal employees to undertake validity examinations. While all units of the National Park System are closed to the location of new mining claims under the Mining Law of 1872, 1292 mining claims exist in 18 parks. These claims pre-date the creation of the park units. The majority of the claims are located in Mojave National Preserve (CA), and Wrangell-St. Elias National Park and Preserve (AK).

On lands adjacent to parks, the NPS works with other federal and state permitting agencies, along with mining project proponents, to have park protection measures incorporated in mineral leasing or other energy development decisions. In 2006, Division staff assisted park and regional offices as well as other federal and state agencies on a variety of projects, such as Tennessee Valley Authority's draft EIS for the Koppers Coal Reserve adjacent to Big South Fork National River and Recreation Area and the proposed rezoning and expansion of a limestone quarry adjacent to Cedar Creek and Belle Grove National Historical Park.

Abandoned mine, and oil and gas exploration and production sites represent a substantial portion of the disturbed lands requiring restoration in parks. NPS lands currently contain an estimated 3,200 abandoned mineral development sites with over 10,000 hazardous openings, at least thirty miles of streams with degraded water quality, and more than 33,000 acres of disturbed land. In 2006, the Division continued to assist parks address this outstanding reclamation need and augmented its efforts through partnerships. For example, the Division assisted the Alaska Regional Office with regulatory questions associated with the cleanup of the Nabesna Mine in Wrangell-St. Elias National Park and Preserve.

Other examples of the Division's minerals management efforts in 2006 that advanced NPS Strategic Goal Ia include:

- At Big South Fork National River and Recreation Area, Division staff submitted several proposals to help the park secure funding needed to plug abandoned wells and address site reclamation. The history of oil and gas development at the park has left a legacy of dozens of orphaned oil and gas wells with no responsible party.
- Division staff worked closely with the Solicitor's Office to defend the NPS in a lawsuit filed by the Sierra Club over the NPS's interpretation and application of the directional

drilling provision in the Service's nonfederal oil and gas regulations at the Big Thicket National Preserve. The provision encourages operators to access their nonfederal oil and gas rights in a park from surface facilities outside park boundaries using directional drilling techniques. While the Service's regulatory interpretation was upheld, the Federal District Court directed the NPS to improve its analysis of potential transboundary effects from the associated surface facilities outside park boundaries. Division staff is currently assisting with efforts to strengthen these analyses.

- Division staff worked closely with Big South Fork National River and Recreation Area to address the cumulative impact on NPS water resources from existing and proposed upstream coal mining. Staff assisted the park in communicating NPS concerns to the Office of Surface Mining. This effort has resulted in improved NPS/OSM



At Aztec Ruins National Monument, New Mexico, a workover rig provides the dominant backdrop along an interpretive trail through the 12<sup>th</sup> century ruins of ancestral Pueblo people.

communication and coordination relating to surface coal mining adjacent to the park.

- The Division provided extensive assistance to New River Gorge National River on a state surface mining permit application for a proposed surface coal mine located 300 feet from the park boundary above the New River Gorge National River. As a result of the NPS's involvement, the state issued a significantly revised mine permit. The approved mine work progressed over the late summer with no adverse affect on park resources or values.
- The Division provided Cedar Creek and Belle Grove National Historical Park with a regulatory and environmental analysis of proposed rezoning of 688 acres adjacent to the park for expansion of an existing limestone quarry. Due to NPS concerns of transboundary impacts and local community support of this important historical area, rezoning has been placed on hold and may not be approved. A final decision on rezoning is forthcoming.
- At Chaco Culture National Historical Park, the Division assisted park staff in authoring a letter for the Superintendent's signature informing BLM of NPS concerns about several potential oil and gas lease parcels directly adjacent to the park. The letter asked BLM to withdraw the parcels from a pending lease sale citing Chaco's enabling legislation specifically addressing interagency coordination

to protect park and area cultural and archeological resources. The final letter resulted in the parcels being withdrawn from consideration from leasing pending further environmental and cultural resource study.

- Division staff provided a detailed analysis to the National Historical Landmarks Committee on mineral development potential in and around Rosebud Battlefield State Park and Wolf Mountain Battlefield located in the Powder River Basin in southeast Montana. The analysis contained an assessment of mineral potential for the two areas including coal, oil and gas and coalbed methane, lands subject to lease, land ownership patterns, and applicable regulatory schemes.
- Collaborating with other Natural Resource Program Center offices and the NPS Utah State Coordinator, the Division prepared extensive comments on the Bureau of Land Management's Notice of Intent to prepare a Programmatic Environmental Impact Statement for Oil Shale and Tar Sands Leasing on Land Administered by the BLM in Utah, Colorado and Wyoming. This new initiative under the Energy Policy Act of 2005 could potentially affect 8 park units in 4 states.
- At Boston Harbor NRA, the Division identified NPS regulatory authorities as well as possible environmental impacts related to the proposed Outer Brewster Island Liquefied Natural Gas (LNG) terminal. The land-based LNG terminal was proposed for construction on state land within the NRA boundary. NPS concerns communicated to state and FERC regulators were instrumental in the "shelving" of this project for the foreseeable future.
- At Whiskeytown National Recreation Area, Division staff helped respond to a June 2006 spill of several tons of drilled material from an upstream gold mine into park waterways. Staff worked with the park and representatives of the Bureau of Land Management, USGS, and the California Regional Water Quality Control Board to ascertain the various types, levels, and receptors of contamination currently entering the park from this mine and other mining sites surrounding the park, and to identify and initiate the enforcement and regulatory actions to reduce contamination of Whiskeytown Lake, an important recreational area and a drinking water source for several municipalities.
- At Pictured Rocks National Lakeshore, staff continue to work with the park superintendent and the Solicitor's Office which is analyzing the implications of restrictive easement deed language for proposed extraction of and gravel within the park.
- For Fort Union Trading Post, the Division assessed the likelihood of oil gas development in and around the park and what forms it may take. The Division provided strategies for park management on proactively working with other federal and state agencies, mineral owners, and future oil and gas operators to avoid or minimize impacts on park resources.
- In Big South Fork National River and Recreation Area and Obed Wild and Scenic River, Division staff continued to play a pivotal role in the development of an Oil and Gas Management Plan for the two parks. Working with park and Environmental Quality Division staff, the Division provided strategies to improve the efficiencies and effectiveness of the approach taken in the plan to assure it addresses the unique oil and gas management challenges facing these two parks.



Staff from the Geologic Resources Division, Mammoth Cave National Park and the Mammoth Cave International Science and Learning Center discusses the surface and subsurface relationships a karstic resurgence from Mammoth Cave during a GRE scoping session

### National Cave and Karst Research Institute

2006 was a transitional year in the development of the National Cave and Karst Research Institute (NCKRI). The legislation that directed the NPS to establish the Institute near Carlsbad, New Mexico, also included direction that the Service jointly administer NCKRI with another private entity responsible for day-to-day administration. This management plan was brought to fruition in 2006 with the formal transfer of administrative responsibility to New Mexico Tech and the creation of a broad-based Board of Directors to guide the Institute. The NCKRI Executive Director position was transferred to New Mexico Tech, and their recruitment action resulting in the October selection of Dr. George Veni as the full time director, to begin duty in early 2007.

In 2006, the effort to construct a NCKRI building, jointly funded by NPS and the State of New Mexico and lead by City of Carlsbad, met with some setbacks due to initial bids greatly exceeding the available budget. Soon thereafter, the death of the primary architect resulted in the need to restart the architectural design and construction bidding process. However, by the close of the fiscal year, the building efforts were moving forward again with assistance from the NPS Construction Office and Denver Service Center.

NCKRI continued to extend its network of partners in 2006 through a variety of efforts. Highlights included appointment of a new Board of Directors and board chairperson; the board now brings together over a dozen key members of the academic, federal, and professional cave and karst communities into a more inclusive and cohesive group. This broad-based Board is expected to assist NCKRI in meeting the unusual challenges presented by the unique legislation mandating NCKRI to find non-federal funding to at least match federal funds.

In 2006, the Institute's lecture series continued to provide a wide verity of informative lectures to the general public and members of the cave and karst community. Talks in 2006 included:

- Dr. Fadi Nader, American University of Beirut Lebanon, gave a presentation titled “Karst Features In Mount Lebanon:

Examples Of Mediterranean Karstic Forms.” Dr. Nader is currently Secretary General of the Union Internationale de Spéléology.

- Dr. Alexander Klimchouk, Director of the Ukrainian Institute of Speleology and Karstology, Ministry of Education and Science in Ukraine, gave a presentation titled “Gypsum Karst of the Western Kraine: a model example of artesian speleogenesis.” Klimchouk is currently Prime Vice-President of the Union International of Spéléology.
- Mr. Peter Jones, a cave photographer and potter from Camden, Maine, gave a photo presentation titled “A Lifetime Caving in the Guadalupe Mountains.” Jones has won numerous awards for his cave photography, which has been published in many books, magazines and newspaper articles. His work has been exhibited in Carlsbad Caverns National Park, The Carlsbad Municipal Art Museum, The Department of Interior Museum (Washington, DC), The American Cave Museum (Cave City, KY) and the Smithsonian Museum of Natural History (Washington, DC).
- Paul Burger, park hydrologist/geologist for Carlsbad Caverns National Park, gave an informative lecture titled, “The Challenges, Triumphs of Authoring Caving Books.” This talk offered advice, and examples of the pitfalls an author can encounter and suggestions on how to start and maintain your writing career. Paul Burger is the author of “Cave Exploring: The Definitive Guide to Caving Techniques and Trip Leadership” and co-author of “Deep Secrets: The Discovery and Exploration of Lechuguilla Cave.”
- In May 2006, Dr. Alexander Klimchouk who founded and is the first Director of the newly established Ukrainian Institute of Speleology and Karstology of the Ministry of Education and Science of Ukraine and is currently Prime Vice-President of the Union International of Spéléology, assumed the position of NCKRI visiting scientist. Through Dr Klimchouk, NCKRI has started the process of becoming a member organization of a newly establish consortium of international cave and karst research institutes.

### Key Geologic Resource Division Contacts

David B. Shaver  
 Chief, Geologic Resources Division  
 dave\_shaver@nps.gov  
 303-969-2094

Carol McCoy  
 Chief, Planning, Evaluation & Permits Branch  
 carol\_mccoy@nps.gov  
 303-969-2096

Jim C. Woods  
 Chief, Geosciences & Restoration Branch  
 jim\_c\_woods@nps.gov  
 303-969-2635

Robert D. Higgins  
 Chief, Information & Outreach Branch  
 bob\_higgins@nps.gov  
 (303) 969-2018

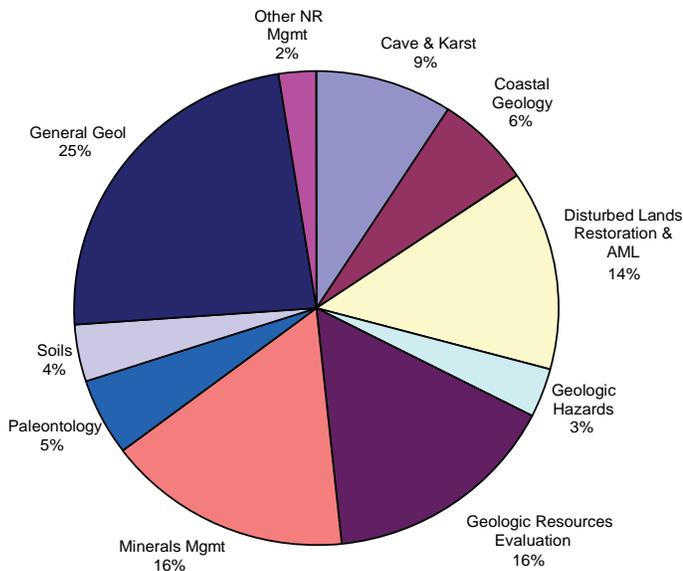
Lindsay McClelland  
 Washington Liaison  
 lindsay\_mcclelland@nps.gov  
 (202) 513-7185

### Geologic Resources Division Budget

In FY 2006, the Geologic Resources Division funding was:	
Funding allocation in FY 2005	\$2,647,000
Classified Pay Increase	\$68,000
Net FY 2006 Decrease	(\$43,000)
Total available in FY 2006	\$2,672,000
FY2006 Funding by Geologic Program Category:	
Cave & Karst	\$267,000
Coastal Geology	\$273,000
Disturbed Lands/AML	\$517,000
Geologic Hazards	\$126,000
Geologic Resource Evaluation	\$596,000
Minerals Management	\$626,000
Paleontology	\$120,000
Soil Resources	\$147,000
FY 2006 Total	\$2,672,000

In FY 2006, NPS funding for NCKRI was:	
Funding allocation in FY 2006	\$333,000
Classified Pay Increase	0
Net FY 2006 Decrease	(\$5,000)
Total available in FY 2006	\$328,000

### Geologic Resources Division Staffing Allocation Across Program Areas



National Park Service  
U.S. Department of the Interior



NPS Geologic Resources Division  
P.O. Box 25287  
Denver, CO 80225

<http://www.nature.nps.gov/geology/publications/>  
(303) 969-2090