

“If I can help document ... change and thereby highlight the effects of our collective actions on the world and particularly on the invertebrate world, a world rarely noticed by humans but comprising over 90% of the species found on Earth, my retirement will be meaningful to me.”

Rich Bray, Volunteer, Rocky Mountain National Park

Citizen Scientists

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Intern Heather Amann prepares to untangle a bird from a mist net so that it can be identified, measured, and banded, as coauthor Paul Super looks on. Amann, interested originally in studying voice in college, served as an intern with Great Smoky Mountains Institute at Tremont and has gone on to major in biology. She says, “My volunteer experience helped me realize that I wanted to pursue a career in environmental science to become a park ranger.”

The National Park System is reaping tremendous benefits from volunteers assisting park staffs with developing the scientific knowledge needed to manage natural resources in the national parks. These “citizen scientists” are often high school or college students who may become the professional park scientists of tomorrow. Others, including park neighbors, enjoy contributing to parks they love and learning about science and its role in park management. Retired professionals share their invaluable, lifelong skills with our national parks. Working with professionals who design and manage research projects, citizen scientists extend the range of park science, enabling biological inventories to cover larger areas and sampling more frequently than could be accomplished with paid staff. National parks and their partners recruit participants and provide training and coordination, often in association with one of the 13 learning centers now operating in the national parks. Articles in this chapter reflect an encouraging trend: public involvement in scientific inventories, resource monitoring, and other research and park management endeavors, often aided by Natural Resource Challenge-funded programs. National parks have profited from an engaged and committed volunteer workforce in 2002.

Intro

Citizen science a key component of Smokies resource management

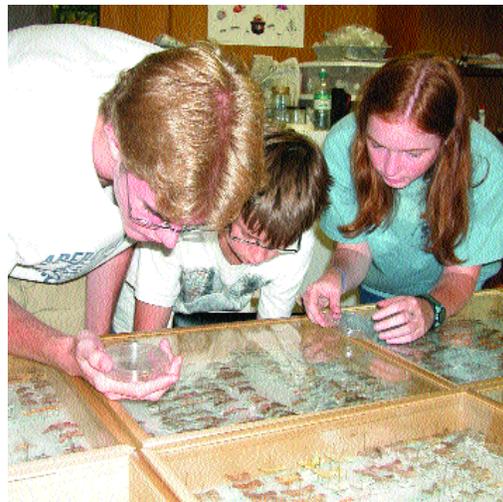
by Michelle Prysby and Paul Super

“Students are part of a growing effort to involve volunteers in the real work of inventorying and monitoring the park’s resources.”

IT’S JULY AND THREE HIGH SCHOOL STUDENTS trek up a sunny slope in Great Smoky Mountains National Park carrying nets and vials. They lay out a strip of brightly colored bowls filled with soapy water, then spend 30 minutes catching bees as they gather nectar from summer wildflowers. By the end of the day, the pan traps will be filled with more than a dozen species of bees that the students will pin and label along with the bees caught on the wing.

These students are part of a growing effort to involve volunteers in the real work of inventorying and monitoring the park’s resources. Without their involvement, most of these projects could not be attempted. In addition, the volunteers benefit from what can be a life-changing experience that could lead them into the fields of scientific research and resource protection. Citizen (or amateur) scientists are collecting data for studies on salamanders, bees, snails, beetles, daddy longlegs, archeology, and more. Many of these projects are part of the All Taxa Biodiversity Inventory (see page 20).

Aided by a summer research assistant at Great Smoky Mountains Institute at Tremont, students identify moths caught the previous night. The youths are part of Teen Science Camp, a 10-day event in which students assist with various research projects at the park. Erin Henegar (far right) is majoring in biology at college. Citizen efforts have added more than 100 new moth species to park lists.



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Great Smoky Mountains Institute at Tremont, Appalachian Highlands Science Learning Center, and the nonprofit Discover Life in America work in conjunction with the park Resource Management and Science and Resource Education Divisions to involve citizens in research in a way that optimizes both the educational and scientific benefits. These citizen science efforts began in 1999, and 2002 saw the launching of several new projects and the expansion of continuing projects.

Surveying along park trails is an excellent way to gather quantitative data on species distributions that can be used for developing habitat models, but most scientists are able to visit only a small area of the park. By 2002, volunteers had collected data on the distribution of more than 40 species of ferns along one-tenth of the park trail system. Using this same model, 54 high school students collected data on Turk’s-cap lily (*Lilium superbum*) in advance of reintroduced elk moving into the lily’s habitat.

Based on an Australian model, the park’s FungiMap project was launched in 2002. Tapping into the expertise of the Asheville Mushroom Club and other mushroom enthusiasts, volunteers are submitting observations of a set of 50 species that are easily identifiable in the field.

Gardens for monitoring the effects of ground-level ozone on native plants have been in place in the park since 2001. With the help of the scientists working on this study, these gardens were being installed in 2002 at sites in school yards, Pisgah National Forest, Blue Ridge Parkway, and Obed Wild and Scenic River to allow students to collect data on local effects while learning about air quality issues.

Using a refrigerator with an attached ultraviolet light, students and adults at the institute monitor moth diversity and abundance on a weekly basis, releasing most of the captured moths alive. A parallel project at the Appalachian Highlands Science Learning Center began in 2002. More than 100 new park species records have been added by these citizen scientists.

Not only is citizen science a useful research tool, it also is a good way to provide visitors with a real connection to park resources. Some students have chosen careers in the National Park Service or in science because of their research experiences. Teacher participants have incorporated more inquiry into their curricula. Through Parks-as-Classrooms and the institute, some teachers are even conducting comparative studies between the park and their school yards. ■

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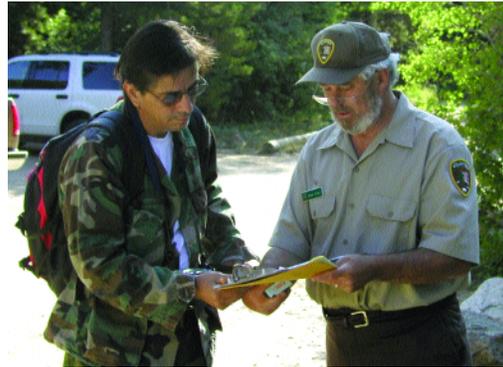
Rocky Mountain National Park benefits from citizen scientists

by Cheri Yost

“In 2002 a legion of citizen scientists donated more than 5,600 hours to Rocky Mountain National Park research projects through the Continental Divide Research and Learning Center.”

AT AN ELEVATION OF 13,160 FEET IN COLORADO sits a field of pink granite boulders that visitors scamper over on their way to the summit of Rocky Mountain National Park’s highest mountain, Longs Peak. It is a stark place devoid of vegetation, scoured by strong winds, and dried by intense sun. Few visitors know that it is among the most complicated landscapes in the park. Geoscientist Jon Achuff has studied this area and believes the entire Longs Peak Boulder Field is moving on a glacier. His research is time-consuming and strenuous, requiring him to carry delicate equipment in all seasons more than 7 miles to the research site. This research effort is astonishing for another reason: Achuff is a volunteer. In 2002 a legion of citizen scientists donated more than 5,600 hours to Rocky Mountain National Park research projects through the Continental Divide Research and Learning Center.

National Park Service volunteer Jim Snider explains a wilderness study to a potential participant.



NPS PHOTO (BOTH)

Research volunteers came from diverse backgrounds and worked on a variety of research activities in 2002, ranging from a Girl Scout troop distributing cameras for a wilderness study to retirees researching the history of the park’s buildings. Groups and individuals monitored vegetation recovery in a burned area, studied rare plant species, observed bighorn sheep behavior, counted elk, monitored air quality, and mapped vegetation for amphibian habitat. The learning center also recruited volunteers for cultural resource projects, enlisting them to research specific historical topics, preserve photographs and documents, and measure historic structures.

Professional scientists are also a critical part of the citizen scientist volunteer initiative at Rocky Mountain National Park. Volunteer and principal investigator Rich Bray has led the butterfly moni-

toring efforts for the past six years, donating a total of 6,000 hours. Not only do researchers like Bray give their own time, but they also help train others. With the help of the learning center, Bray recruited and trained volunteer field assistants. The financial value of the contribution of volunteer scientists is also substantial. For example, Achuff’s glacier studies would have cost the park or its partners approximately \$35,000, and volunteer efforts to measure historic buildings saved the park thousands of dollars in contract fees.

Whether they are volunteers assisting researchers with a specific project or professional scientists acting as principal investigators, research volunteers work closely with park professionals to develop and complete research projects. Volunteer researchers extend the capacity of the National Park Service to develop the science necessary to appropriately manage park resources. For example, volunteers working with a university researcher observed the behavior of bighorn sheep, helping park scientists to develop quantitative documentation of the influence of cars and people on bighorn behavior. Based on this research, managers are creating a strategy for reducing stress on the animals when they attempt to cross a popular park road to access a mineral lick.

Not only does the park benefit from citizen scientists, but also volunteers deepen their understanding of the complexities of ecosystems, learn about the quandaries of resource protection, and become active stewards of the park’s natural and cultural resources. In addition to providing exceptional educational opportunities, parks are living laboratories that offer unparalleled research possibilities to professional scientists. National parks allow researchers to investigate natural systems that are relatively undisturbed, providing important opportunities to develop baseline information.

Supporting park research and providing exceptional educational experiences are the dual goals of the National Park Service’s learning centers. The Continental Divide Research and Learning Center found an exciting and rewarding way to reach these goals by recruiting citizen scientists to assist with park research activities. ■

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With Longs Peak of Rocky Mountain National Park in the background, volunteer and principal investigator Jon Achuff, other volunteers, and park staff survey the Longs Peak Boulder Field for glacier movement.



The Natural Resource Challenge promotes education and stewardship in John Day Fossil Beds

by Tom Rodhouse and Lisa Garrett

IN 2002, BIOLOGISTS TOM RODHOUSE AND Alan St. John brought learning and volunteer opportunities to educators and their students in the John Day Fossil Beds National Monument, Oregon. The two were contracted by the National Park Service Northern Semi-Arid Network to conduct the Natural Resource Challenge biological inventory of birds, mammals, reptiles, and amphibians. Tom and Alan arranged for school groups, community volunteers, and NPS interpreters to meet them in the field and lend their eyes, ears, and hands to aid the project.

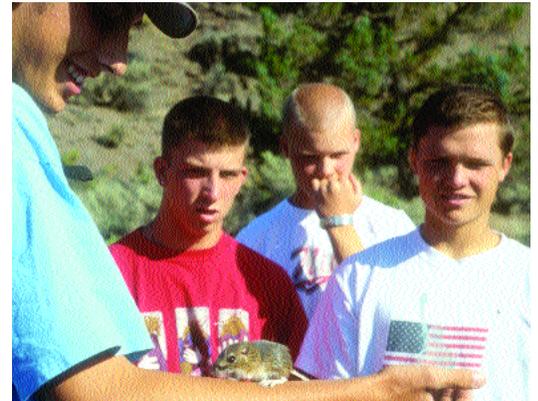
“Kids are great at finding stuff and they can cover a lot more ground than I can alone,” according to Alan, a herpetologist, after an outing with young volunteers in a search for the elusive pygmy short-horned lizard. “Plus, it’s great fun for them and they certainly are learning at the same time.”

In exchange for their help, volunteers are rewarded with exciting close encounters with park animal species such as bats, pocket mice, and rattlesnakes. The use of volunteers is a great introduction to citizen involvement and stewardship in national parks. Many volunteers are surprised at the diversity of animals in the John Day Fossil Beds, and their enthusiasm is increased as they realize the importance of this first-ever comprehensive inventory to park management.

Although located in remote eastern Oregon, John Day Fossil Beds is frequently visited by school groups from across the state. Hancock Field Station, an Oregon Museum of Science and Industry environmental education camp, is located in the national monument and provides an excellent link between students and science activities at the park. Field station instructors were recruited as volunteers early in the summer season and were able to incorporate inventory activities into their school programs and summer camps.

National Park Service staff also provide educational programs to visitors. The experiences they have gained working with the biological inventory have enhanced their knowledge of natural resources in the park and enriched the content of these programs. Several staff members have even become regular after-hours assistants on bat mist-net outings for the inventory.

John Day Fossil Beds is an interesting site in which to conduct a biological inventory given its spectacular fossil record. For example, a group of Oregon State University biogeography students



NPS PHOTO BY TOM RODHOUSE

High school students closely examine a kangaroo rat in John Day Fossil Beds National Monument as part of the first comprehensive inventory of park mammals, birds, reptiles, and amphibians. School groups, volunteers, and NPS interpreters all played roles in the surveys, increasing their appreciation of park biological diversity, management, and science.

recently spent a morning working in the field with the small mammal inventory and an afternoon in the lab visiting the monument’s mammal fossil collection. The group’s instructor, Dr. Mary Santelmann, has brought students to the park before, but was very excited that this year students could get out in the field with scientists studying present-day fauna. “There is something about holding a small furry creature in your hand that engages the imagination. When the students looked at fossil teeth, bones, and skulls, I could see they were starting to ‘see’ the animal and not just the pieces.”

Volunteer involvement in the 2002 John Day Fossil Beds inventory was largely an informal and spontaneous arrangement. Tom and Alan, who have both worked as educators in the past, met with volunteers and students when schedules and activities coincided. The benefits to the National Park Service inventory and the public were clearly demonstrated in 2002. Tom and Alan both hope to see increased citizen involvement in the inventory in 2003 and will be looking for ways to formalize arrangements with educators to involve students. ■

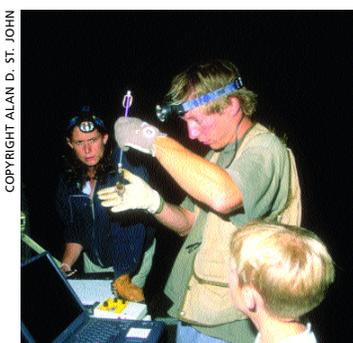
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“The use of volunteers is a great introduction to citizen involvement and stewardship in national parks.”



Biologist Tom Rodhouse weighs a Yuma myotis bat. The inventory revealed baseline species information for management and presented excellent learning opportunities for school-age students and adult volunteers alike.

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Involving the public in the search for rare plants at Point Reyes National Seashore

by Michelle Coppoletta

“The events drew a wide diversity of participants that included teachers, engineers, artists, students, and amateur and professional botanists.”

POINT REYES NATIONAL SEASHORE HOSTS MORE than 900 species of flowering plants, representing approximately 16% of the plant species known to occur in California. Five plant species at Point Reyes appear on the federally endangered list, 21 are federal species of concern, and the California Native Plant Society lists an additional 24 plant species as rare. Since 1984, park staff and a devoted group of volunteers have monitored rare plant populations at Point Reyes. Before 2001, comprehensive information describing the abundance and distribution of many of these rare species did not exist. Recognizing the need for a rare plant inventory and faced with the daunting task of surveying more than 71,000 acres of potential habitat, resource managers created an event called the “Rare-Plant-A-Thon.” This event involves members of the local community, agency botanists, students, and plant enthusiasts from around the San Francisco Bay Area in the search for undocumented rare plant populations within the national seashore.

In 2002, park vegetation managers hosted two Rare-Plant-A-Thons. More than 100 volunteers participated in these weekend events, traveling from as far away as Sacramento, Los Angeles, San Francisco, and Death Valley. The events drew a wide diversity of participants that included teachers, engineers, artists, students, and amateur and professional botanists. At the start of each event, volunteers received training that included a slide show of the seashore’s rare plant species and a discussion of where participants might expect to encounter them. Park staff and local botanists then led small groups of volunteers to different

areas within the seashore with instructions to survey and monitor rare plant species.

In addition to involving the public in the park’s management activities, Rare-Plant-A-Thon events have made a large contribution to the Point Reyes inventory effort as a whole. As a result of the 2002 events, 23 previously unrecorded rare plant populations were located, documented, and mapped. One of these new occurrences was the first documented population of a very recent addition to the seashore, the federally endangered robust spineflower (*Chorizanthe robusta*). Volunteers also monitored and mapped 18 known rare plant populations. One group helped transplant the federally endangered wetland grass Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*) into the wild as part of a reintroduction project.

Whether participants were experienced botanists seeking opportunities to photograph endangered species or individuals who simply wanted to learn more about California’s coastal wildflowers, the response was universal. Volunteers couldn’t wait to come back for more. These events have generated such excitement and interest from participants that the Rare-Plant-A-Thon has now become one of the seashore’s annual events. A resource management success story, the Rare-Plant-A-Thon increases local awareness and inspires enthusiasm for the abundance and diversity of rare plant species in Point Reyes. ■

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A Rare-Plant-A-Thon volunteer climbs a hillside above Tomales Bay in Point Reyes National Seashore in search of coast rock cress (*Arabis blepharophylla*) and other rare plants. During two weekends in 2002, more than 100 volunteers surveyed the park, documenting 23 previously unrecorded rare plant populations and taking part in related restoration activities.

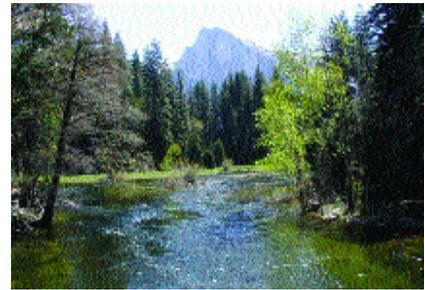


NPS PHOTO BY MICHELLE COPPOLETTA

Hands-on science brings student researchers to Yosemite National Park

by Kathy Dimont

YOSEMITE NATIONAL PARK AND THE UNIVERSITY of California signed a memorandum of understanding that promises to fulfill goals of both entities with the creation of the Environmental Science Academy program. The university's new campus in nearby Merced focuses on science and research, and the proximity of the park offers an excellent opportunity for field studies. Additionally, the university serves the growing and culturally diverse population of California's Central Valley. The San Joaquin Valley's population expands by about 100,000 residents per year, dominated by Latinos, Asians (primarily Vietnamese and Hmong), African Americans, and other ethnic groups. The park wants to reach these audiences to help them form meaningful relationships with Yosemite National Park and to foster resource conservation.



NPS PHOTO BY JEFFREY TRUST

“Behaviors, beliefs, attitudes, and aspirations are changed by allowing students to interact directly with park resources.”

Capitalizing on the combined strength of the university and park systems to reach those goals, the park, University of California–Merced, and the Merced Union High School District work together to immerse high school students in natural resource education. The USDA Forest Service also joined the partnership with the participation of their wilderness education coordinator. Students selected by their science teachers begin park classes in the summer following their freshman year. Park resource management staff and USGS scientists involve the students in projects related to air quality, water quality, geology, fire ecology, plant ecology, wildlife biology, and other studies. Students collect data throughout the watershed of the South Fork of the Merced River and participate in backpacking trips, including a six-day trip into the Clark Range, that allow them to experience the outdoors in a way they never have before. They offer their findings in presentations delivered to their families, park managers, school boards, and alumni groups. The program offers students the opportunity to return to the park each summer for advanced classes. Many of these students plan to enroll in the University of California in natural resource–related majors after completing high school.

The partnership between the university and the park allows low-income students to be the first in their families to attend college. The university pro-

vides mentors, tutors, and financial aid advice, while the park has been able to offer salaried positions in the California Welcome Center in Merced to five students each summer through a grant from the Ford Foundation. There they provide information to travelers, focusing on alternative transportation methods to help ease traffic congestion in Yosemite. Graduates of the program can serve in Ford-sponsored summer internships in the park and will also be eligible for STEP (Student Temporary Employment Program), SCEP (Student Career Experience Program), and other park employment opportunities. The program lays the foundation for a future employee pool for the National Park Service that serves a national goal of cultural diversity in hiring.

The program, begun in 1999, delivered its first graduates in 2002. It is only a beginning, but these students are reaching out exponentially to their peers, families, and communities with a conservation message, proving that the program is working. One young Hmong student tested water samples from the headwaters of the Merced River through the park and national forest, through agricultural land, and into the city of Merced. As a result of his findings, he and his family no longer eat fish caught in or near the city. One young Latina told of watching in horror as a peer threw fast-food containers into the shrubbery, then admitted that she was once guilty of thoughtless littering herself. Behaviors, beliefs, attitudes, and aspirations are changed by allowing students to interact directly with park resources. The science behind the program offers a new view of the world for these students, a place that they've learned to cherish through the Environmental Science Academy. ■

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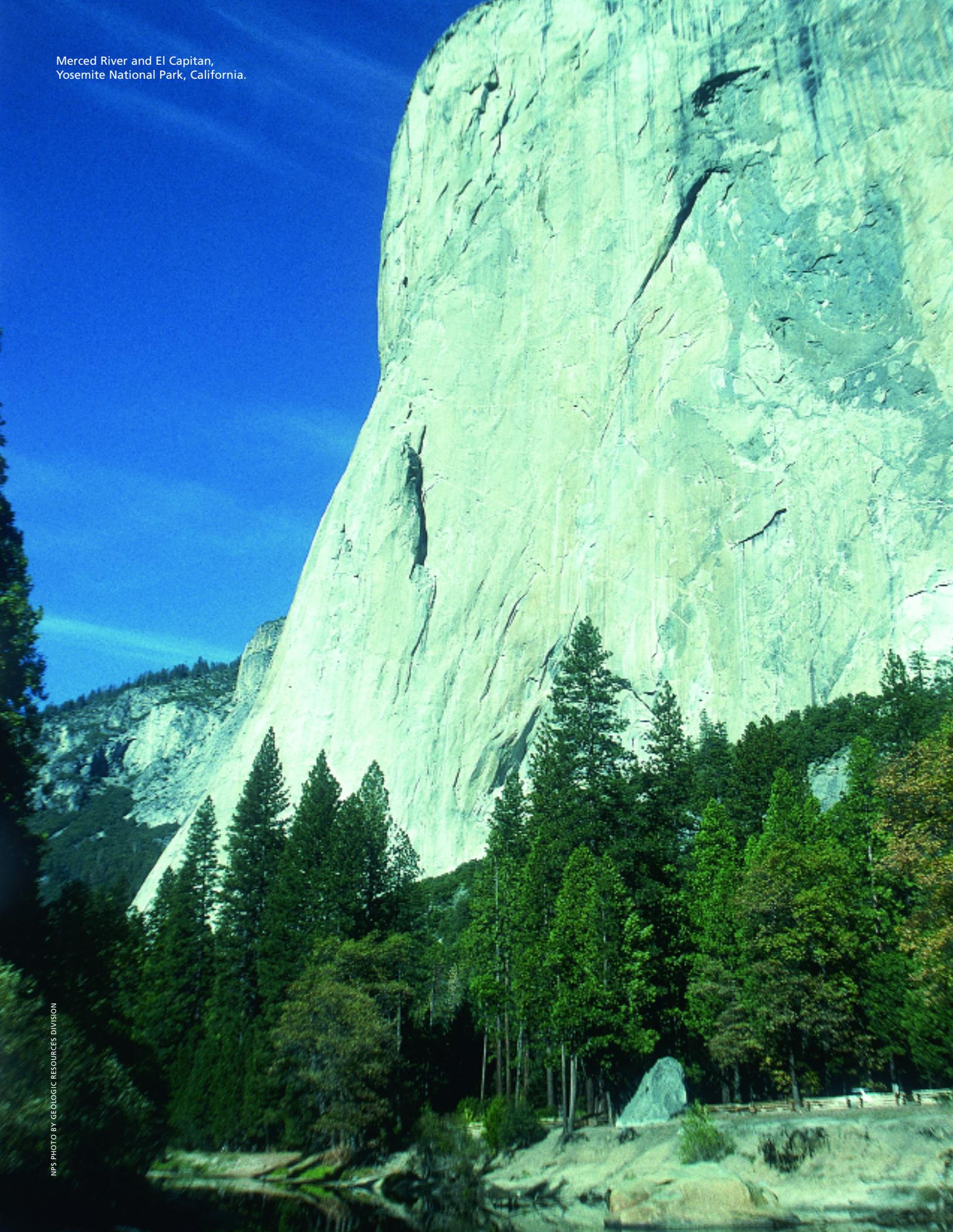
Chief, Education Services; Yosemite National Park, California



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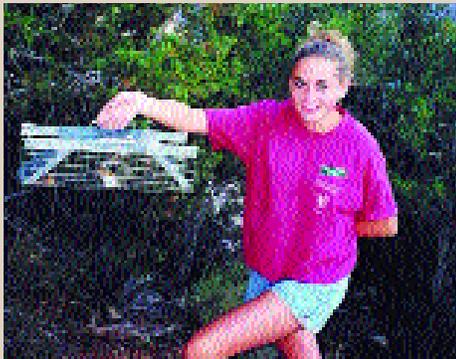
The Environmental Science Academy combines the strengths of Yosemite National Park and the University of California, exposing high school students from various backgrounds to field-oriented science and conservation and encouraging personal growth. In stark contrast to when they were selected for the program and not planning to attend college, nearly all participants who have completed the program are now enrolled in college; most are majoring in science.

Merced River and El Capitan,
Yosemite National Park, California.



Other Developments

NPS PHOTO



Youth biologist Casey Salestrom is now enrolled in the Wildlife Ecology Program at Colorado State University and plans to pursue a master's degree in marine science and ecology.

Youth biologists busy at Grand Canyon

by Elaine F. Leslie

Summer 2002 marked the sixth year that NPS biologists at Grand Canyon National Park, Arizona, have demonstrated the concept that parks are powerful environments for learning. The park and Grand Canyon National Park Foundation sponsor volunteers with a keen interest in biology and the work of the National Park Service. For two to four weeks, park staff supervise the volunteers, who range in age from 10 to 17. The program has attracted young people from coast to coast.

These youths participate in ongoing wildlife inventory and monitoring projects on the North and South Rims and along the Colorado River corridor. After training, they resolve human-wildlife conflicts, present interpretive programs, collect data from DNA sampling transects as part of noninvasive carnivore studies (see page 23), and live-trap small mammals for a verte-

brate inventory. In 2002 they documented a species of kangaroo rat that was not known to inhabit the south side of the Colorado River (the river was thought to have been a barrier to the species).

Park staff fully understand the importance of involving young people in science as soon as they express an interest. The young volunteers acquire useful skills in wildlife management and have an opportunity to understand the role and function of a park biologist. These youths have gone on to graduate from college and have entered into advanced studies in wildlife ecology. Although this program requires patience, the investment pays off and has proved to be an enriching experience for volunteers and park staff alike. ■

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Great Smokies species numbers continue to climb

by Becky Nichols

The All Taxa Biodiversity Inventory (ATBI), a long-term effort to document all life-forms in Great Smoky Mountains National Park, completed its fifth year in 2002 and continued to build momentum. The park has hosted several “bioquests,” events designed to identify a large number of specimens over a short period of time. Many scientists are on-site during these events, in addition to volunteers and students who assist and learn from the scientists. The largest bioquest to date brought together 30 lepidopterists (moth and butterfly specialists) in the park from June 9 to 11, 2002.

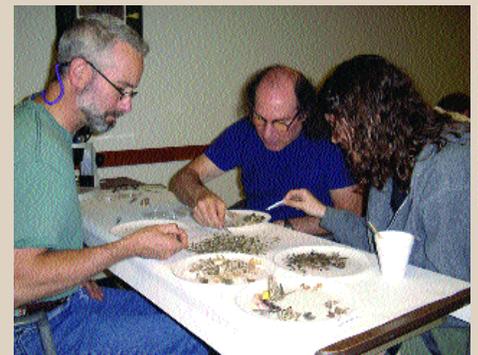
During this event, special emphasis was placed on high-elevation habitats—areas that may be at great risk from air pollution and global warming. Teams of volunteers, with llamas to carry the heavy traps and batteries, visited four remote balds. At lower eleva-

tions, schoolchildren beat the bushes for caterpillars and leaf miners. Overall, collecting was heaviest the first day, with the second day devoted to producing vouchers—specimens that scientifically document species presence—and species lists.

As of December 2002, the total number of identifications for the two-day quest stood at 860 species, but more are being identified in the researchers' labs. Of this total, an estimated 51 were undescribed species and 133 other species were new records for the park. For the ATBI as a whole, by year's end 334 undescribed species had been reported and an additional 2,121 new park records had been documented. These numbers change rapidly as the project moves forward. ■

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Butterfly and moth experts sort and identify specimens caught during the 2002 lepidoptera quest.

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Volunteers vital in completing National Capital Region bird inventories

by John Sinclair

In the early stages of the National Capital Region's Inventory and Monitoring Program, a data review determined that additional baseline information on bird species within six National Capital Region parks was needed. A large number of avid bird-watchers and clubs within the region provided a cost-effective means to complete the inventory. More than 30 volunteers have joined efforts with the National Park Service at Antietam National Battlefield, Catoctin Mountain Park, Harpers Ferry National Historical Park, Manassas National Battlefield Park, Prince William Forest Park, and Wolf Trap Farm Park. These skilled birders began visiting the parks in January 2001 and have collectively spent more than 2,300 hours in the field, 925 hours in 2002, and have identified 175 species, with more than 140 species identified in 2002. Many of these species have never been recorded in the parks. Furthermore, the volunteers have made special efforts to confirm nesting species, particularly those identified as species of concern by Partners in Flight, a cooperative effort among multiple agencies, nongovernmental organizations, and industry to conserve birds. The data collected will provide park managers with seasonal and breeding distributions, which can be used to identify and protect critical habitats.

Thanks to the efforts of the volunteers, the initial program goal of documenting 90% of the expected resident bird species has been reached at four of six parks. However, because the program is volunteer-based, it will continue at all parks only so long as participants are interested. ■

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Volunteers survey bird species at Manassas National Battlefield Park, Virginia.