State of the Parks®

March 2009

Great Basin National Park

A Resource Assessment

National Parks Conservation Association®
Protecting Our National Parks for Future Generations®

State of the Parks®

Center for State of the Parks®

More than a century ago, Congress established Yellowstone as the world's first national park. That single act was the beginning of a remarkable and ongoing effort to protect this nation's natural, historical, and cultural heritage.

Today, Americans are learning that national park designation alone cannot provide full resource protection. Many parks are compromised by development of adjacent lands, air and water pollution, invasive plants and animals, and rapid increases in motorized recreation. Park officials often lack adequate information on the status of and trends in conditions of critical resources.

The National Parks Conservation Association initiated the State of the Parks program in 2000 to assess the condition of natural and cultural resources in the parks, and determine how well equipped the National Park Service is to protect the parks—its stewardship capacity. The goal is to provide information that will help policymakers, the public, and the National Park Service improve conditions in national parks, celebrate successes as models for other parks, and ensure a lasting legacy for future generations.

For more information about the methodology and research used in preparing this report and to learn more about the Center for State of the Parks, visit www.npca.org/stateoftheparks or contact: NPCA, Center for State of the Parks, P.O. Box 737, Fort Collins, CO 80522; phone: 970.493.2545; email: stateoftheparks@npca.org.

Since 1919, the National Parks Conservation Association has been the leading voice of the American people in protecting and enhancing our National Park System. NPCA, its members, and partners work together to protect the park system and preserve our nation's natural, historical, and cultural heritage for generations to come.

* More than 325,000 members
* Twenty-five regional and field offices
* More than 120,000 activists

A special note of appreciation goes to those whose generous grants and donations made this report possible: Tiffany & Co., Dorothy Canter, Ben and Ruth Hammett, Marty and Lee Talbot, and anonymous donors.

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Cover photo of a bristlecone pine in Great Basin National Park courtesy of Dave Rock/istockphoto.

REPORT SUMMARY

LOREN REINHOLD

The state of Nevada is seen by some as a never-ending desert; these observers overlook the fact that the state is home to more mountain ranges than any other. It is a place that has been described in rugged terms—brutal, raucous, extreme. But where some see the inhospitable, others find beauty, both subtle and bold. For the inquisitive traveler who takes time to explore, the reward here is great—a surprising variety of landscapes, plants, and animals. In no place is this truer than in Great Basin National Park.

Great Basin National Park is one of the country's youngest (established in 1986), but it serves as a refuge for representatives of the world's oldest living tree species, the bristlecone pine. Some specimens of these ancient timberline dwellers share birth years with Egyptian pyramids, being 4,000 to 4,500 years old.

Nevada is home to more mountain ranges than any other state. Shown here are Wheeler Peak (the park's tallest at 13,063 feet) and Jeff Davis Peak within Great Basin National Park.

KELLY COURKAMP

Great Basin National Park preserves a portion of the South Snake Range.

Despite the name Great Basin—which refers to the area that extends from the Sierra Nevada Range in California to the Wasatch Range in Utah, and from southern Oregon to southern Nevada, where water drains inland rather than to the sea—this is a mountainous park. Located in one of the most remote regions of the contiguous United States, it preserves a portion of the South Snake Range. Wheeler Peak, the park's tallest at 13,063 feet, guards three verified rock glaciers: Lehman, Teresa, and North Fork Baker. Because of the park's elevation gradient, water sources, underground caves, and distance from urban centers (the nearest major cities of Salt Lake City and Las Vegas are 250 and 300 miles away, respectively), it serves as a sanctuary for an extensive variety of ecosystems and wildlife. In addition, the Park Service administers all of the lands within the park's borders, which further ensures their future protection.

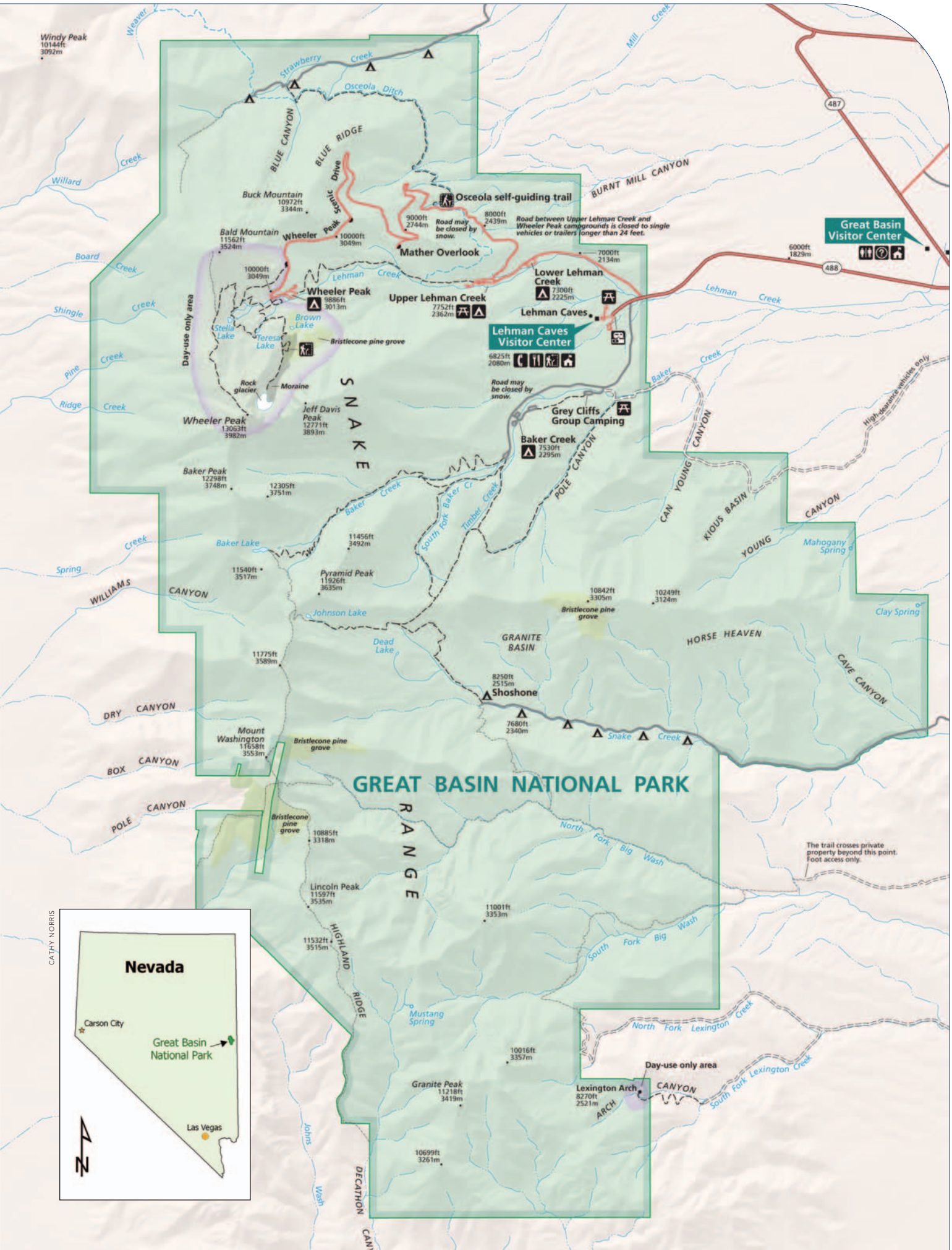
Great Basin National Park has some of the darkest night skies in the country, attracting stargazers as well as adventure travelers. In daytime, visitors are treated to excellent visibility and expansive views of Spring and Snake Valleys. But clear skies and air quality are in jeopardy at the park. Large, new coal-fired power plants have been proposed within 186 miles of Great Basin. Four coal-fired plants already operate within 200 miles of the park. Because the area is currently a Class 2 airshed, some degree of degradation from current and planned power plants would be allowed; the amount of degradation could be estimated but not actually known until the new power plants come online.

Regional groundwater withdrawal threatens water sources in the park. Groundwater rights were granted in 2007 to the Southern Nevada Water Authority to pump 60,000 acre-feet per year from Spring Valley, on the west side of the park, to provide for the growing needs of Las Vegas and other communities in southern Nevada. An application has been filed to withdraw water from Snake Valley for the same purposes. Loss of groundwater threatens streams, wetlands, springs, and cave systems.

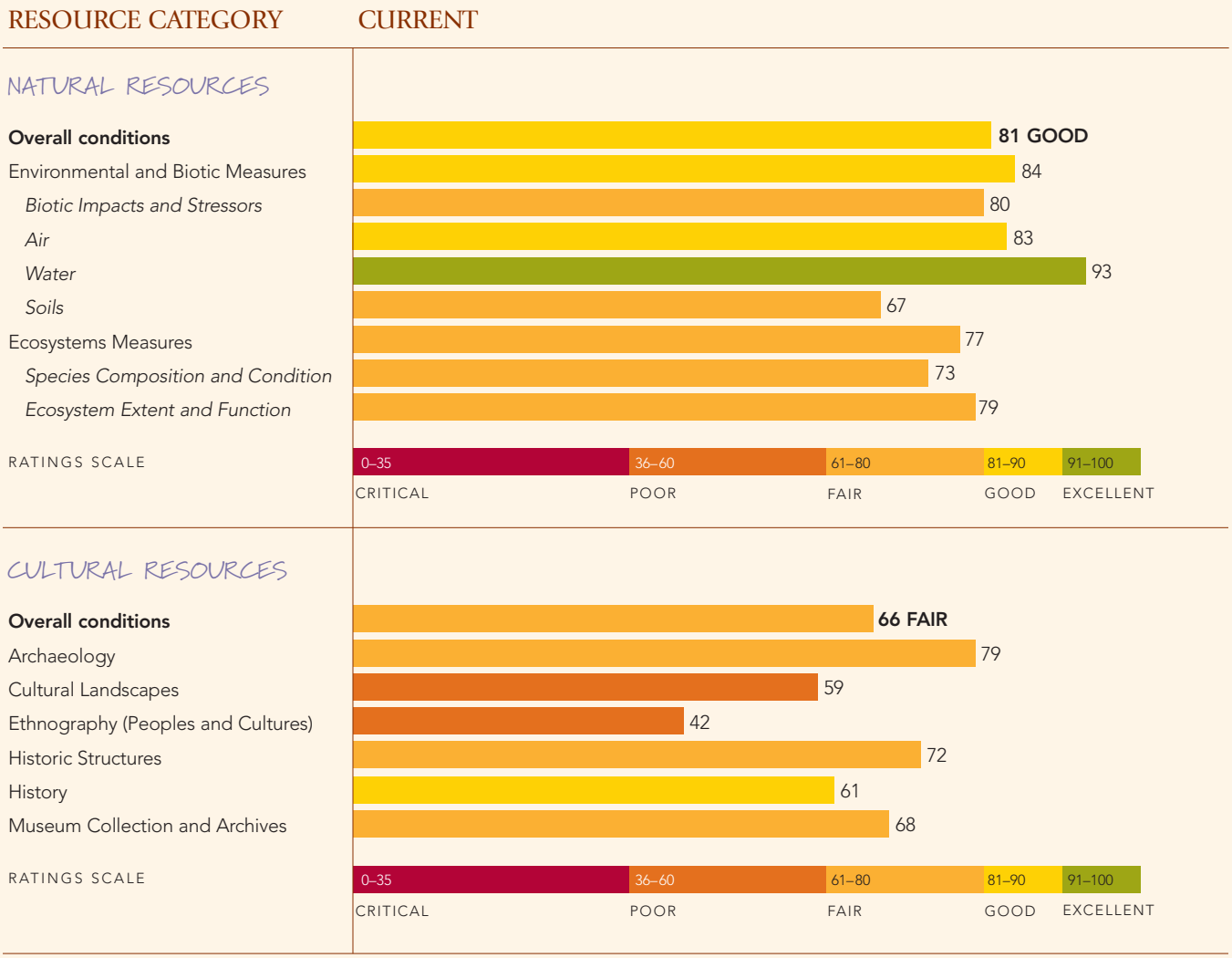
Other issues affecting park resources include the spread of non-native plant species and a history of fire suppression and grazing, all of which have impacted natural habitats.

Human beings have traveled through and lived in the Great Basin region for at least 12,000 years. Rock art panels at Grey Cliffs are evidence of some of these ancient inhabitants. Native peoples subsisted here until the 1870s, when white settlers took over the land to ranch, farm, and mine. Aspen trees in the park bear the marks of Basque, Peruvian, and Scandinavian sheepherders who carved symbols in the bark in the late 1800s. The park also protects the Johnson Lake Mine Historic District, the remnants of an early 1900s tungsten mining operation.

Cultural resources, such as tree carvings (dendroglyphs), pictographs, and historic structures, face multiple threats at Great Basin. The harsh natural elements take their toll on cave paintings and historic buildings, while


GREAT BASIN NATIONAL PARK
Great Basin Visitor Center
Lehman Caves Visitor Center
Osceola self-guiding trail
Mather Overlook
Wheeler Peak
Lehman Caves
Upper Lehman Creek
Lower Lehman Creek
Grey Cliffs Group Camping
Baker Creek
Shoshone
Lexington Arch
Day-use only area
Bristlecone pine grove
Road may be closed by snow.
Road between Upper Lehman Creek and Wheeler Peak campgrounds is closed to single vehicles or trailers longer than 24 feet.
The trail crosses private property beyond this point. Foot access only.
Windy Peak 10144ft 3092m
Buck Mountain 10972ft 3344m
Bald Mountain 11562ft 3524m
Wheeler Peak 13063ft 3982m
Jeff Davis Peak 12771ft 3893m
Baker Peak 12298ft 3748m
Pyramid Peak 11926ft 3635m
Mount Washington 11658ft 3553m
Lincoln Peak 11597ft 3535m
Granite Peak 11218ft 3419m
Strawberry Creek
Osceola Ditch
Willard Creek
Board Creek
Shingle Creek
Pine Creek
Ridge Creek
Lehman Creek
Baker Creek
Baker Lake
Johnson Lake
Dead Lake
Brown Lake
Stella Lake
Teresa Lake
Mahogany Spring
Clay Spring
Mustang Spring
Snake Creek
North Fork Big Wash
South Fork Big Wash
North Fork Lexington Creek
South Fork Lexington Creek
BLUE CANYON
BLUE RIDGE
Scenic Drive
BURNT MILL CANYON
SNAKE RANGE
WILLIAMS CANYON
DRY CANYON
BOX CANYON
POLE CANYON
HIGHLAND RIDGE
GRANITE BASIN
HORSE HEAVEN
CAVE CANYON
KIOUS BASIN
YOUNG CANYON
ARCH CANYON
DECATHON CANYON
Day-use only area
High-clearance vehicles only
Rock glacier
Moraine
Nevada
Carson City
Great Basin National Park
Las Vegas
CATHY NORRIS
NATIONAL PARK SERVICE

Note: When interpreting the scores for resource conditions, recognize that critical information upon which the ratings are based is not always available. This limits data interpretation to some extent. For Great Basin, 64 percent of the natural resources information was available and 98 percent of the cultural resources information was available.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases before a park was established. The intent of the Center for State of the Parks is not to evaluate Park Service staff performance, but to document the present status of park resources and determine which actions can be taken to protect them into the future.

LOREN REINHOLD

Proposed power plants, transmission lines, energy farms, and groundwater withdrawals could potentially threaten Great Basin's natural resources. All require thoughtful evaluation.

some visitors may threaten rock art, trespass in sensitive areas, and damage delicate cave formations. In addition, while the park works with traditionally associated groups as necessary, there are no ethnographic studies in place for Great Basin, and more planning is needed in order to effectively protect ethnographic resources. The park did not have a formal cultural resources program until a cultural resources manager was hired in 2003. Since then, the park has made progress documenting resources and planning for their protection into the future, though additional support is needed to expand these efforts.

RATINGS

The National Parks Conservation Association's Center for State of the Parks assessed the condition of both natural and cultural resources at Great Basin National Park. Current overall conditions of the park's known **natural resources** rated a "good" score of 81 out of 100. Ratings were assigned through an evaluation of park research and monitoring data using the center's comprehensive assessment methodology (see "Appendix"). The park currently has "good" air quality and "excellent" water quality, but they are threatened by power plants and groundwater withdrawals, respectively, and past grazing practices and fire suppression have degraded park habitats. Staff are working to restore some areas.

Overall conditions of Great Basin National Park's known **cultural resources** rated 66 out of a possible 100, indicating "fair" conditions. The scores for cultural resources are based on the results of indicator questions that reflect the National Park Service's own *Cultural Resource Management Guideline* and other policies related to cultural and historical resources. While the addition of a cultural resources manager in 2003 has greatly benefited Great Basin, additional staff are needed for all programs to assist with baseline research, archaeological surveys, and museum and archival collections upkeep.

Great Basin National Park Statistics

Park location:
East-central Nevada

Park establishment:
1986

Park size (acres):
77,082

Annual visitation (2008):
69,235

RESOURCE MANAGEMENT HIGHLIGHTS

- **Native fish reintroduced.** Great Basin National Park is home to four native fish species: Bonneville cutthroat trout, mottled sculpin, redside shiner, and speckled dace. Non-native fish, stocked here by early settlers and later government agencies, outcompeted natives for food, and most natives had disappeared by the time the park was established. In 1999, park staff reintroduced Bonneville cutthroat trout to five of the six streams they once inhabited at Great Basin. In 2005, due to the success of the trout reintroduction program, the park began reintroduction of the remaining three native fish species in select streams.
- **Lehman Caves restoration begun.** In 2008, the park began work to restore the Talus Room and other areas of Lehman Caves to approximate more natural conditions. Though cave tours once visited this and other rooms in the cave, the trails here were closed permanently in 1981, due to safety concerns. Since then, trail material and electrical conduit have been deteriorating, creating harmful conditions to the cave environment. As part of the restoration effort, an 800-foot section of paved walkway leading to the Talus Room is now being removed.
- **Sagebrush restoration ongoing.** In 2004, Great Basin National Park began restoring Lehman Flat, which was once largely sagebrush. As a result of fire suppression and grazing, pinyon-juniper and other vegetation had encroached on the area, degrading or eliminating shrub steppe wildlife habitat. By removing pinyon-juniper that had invaded the area, park staff have now restored several hundred acres of sagebrush.
- **Abandoned mine lands reclaimed.** There were about 250 abandoned mine sites from historic mining activities located within the park. These were comprised of rock quarries, prospecting pits, shafts, bulldozer scrapes, abandoned access roads, waste-rock piles, and ditches dug for water diversion. All of the 171 acres of abandoned mine lands have been reclaimed through park efforts along with 21 miles of associated roads.

NATIONAL PARK SERVICE

Park staff have successfully reintroduced native fish to many park streams.

- **Great Basin National Heritage Route designated.** The park has a good relationship with the descendants of Basque, Peruvian, and Scandinavian sheepherders in the region. Some are active in the Great Basin Heritage Area Partnership, a nonprofit group that works to preserve local heritage. The partnership helped garner the area congressional designation as the Great Basin National Heritage Route.
- **Second visitor center opened.** In 2005, the park opened a visitor center in Baker, Nevada; support from the Great Basin National Park Foundation made this facility possible. It features exhibits, an informative film, and opportunities to interact with rangers and to purchase educational items. A new exhibit, currently being installed, encompasses a timeline of more than 12,000 years of habitation in the Great Basin, including occupation and use by Paleo-Indian, Fremont, Shoshone, and Paiute peoples, as well as by miners and ranchers. Representations of pictographs, petroglyphs, and dendroglyphs, as well as a pithouse, wickiup, log cabin, and sheepherder camp, will also be displayed. The park also operates an additional visitor center at the entrance to Lehman Caves; this facility is devoted to education and interpretation of cave features and history.
- **Archaeological site assessments completed.** With the addition of a term archaeologist in 2006 the capacity for assessment and documentation of archaeological sites has increased. In fact, condition assessments for all of the park's archaeological sites were completed in 2008.

GREAT BASIN NATIONAL PARK AT A GLANCE

- Great Basin National Park overlooks Spring Valley to the west and Snake Valley to the east, offering expansive desert views and opportunities to see ancient bristlecone pines, the world's oldest living tree species.
- Great Basin National Park is remote—Salt Lake City and Las Vegas, the nearest major cities, are 250 and 300 miles away, respectively. The park's isolation accounts for its excellent air quality; on most days, visibility is at least 186 miles. At night, visitors are treated to one of the darkest skies and best opportunities for stargazing in the park system. Lack of light pollution allows stargazers an unparalleled view of planets, constellations, the Milky Way, and other celestial bodies.
- Lehman Caves, discovered more than 130 years ago, include a wide variety of cave formations, such as stalactites, stalagmites, cave popcorn, flowstone, and more than 300 rare shield formations. The caves were protected as Lehman Caves National Monument in 1922, inspiring the eventual creation of the park. Now part of Great Basin National Park, the caves offer guests opportunities to view spectacular cave formations and learn about the unique history of cave exploration in the area. In addition, the park contains 45 additional limestone caves—including the longest cave system in Nevada and the deepest cave in the state.
- The Lexington Arch, a six-story-tall natural limestone arch located in the Lexington Canyon, is one of the largest limestone arches in the Western United States. It is unique because above-ground arches are usually sandstone (limestone is usually associated with underground formations). It is possible that the arch was once a cave feature, or it may be a natural bridge.
- The park is home to the Johnson Lake Mine Historic District. Accessible only by a strenuous hike with a 2,700-feet elevation gain, these abandoned ruins represent what is left of an early 1900s tungsten mining operation.
- Great Basin National Park offers visitors opportunities to take guided tours of Lehman Caves, attend evening campfires, hike a variety of trails, fish for trout in Baker Lake and several streams, visit the site of a 13th-century Fremont Indian village, enjoy scenic drives, and more.

KEY FINDINGS

- New coal-fired power plants in the planning stages are within 186 miles of Great Basin; four coal-fired plants already operate in the region. According to estimates from permit applications, new coal-fired plants could potentially emit millions of tons of carbon dioxide, thousands of tons of sulfur dioxide and nitrogen oxides, and hundreds of pounds of mercury each year. These pollutants would bring haze to Great Basin's skies, diminishing visibility and the park's notable night sky viewing, as well as an increase in the deposition of air pollutants that could harm ecosystems, particularly park lakes, which are susceptible to acidification.

- The park's streams and springs are threatened by the increasing water needs of LasVegas and communities in southern Nevada. In the 1980s, the Las Vegas Valley Water District—now part of the Southern Nevada Water Authority—applied for future groundwater rights throughout much of Nevada. In 2004, the Southern Nevada Water Authority began exercising these rights for groundwater. Several applications submitted to the Nevada State Engineer call for large-scale withdrawals of groundwater from the two valleys adjacent to the park (Spring and Snake Valleys). Water rights were granted with stipulation in 2007 to pump 60,000 acre-feet per year from Spring Valley. The Snake Valley application is scheduled for decision in the fall of 2009. The park's unique geology makes it difficult to predict how groundwater withdrawals could affect park ecosystems, but any decreases in flow of park streams and springs could have far-reaching adverse effects on Great Basin's water-dependent biological and geological systems.

- Park staff have identified ten non-native plant species that are of concern due to their ability to invade ecosystems and outcompete native species. The most widespread is cheatgrass, which now covers about 25 percent of the park. Park staff treat some non-native species, such as spotted knapweed, white top, mullen, and thistles, with biological and mechanical controls. They have eradicated two populations of spotted knapweed and contained several others.

- A history of grazing and fire suppression has contributed to landscape-level changes in plant successional patterns in the park. As a result, some species of wildlife are declining due to habitat loss. The sage-grassland ecosystem has been particularly hard hit, as pinyon-juniper and other vegetation have encroached onto the former sage steppe. Grazing was allowed to continue when the park was created, but in 2000 the park was able to end cattle grazing when ranchers donated their grazing permits in return for monetary compensation. Since then, the park has removed 18 spring developments and 18 miles of barbed wire fence, and has noted dramatic recovery in these areas. As of 2009, sheep grazing, which has occurred on two allotments on the west side of the park, will be phased out. Great Basin National Park has attempted to minimize adverse

Lehman Creek earned a Class A designation from the State of Nevada due to its excellent water quality. If nearby groundwater withdrawals cause decreases in water flows in park streams and springs, Great Basin's biological systems and geological caves could be greatly affected.

U.S. GEOLOGICAL SURVEY

effects from grazing through the terms and conditions for compliance placed in the grazing permits.

- Prior to hiring a cultural resources manager in 2003, a cultural resources program was almost nonexistent at the park. Since then, the park has made progress identifying and documenting resources. A management plan to guide cultural resource protection is under way at Great Basin, but various other reports—including an administrative history and an ethnographic overview and assessment—are needed to meet Park Service baseline requirements.
- Carvings on aspen trees, left behind by Basque, Peruvian, and Scandinavian sheepherders, are visible in parts of the park. Documenting these dendroglyphs is a time-sensitive need because some of the aspen trees are reaching the end of their life cycle, and others are susceptible to fire. The park is documenting the dendroglyphs with photography and has proposed conducting a three-year study of aspen stands throughout the park, scheduled for funding in 2010.
- There are no ethnographic studies in place for Great Basin, and the park's planning does not adequately provide for the protection of ethnographic resources. With sufficient funds and other support, the park would have the potential to expand its ethnography program.
- Funding shortfalls compromise the park's ability to fully protect resources and provide the level of visitor services staff would like to achieve. The park has five full-time, permanent natural resources employees, but key natural resource positions remain vacant, including cave management specialist, hydrologist, and geographic information systems (GIS) analyst. Other vacant positions at the park include purchasing agent and protection specialist (ranger) positions. The cultural resources division is composed of a cultural resource manager and a term archaeologist (to become permanent in 2010). To care for the museum and archival collections, the park needs additional assistance. The park also requires additional administrative support for interpretation, protection, and resource management. Park managers would like to be able to provide more campground talks and extended visitor center hours, and expand outreach and education to meet the park's mandate of telling the story of the entire Great Basin, but with only about ten full-time equivalent interpretive staff, the park is unable to increase the level of visitor services offered. An additional two permanent interpretive staff and three seasonal staff would allow the park to expand its visitor services.

ALANA DIMMICK

Great Basin National Park includes more than 60 miles of developed trails that provide access to destinations such as Stella Lake, one of the park's six subalpine lakes.

LAND USE HISTORY—SETTLERS BRING CHANGES TO GREAT BASIN

For at least 12,000 years, people have lived in the remote and sometimes forbidding environment of the Great Basin. Paleo-Indians (12,000–9,000 BC) lived here in small groups that could mobilize quickly in pursuit of prey, harvesting now-extinct Pleistocene animals, including mammoth, bison, and ground-sloth. Larger Pleistocene mammals had disappeared by the beginning of the Great Basin Desert Archaic period (9,000 BC–AD 500). Archaic peoples adapted to these changes by including a wider variety of vegetation in their diets—seeds, berries, and cattail—as well as fish and small mammals. People moved their settlements seasonally and used caves and rock shelters for storage. By the start of the Fremont Period (AD 500–1300), inhabitants had employed small-scale agriculture. Unlike their hunter-gatherer predecessors, the Fremont people settled in small villages along streams in low valleys. While scholars debate the cause of the Fremont decline (one theory suggests that farming became unreliable, due to climate changes), they generally believe that the Fremont culture disappeared from the Great Basin by 1300.

The Shoshone—an American Indian group that relied on a subsistence lifestyle—persisted in the region until the 1870s, when increased Euro-American settlement accelerated their conversion to wage-based economies (farming, ranching, and mining). Originally from southeastern California, Shoshone peoples may have entered the Snake Valley as early as 1100. Spanish slave traders, most active in the mid-18th century, abducted Shoshone and other American Indians in the Great Basin region, affecting local indigenous populations.

Spanish expeditions and fur traders from the Hudson's Bay Company ventured into the Great Basin throughout the 1700s, but there is no evidence that they came near the present park boundaries.

The earliest known Euro-American historical documents for the Wheeler Peak area date from 1827, when "mountain man" Jedediah Smith traveled the Snake Range. Data on the topography, climate, wildlife, botany, geology, paleontology, and native peoples of the region were published in Smith's journal in 1876.

In the 1840s, the U.S. Army Bureau of Topographical Engineers began scientific and military exploration of the region. During his 1843–44 expedition, which passed through the Great Basin, explorer John C. Fremont observed that the region was "surrounded by lofty mountains, contents almost unknown, but believed to be filled with rivers and lakes which have no communication to the sea, deserts and oases which have never been explored." Although he never surveyed current park lands, his description aptly describes the landscape that would ultimately form the park. Captain James H. Simpson conducted the first comprehensive study of the Snake Range and adjacent valleys in 1859, while mapping out a new wagon route from Camp Floyd, Utah (near Salt Lake), to Genoa, Nevada.

Bound for California during the mid-19th century, numerous emigrants crossed Nevada, and following more northerly or southerly routes of passage, entirely missed the area now within Great Basin National Park. During this time period, however, various Mormon settlers surveyed the area for settlement potential. In 1855, an exploratory group of Mormon settlers from Lehi, Utah, camped on what are now park lands.

Lieutenant George Wheeler of the U.S. Corps of Engineers, for whom Wheeler Peak is named, conducted detailed topographic and geological reconnaissance of the area in 1869 as part of his *U.S. Geological Surveys West of the One Hundredth Meridian*. Following his extensive survey work, people began to settle and mine the area in earnest. From 1869 until the park's creation in 1986, prospectors and miners were active in several areas of Great Basin. Early

efforts included unsuccessful lead, gold, and silver mining, followed by copper and tungsten mining in the 1880s. People filed numerous mining claims as recently as the 1950s. None of the mines in the park produced enough high-quality ore to be commercially successful, although several resulted in extensive exploratory excavations.

Garrison and Baker, the two communities nearest the park, were founded in 1870 and 1873, respectively, as centers of cattle ranching. When Basque sheepherder Guy Saval purchased one of the larger ranches in 1914, other Basques followed, temporarily earning Baker the nickname "Basque Town." Basque sheepherders, originally from the Pyrenees region of Spain, left their marks throughout the region in the form of carvings on the bark of aspen trees. Many of these carvings, also known as dendroglyphs or arboglyphs, remain in the park today. Sheep grazing continues in the park but is being phased out; cattle grazing allotments were retired in 2000.

Historic disturbances to terrestrial and aquatic systems in the area included extensive logging of ponderosa pine (*Pinus ponderosa*) and use of horse-drawn draglines across five watersheds (Baker, Lehman, Snake Big Wash, Big Wash, and Strawberry Creeks), as well as unregulated grazing. In 1891, an act of Congress enabled the designation of federal forest reserves, and in 1909, President Theodore Roosevelt established the Nevada National Forest, encompassing more than 1.2 million acres in eastern Nevada. Timber harvest within current park boundaries was halted in 1959 when the U.S. Forest Service established the Wheeler Peak Scenic Area, the predecessor of Great Basin National Park.

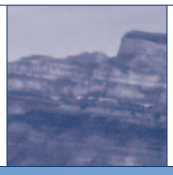
Absalom Lehman was one of the first settlers to establish a permanent residence in the Great Basin area. Homesteading first on Weaver Creek in the Snake Valley between 1866 and 1868, Lehman relocated to present-day Lehman Creek inside the park by 1870 and established a ranch. The caves that bear his name are his greatest legacy to the park. One account notes that, in the mid-1880s, Lehman stumbled upon a hole in the ground. Upon further investigation, he discovered that the hole led to a vast cave system filled with beautiful formations. Lehman began showing others his find, and by fall of 1885, he had installed ladders and stairs and created new openings into the underground rooms.

In 1912, the caves and lands that would eventually become Lehman Caves National Monument were added to the recently established Nevada National Forest. President Warren G. Harding created Lehman Caves National Monument by presidential proclamation in 1922, setting aside a 640-acre site surrounding the cave entrance. Overnight accommodations (log cabins and tents) were developed and new trails were created to allow access to the caves.

Serious proposals to create a national park, expanding beyond Lehman Caves to include Mount Wheeler, were launched in 1924, but this designation did not occur until 1986. Public Law 99-565 established Great Basin National Park "to preserve for the benefit and inspiration of the people a representative segment of the Great Basin of the Western United States possessing outstanding resources and significant geological and scenic values." The park now encompasses 77,082 acres.

ALANA DIMMICK

The 12-mile Wheeler Peak Scenic Drive is a popular way to see the park. Different park ecosystems—from sagebrush scrub to aspen groves—are revealed as the road gains 3,000 feet in elevation.



THE GREAT BASIN NATIONAL PARK ASSESSMENT

U.S. GEOLOGICAL SURVEY

Great Basin National Park is home to three verified rock glaciers. One sits at the base of the bowl-shaped glacial cirque on Wheeler Peak's eastern face.

NATURAL RESOURCES—ISOLATION OFFERS PROTECTION, BUT THREATS REMAIN

NPCA's Center for State of the Parks assessment rated the overall condition of natural resources at Great Basin National Park 81 out of 100, which ranks park resources in "good" condition. The park has "excellent" water quality, and air quality is also high. In addition, the park is not fragmented by inholdings and is generally remote from external development such as urban areas. Despite the park's isolated location, population growth in the Western United States threatens natural resources, primarily due to the ever-increasing demand for water and power to supply population centers hundreds of miles away. Withdrawals of groundwater from surrounding valleys to supply the needs of Las Vegas put Great Basin's ecosystems at risk,

and nearby established and proposed coal-fired power plants jeopardize air and water quality in the region.

Geology and Hydrology—Park Features Caves and Nevada's Only Glaciers

Great Basin's northern desert climate is characterized by extremes in daily and seasonal temperatures, with hot summers and cold winters. Elevation heavily influences both precipitation and temperature—annual rainfall in the basin valleys is less than 6 inches; on mountain ridges it exceeds 30 inches. Most precipitation in the Great Basin region falls in the form of snow that melts in the spring.

Rocks compose much of the landscape of Great Basin and include quartz monzonite, limestone, shale, siltstone, dolomite, and quartzite. Limestone deposits are of special importance in the park because they contain numerous cave systems. In addition to the famous Lehman Caves, Great Basin contains more than 45 additional wild caves (caves with no lighting or paved thoroughfares), most of which are closed to protect their fragile ecosystems. Eight of these caves, which require specialized skills to explore, are open to the public with a permit; an average of 20 permits are granted each year with an average of five members per party under the permit. Several of these caves are important hibernacula and maternity roosts for various species of bats. The park closes these caves during certain parts of the year to limit disturbance to the bats.

Park staff have mapped and surveyed most caves, and through this work they have discovered several endemic and new species of cave-dwelling fauna. A 2003 inventory uncovered a never-before-seen millipede (*Idogona lehmanensis*), another new species of millipede that is still being described and also represents a new genus, and a new species of globular springtail that is still being described (Model Cave springtail, *Arrhophilates* sp.). The park is engaged in a survey of all cave biota, and staff have inventoried more than half of all park caves so far. To guide management of the caves, park staff are in the process of preparing a cave management plan.

Great Basin National Park is home to three rock glaciers (Lehman, Teresa, and North Fork Baker) around the Wheeler uplift, all of which have been validated with ground-penetrating radar. A fourth glacier has been found but has not yet been validated. A rock glacier is a lobe of angular boulders and cobbles that resembles an alpine glacier in outline and in its slow downslope movement. Inside rock glaciers, ice fills in the spaces between blocks of rock. By freezing, thawing, and sagging, ice works with gravity to provide force that moves the glacier. The Lehman rock glacier measures 300 by 400 feet—its exact depth is unknown.

The park contains ten perennial streams, six subalpine lakes, and more than 425 perennial springs. Five of the park's six lakes are located above 10,000 feet. All lakes are oligotrophic (nutrient poor) and all were originally without fish, although they did harbor macroinvertebrates. Historically these lakes were stocked with various trout species, but Baker Lake is the only lake that still harbors fish populations today.

LOREN REINHOLD

The summit of Wheeler Peak offers spectacular views of the surrounding mountains.

KELLY COURKAMP

Pinyon-juniper forest is the most prevalent ecosystem at Great Basin National Park.

Although aquatic areas compose a small percentage of total land cover in the park, they are vitally important ecologically. Land-dwelling animals in the desert environment depend on these sources of scarce water. Fish are able to thrive in Great Basin due to these water sources, and more than 100 species of macroinvertebrates, such as mayfly (*Drunella* sp.) and stonefly (*Hesperoperla pacifica*) nymphs, have been documented in park waters, a sign of good water quality and a source of food for trout and other native fish species.

Groundwater flows in the park are not well understood; however, movement is likely through an unknown number of underground aquifers. Groundwater-fed surface waters in the park are at risk because Spring and Snake Valleys contain substantial underground aquifers that are being targeted for pumping and transport to Las Vegas (see "Groundwater removal" on page 20). Any decreases in flow of park streams and springs could adversely affect Great Basin's water-dependent biological and geological systems.

PLANT LIFE AT GREAT BASIN—TEN ECOSYSTEMS HARBOR RICH BIOLOGICAL DIVERSITY

A wide range of ecosystem types exists at Great Basin National Park, due to its variations in elevation, temperature, and moisture gradients. Communities range from hot desert to cold alpine. Isolation of the South Snake Range by the surrounding desert has led to the evolution of endemic plants and animals—species found here and nowhere else. Native plant species in the park and the vicinity number more than 860; 41 are non-native. Notable native plant species include aspen (*Populus tremuloides*), whose stands are known for their biological diversity, and Great Basin bristlecone pines (*Pinus longaeva*), the oldest living tree species on Earth. The park has identified ten ecosystem types within its borders, as follows:

Salt desert scrub/shrub covers a mere 1 percent of land area in the park and consists of two plant communities. The winterfat (*Ceratoides lanata*) community, dominated by this single shrub species, provides important forage for bighorn sheep (*Ovis canadensis*), pronghorn antelope (*Antilocapra americana*), elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and many small mammals and birds. The salt flat community, sparsely vegetated with large patches of bare ground, includes shadscale (*Atriplex confertifolia*), winterfat, and greasewood (*Sarcobatus vermiculatus*). The spiny-tipped branches and coarse structure of greasewood provide good cover for small nesting birds and small mammals, as well as forage for wildlife.

Northern desert scrub/shrub makes up 5 percent of Great Basin, occupying valleys and the lower slopes of adjacent mountains; it includes three communities dominated by sagebrush. Many species of birds depend on sagebrush ecosystems for survival, including the sage thrasher (*Oreoscoptes montanus*) and sage sparrow (*Amphispiza belli*).

Pinyon-juniper forest covers 29 percent of Great Basin National Park and consists of one

BRISTLECONE PINES—PARK PROTECTS "TIMBERLINE ANCIENTS"

"This tree is pre-eminently picturesque, far surpassing not only its companion species of the mountains in this respect, but also the most noted of the lowland oaks and elms. Some stand firmly erect, feathered with radiant tail tassels down to the ground, forming slender, tapering towers of shining verdure; others with two or three specialized branches pushed out at right angles to the trunk and densely clad with the tasseled sprays, take the form of beautiful ornamental crosses … while on the roughest ledges of crumbling limestone are lowly old giants, five or six feet in diameter, that have braved the storms of more than a thousand years."

—JOHN MUIR

Bristlecone pines fascinate many people. Their twisted, hobgoblin shapes evoke characters from J. R. R. Tolkien or *The Wizard of Oz*, each a new and fantastic character. Bristlecone pines are thought to be the Earth's oldest living organisms, with life spans of up to 5,000 years. Great Basin is home to trees that are up to 4,500 years old.

Three closely related species of bristlecone pine occur in the United States: Rocky Mountain bristlecone pine (*Pinus aristata*) in Colorado, New Mexico, and Arizona; Great Basin bristlecone pine (*P. longaeva*) in Utah, Nevada, and eastern California; and foxtail pine (*P. balfouriana*) in California.

Great Basin bristlecone pines in Great Basin National Park grow in isolated groves just below tree line—also known as the timberline—hence the name, "Timberline Ancients," as given by David Muench in his 1972 book of that same name. Conditions are harsh, with cold temperatures, a short growing season, and high winds. Bristlecone pines in these high-elevation environments grow very slowly, and in some years do not even add a ring of growth. This slow growth makes their wood extremely dense and resistant to insects, fungi, and rot. Vegetation in bristlecone groves is sparse, limiting the role of fire as a threat. Bristlecone pines grow more rapidly in more favorable (i.e., warmer and less windy) environments at lower elevations, where they do not achieve their legendary age or bizarrely twisted shapes.

One bristlecone pine near Wheeler Peak, dated to be more than 4,900 years old, was cut down while still living and sectioned for scientific research in 1964, before Great Basin National Park was established. While scientists learned more about carbon dating and climate history by studying it, the sacrifice of this tree, known as Prometheus, caused a public outcry. Activism as a result of the martyrdom of this tree led to advocacy for the preservation of bristlecone pines. These ancient trees are now protected on all federal lands.

Naturalist, author, and preservationist John Muir, pictured here in 1907, poetically described the appearance of bristlecone pines.

FRANCIS M. FRITZ

Sixty-seven mammal species are known to occur or may occur in Great Basin National Park, including Rocky Mountain bighorn sheep.

plant community with two principal tree species: single-needle pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*).

Mountain scrub, which includes taller shrubs intermixed with forest stands, is vital habitat for many bird species. It covers 18 percent of Great Basin and is composed of three communities that vary with elevation—mixed shrub; mountain big sagebrush (*Artemisia tridentata*)/grass; and mountain mahogany (*Cercocarpus ledifolius*).

Deciduous forest and scrub covers 8 percent of the park and consists of riparian vegetation and aspen forest. Riparian areas (river and stream bank areas) not only provide wildlife with food and water, but also serve as important migration corridors.

Mixed aspen/conifer forest covers 10 percent of the park. This system represents a transition zone between the riparian areas/aspen stands and higher, drier sites dominated by conifers.

Coniferous forest makes up 17 percent of the park and is found on northern exposures at mid- to high elevations. This community consists of a mix of three trees: Engelmann spruce (*Picea engelmannii*), Great Basin bristlecone pine, and limber pine (*Pinus flexilis*).

Alpine tundra accounts for 8 percent of Great Basin. It occurs above 10,000 feet in elevation and consists primarily of small, low-growing perennial herbs, grasses, sedges, and dwarf wildflowers.

Grasslands—robust areas of short- to mid-grasses, the majority of which are native species—cover 3 percent of the park. Non-native species seen in these communities include crested wheatgrass (*Agropyron cristatum*).

Bare ground/rock covers 1 percent of the park, primarily on steep slopes and rugged mountain crests above 7,000 feet. It is composed of exposed bedrock or broken rocks that harbor lichen colonies. While little plant life occurs in this community, it provides vital cliff nesting sites for birds of prey, such as golden eagles (*Aquila chrysaetos*) and peregrine falcons (*Falco peregrinus*).

WILDLIFE—ENDEMIC ANIMALS PROTECTED, AQUATIC ECOSYSTEMS RESTORED

The variety and number of wildlife species in Great Basin is unusual for the desert region, due in large part to an elevation gradient, which provides a multitude of habitat types, and to the park's numerous water sources. Some animals are endemic to the region.

A total of 67 mammal species are known to occur or potentially occur in the park. Mule deer, Rocky Mountain bighorn sheep, bobcat (*Lynx rufus*), ring-tailed cat (*Bassariscus astutus*), coyote (*Canis latrans*), and beaver (*Castor canadensis*) are among the resident large mammal species. Smaller mammals include several species of shrews, mice, squirrels, and rabbits. The pygmy rabbit (*Brachyllagus idahoensis*) is endemic to the Great Basin region and is protected under Nevada law, listed by the state as at risk of extinction or serious decline. Its primary habitat is old-growth sagebrush; loss of this habitat to pinyon-juniper encroachment limits habitat for the rabbit in the park. At least ten bat species have been found in the vicinity of Great Basin, including the Townsend's big-eared bat (*Corynorhinus townsendii*); the federal government and the State of Nevada have listed subspecies of this bat as threatened, endangered, or of special concern.

Depending on season and habitat type—grassland, wetland, forest, desert, or alpine—bird-watchers are treated to a multitude of species at Great Basin. One hundred fifty bird species use park habitat for part of their life cycles. Visitors to the park's alpine area may spot black rosy-finches (*Leucosticte atrata*), while those who hike the Alpine Lake Loop trail occasionally catch glimpses of red crossbills (*Loxia curvirostra*) flitting in the aspens and pines. Raptors use a multitude of habitats—prairie falcons (*Falco mexicanus*) are visible as they soar above the grasslands, while some visitors may

observe a golden eagle tending chicks at a cliff nest. Even waterbirds such as common snipe (*Gallinago gallinago*) and ducks, unexpected in the desert, are found in the park.

In 2006, the National Audubon Society recognized Great Basin National Park as an Important Bird Area (IBA)—a site that provides essential breeding, migration, or wintering habitat for birds. The park received recognition as an IBA for several reasons: its support of species of high priority for conservation; its uncommon high-elevation desert habitats; and its pristine, protected environment.

Eighteen reptile species occur in the South Snake Range, most in the lower elevations. Common snakes in the park include gopher snakes (*Pituophis cateniferer*), Great Basin rattlesnakes (*Crotalus lutosus*), and night snakes (*Hypsiglena chlorophaeos*). The common northern desert horned lizard (*Phrynosoma platyrhinos*), known as the "horny toad," blends into rocky ground and may be difficult to spot. Other lizards in the park include the region's only skink and whiptail—the western skink (*Plestioclon skiltonianus*) and Great Basin whiptail (*Aspidoscelis tigris*). As for amphibians, only the Great Basin spadefoot toad (*Spea intermontana*) has been definitively found in the park.

Great Basin National Park is home to eight fish species. Four are native to the region—Bonneville cutthroat trout (*Oncorhynchus clarki utah*), mottled sculpin (*Cottus bairdi*), speckled dace (*Rhinichthys osculus*), and redside shiner (*Richardsonius balteatus*). Due to a remarkable recovery program, native fish are thriving in park streams. The other four fish species in the park are non-native species that were introduced prior to park establishment—brook trout (*Salvelinus fontinalis*), rainbow trout (*Onchorynchus mykiss*), brown trout (*Salmo trutta*), and Lahontan cutthroat trout (*Onchorynchus clarki henshawi*). Non-native fish were stocked in area streams and lakes for many years (up until 1986), first by miners and settlers, and later by government agencies to improve recreational fishing opportunities.

A wide variety of insects occurs in Great Basin. More than 100 species of butterflies alone have been identified, and these include only those seen between May and August. Streams in the park have been sampled for aquatic insects since 1997, and a comprehensive list of more than 200 species has been compiled. Park staff survey beetles about every two years near the Lehman Caves Visitor Center and Baker Creek Road to determine their response to sagebrush

NATIONAL PARK SERVICE

A remote camera captured this photo of elk browsing in the park.

PARK RESTORES NATIVE FISH

By the time Great Basin National Park was established in 1986, native fish had been almost wiped out, losing the competition for limited resources with non-native fish. Through a cooperative effort with other federal, state, and nonprofit agencies, Great Basin National Park began a Bonneville cutthroat trout reintroduction program in 1999, with outstanding results. Bonneville cutthroat trout are now present in five of the six watersheds in which they were historically found. As of 2006 there were Bonneville cutthroat trout in more than 10 miles of creeks in and near the park, and populations are expected to expand to cover 19 miles by 2011—52 percent of their historic habitat in the park.

As a result of the successful Bonneville cutthroat trout program, the park began reintroducing the remaining three native fish species into lower Strawberry and South Fork Big Wash Creeks in 2005. In so doing, Great Basin has reintroduced all native fish species to the park. This cutting-edge fisheries management program will be closely monitored in years to come.

Cooperation among the Park Service and other agencies and organizations has resulted in the successful reintroduction of native Bonneville cutthroat trout to Great Basin National Park.

restoration. In 1999, as part of the Bonneville cutthroat trout reintroduction, the park initiated a large-scale study of macroinvertebrates to assess ecosystem health; 82 taxa were identified. And in 2006 and 2007, park staff surveyed invertebrates in 15 park caves; 46 were found.

Spiders, scorpions, and other arachnids also occur at the park. Very little is known about the spiders at Great Basin. Scorpions in the park are not usually seen, as they are nocturnal. Several close relatives to true spiders have been identified as part of the park's cave invertebrate inventory, including the endemic Great Basin cave pseudoscorpion (*Microcreagris grandis*), first found in Lehman Caves.

PAST AND CURRENT THREATS—HUMAN PRACTICES PUT PARK RESOURCES AT RISK

Great Basin National Park is one of the country's most remote parks, but even so, its natural resources have been compromised by historic and adjacent land use, and they face several ongoing and future threats.

Grazing. Although grazing is prohibited in most units of the National Park System, Great Basin is an exception. Since the mid-1800s, a few ranching operations have existed in the Snake Range, with land and public land grazing permits passed down through families. With the creation of Great Basin National Park in 1986, grazing within the park's boundaries was allowed to continue in perpetuity. Soon after the national park was created, an agreement among the National Park Service, the Bureau of Land Management, and the U.S. Forest Service coordinated the administration of seven grazing allotments in the park. These included five cattle allotments on the east side of park and two sheep allotments on the west side, both of which extended onto other public land (managed by the U.S. Forest Service and Bureau of Land Management).

While allowed by the original legislation,

continued cattle grazing in Great Basin National Park resulted in conflicts in terms of resource management and visitor experience. In concert with fire suppression, grazing degraded certain natural systems. And because many park visitors were not accustomed to sharing a national park with cattle, they complained to park staff about the experience. In response, the park superintendent and local ranchers began discussing ways to address the issue. In December 1999—after much discussion, compromising, and fundraising—The Conservation Fund, aided by Senator Harry Reid (D-NV), offered monetary compensation to ranchers for donating their grazing permits. (Once these permits were donated, they could then be terminated.) Since the buyout, the park has restored several springs in the former allotments and removed 21 water structures.

Sheep grazing is currently being phased out in the Murphy Wash and Shingle Creek allotments. Sheep within these remaining allotments in the park, which cover a relatively small area (fewer than 10,000 acres), were consistently found outside the grazing boundaries, affecting sensitive alpine areas. In addition, the continued presence of domestic sheep is a major threat to bighorn sheep populations in the park, partly because grazing reduces the amount of available forage, but mostly due to disease carried and passed on by domestic sheep.

Fire suppression and loss of native systems. As with much of the Western United States, fire historically played an important role at Great Basin, helping to shape the vegetative communities found there. Since the arrival of Euro-American settlers in the mid-1800s, people have suppressed fires in the region. From 1959 to 1988, 83 fires were suppressed in the area now comprising the park, and only since the 1990s has the Park Service allowed any fires to burn naturally.

More than a century of active fire suppression (combined with grazing) has contributed to landscape-level changes in plant successional patterns in the park. The elimination of fire has shifted the landscape away from a diversity of community types to predominantly late-successional woody plant communities that contain a lot of vegetation that could fuel fires. As a result, bird and animal species, including some that are considered sensitive and dependent on shrub steppe, open woodlands, and ponderosa pine habitat, are declining due to habitat loss. In particular, recent inventories have shown significant declines in the abundance of shrub steppe species such as yellow-bellied marmot (*Marmota flaviventris*), Merriam's shrew (*Sorex merriami*), sagebrush vole (*Lemmiscus curtatus*), Brewer's sparrow (*Spizella breweri*), and Sonoran mountain kingsnake (*Lampropeltis pyromelana*). In addition, two types of beetles—mountain pine beetle (*Dendroctonus ponderosae*) and fir engraver (*Scolytus ventralis*)—are having increasing impacts on park resources. They kill pine and fir trees by entering the inner bark and girdling the trees. They are both native species that are becoming more destructive due to changes in fire regimes and warming trends in climate conditions. As larger numbers of trees are killed, there is a corresponding increase in the danger of catastrophic wildfire.

Although much of the park has been affected by fire suppression and grazing, the sage-grassland ecosystem has been particularly hard hit, as pinyon-juniper and other vegetation have encroached onto the former sage steppe. One study estimates that 16,400 acres of former sage-grassland habitat have been replaced by other vegetation. The Lehman Flat area of Great Basin, historically 96 percent sagebrush (and only 4 percent pinyon-juniper), had been reduced to less than 9 percent sage by 2004. The loss of sagebrush and grassland in the park has affected many species, particularly birds, voles, and insects. Sage-grasslands support a higher diversity of wildlife species than the woody plant communities that replace them.

In 2004 the park began to restore Lehman Flat by removing certain woody species. The

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Shrub steppe species such as the yellow-bellied marmot have declined due to habitat loss.

park has now completed several hundred acres of shrub-steppe restoration and considers continued restoration efforts to be a top priority.

Non-native species. Non-native species plague many national parks, and Great Basin is no exception, despite its remote location. Such species often gain entry when native ecosystems suffer some sort of disturbance, such as livestock grazing, altered fire regimes, or human activities such as mining, agriculture, ornamental landscaping, or other development. Non-natives are introduced via many routes. Some are planted in gardens or during roadside stabilization projects, while others are introduced accidentally as contaminants in seed, animal feed, or even packing material. Non-native seeds and plant parts are often spread on the hooves or hides of animals, through animal and bird droppings, in the doors or undercarriages of vehicles, or on hikers' clothing.

Forty-one species of non-native, herbaceous plants occur in Great Basin National Park. Ten species of concern have been identified, due to their invasive nature and threat to native plant communities: cheatgrass (*Bromus tectorum*), spotted knapweed (*Centaurea maculosa*), musk thistle (*Carduus nutans*), bull thistle (*Cirsium vulgare*), field bindweed (*Convolvulus arvensis*), common mullein (*Verbascum thapsus*), crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), common timothy (*Phleum pratense*), and Russian thistle (*Salsola kali*). Cheatgrass is estimated to cover about 25 percent of the park. It invades disturbed habitat and is usually found in areas that have been affected by grazing or fire suppression. Spotted knapweed can move into undisturbed areas, and the park aggressively treats it by spraying it with herbicide. In recent years, the park has eradicated three of the five known populations of spotted knapweed and park efforts have the remaining two in a state of control.

As mentioned in the "Wildlife" section on page 16, introduced fish species, including rainbow, brown, and brook trout, outcompeted native fish, leading to their near extirpation by the time of the park's establishment. As part of their efforts to reintroduce native fish, park staff have removed non-native fish when necessary.

While the Nevada Department of Wildlife has been stocking the mountain ranges of the state with game birds for decades, the park considers them non-native species. They include ruffed grouse (*Bonasa umbellus*), Merriam's turkeys (*Meleagris gallopavo merriami*), and gray partridge (*Perdix perdix*). Turkeys are of particular concern, as their populations are growing, and resource managers do not know how they affect native species.

Groundwater removal. Great Basin owes much of its ecological value and diversity to the water available in its streams and springs. Unfortunately, water withdrawals to serve the populations in Las Vegas and southern Nevada are threatening groundwater that feeds Great Basin's water sources. Water rights were granted with stipulations in 2007 to the Southern Nevada Water Authority to pump 60,000 acre-feet per year from Spring Valley. Streams, springs, and seeps in the park could be affected because of the close proximity to the withdrawals. Several recent applications submitted to the Nevada State Engineer by the water authority also call for large-scale withdrawals of groundwater from Snake Valley for transport to Las Vegas. According to a U.S. Geological Survey study, resources threatened by groundwater withdrawal include five watersheds; four stream systems totaling 9.25 miles; 137 wetland acres; 28 springs; 156 riparian acres; and 23 cave systems found on 6,040 acres of land administered by the National Park Service. In fall of 2009, hearings before the Nevada State Engineer will determine if the Southern Nevada Water Authority's applications for groundwater rights in Snake Valley are granted.

Water is critical for plants and animals in the desert environment of the park, including

DAN DURISCOE/NATIONAL PARK SERVICE

Great Basin National Park has some of the darkest night skies in the park system, but light pollution from growing regional population centers threatens this resource.

unique species found only in regional springs, which are directly threatened by pumping of groundwater. Loss of groundwater can also lead to the deaths of thousands of acres of deep-rooted shrub and wetland plant communities, potentially leading to "dust bowl" conditions. Water withdrawals may affect aquifers, leading to even greater impacts. In addition, the proposed water pumping plan would bring 200 or more wells with power lines, roads, and buried pipelines just outside the park, which could lead to other problems such as habitat fragmentation.

An additional water management issue, smaller in scale but still significant, involves the three-mile long Snake Creek pipeline, which the U.S. Department of Agriculture installed on behalf of ranchers to reduce losses along a porous section of the streambed en route to the town of Garrison. The adverse effects of the pipeline include loss of riparian vegetation, loss of fish and other aquatic habitat, and loss of groundwater recharge, with unknown consequences for aquifers and downstream springs.

Mining. Tungsten, gold, silver, copper, and lead mining has occurred in the park, but currently there are no active mines or claims, and mineral leasing is no longer permitted. The park has reclaimed its 171 acres of abandoned mineral lands as well as an estimated 21 miles of mine-associated roads, work that entails smoothing out or filling in excavated areas, replanting some with native plants, or waiting for vegetation to naturally reclaim areas. The few remaining structures on un-reclaimed lands in the park are remote. There are no known water quality issues from the abandoned hard rock mines.

AIR AND WATER QUALITY—PARK BOASTS EXCELLENT VISIBILITY, CLEAN WATER, AND DARK NIGHT SKIES

Great Basin National Park has good data on air quality, with monitoring sites in the National Atmospheric Deposition Program, Clean Air Status and Trends Network, and Interagency Monitoring of Protected Visual Environments program present in the park. Currently, the park enjoys exceptional air quality—on most days

visitors can see more than 186 miles, and occasionally views exceed 230 miles. The park's distance from urban areas helps buffer it from pollution, but emissions from Las Vegas, Los Angeles, and occasionally, Salt Lake City do travel as far as the park. Because of prevailing southwesterly winds, Las Vegas is usually the most significant source of vehicular nitrogen in the park. Even greater sources of air pollution in Great Basin are the four coal-fired power plants within a 200-mile radius of the park. Additional coal-fired power plants are proposed within 186 miles of Great Basin. It is estimated that each year the new plants would emit into the airshed millions of tons of carbon dioxide, thousands of tons of sulfur dioxide and nitrogen oxides, and hundreds of pounds of toxic mercury. This new pollution could make hazy skies the norm at Great Basin, and it could affect the pristine water quality of the park's lakes and streams, as well as the wildlife and fish dependent upon them.

Ground-level ozone, which is formed when nitrogen oxides and volatile organic compounds react in the presence of sunlight, is harmful to people, wildlife, and plants, and it is the primary component of smog. Five plant species that are potentially sensitive to ozone grow at Great Basin National Park: western serviceberry (*Amelanchier alnifolia*), evening primrose (*Oenothera elata*), ponderosa pine (*Pinus ponderosa*), aspen, and skunkbush (*Rhus trilobata*). Based on low levels of ozone recorded in the park to date, the risk of injury to these plants is minimal, but increases in the levels of pollutants that lead to ground-level ozone formation (from sources such as new power plants) could result in higher ozone levels at the park in the future.

In 2005, the National Park Service's Night Sky Team, formed in response to the alarming increase of light pollution and its effects on national parks, visited Great Basin to test light levels. Night skies at Great Basin are some of the darkest in the park system, making it an ideal location for stargazing. However, booming growth of population centers, such as Las Vegas, Salt Lake City, Provo, St. George, Cedar City, Ely, and other cities, poses light pollution threats to the region and to the park; lights from these centers are visible on the night horizon.

Water quality of streams within Great Basin National Park is excellent. The State of Nevada defines Class A waters as relatively undisturbed by human activity, with no industrial development or intensive agriculture. Four of the ten streams in the park earned Class A status by the state—Baker, Lehman, Pine, and Ridge Creeks. In addition, Nevada is required by the Clean Water Act to conduct water quality surveys and to report any water bodies that are "impaired"; no streams at Great Basin were reported as impaired. And a baseline study of all the perennial streams in the park found that 88 percent of water sampled fell in the "optimal" condition category according to the Environmental Protection Agency's Rapid Bioassessment Protocols. No stations or streams received an overall score within the "poor" condition category.

While the water quality in park streams is currently in good shape, the possibility of additional power plants in the area is a significant threat to high-elevation lakes at Great Basin. In particular, current nitrogen deposition in Great Basin (1.35 kg/ha/yr average from 2000 to 2006) is approaching the level at which negative ecosystem impacts might occur, based on effects to similar high-elevation lakes seen in Rocky Mountain National Park. Nitrogen acidifies rain and acts as a fertilizer, making it possible for some plants and animals, including non-native ones, to increase in abundance. In addition, the lakes of Great Basin are considered to be acid-sensitive, meaning that an increase in sulfur dioxide or nitrogen from the power plants could fuel negative effects at an even faster pace.

KELLY COURKAMP

The Great Basin Visitor Center in Baker, Nevada, includes exhibits that educate visitors about both cultural and natural resources.

CULTURAL RESOURCES—PROGRAM IN ITS EARLY STAGES; MORE STAFF NEEDED

The assessment rated the overall condition of cultural resources at Great Basin National Park a 66 out of 100, which ranks park resources in "fair" condition. The cultural resources program at Great Basin is in its infancy—prior to the addition of a cultural resources manager in 2003, little work was conducted. With the exception of a term archaeologist currently at the park, this staff member has been the only employee responsible to date for management of cultural resources in the park. The park needs additional staff to assist with baseline research and museum and archival collections upkeep. Additional staff will allow the park to document resources, care for them, and better interpret them for visitors. The park has been approved for a base funding increase for 2010 that will help address these goals.

Great Basin's current resource management plan requires major revision to establish resource priorities. A separate cultural resource management plan is currently being developed to guide protection in all programs—history, archaeology, cultural landscapes, historic structures, museum collections and archives, and ethnography.

HISTORY—HISTORICAL RESEARCH AND ADMINISTRATIVE HISTORY NEEDED

Historic resource studies provide a historical overview of a park and identify and evaluate its cultural resources within historic contexts. They also identify the need for any special studies and make recommendations for resource management and interpretation. Park staff rely on the 1990 historic resource study *Basin and Range: A History of Great Basin National Park* for guidance. While broad in scope, the report lacks depth and requires revision to meet current standards; staff view it as more of a bibliography than a historic resource study. Another report, *Lehman Caves: Its Human Story*, serves as an additional source of historical information for the park. This document, outlining the discovery and public use of Lehman Caves, was written in 1966 and has since been updated by staff through 1975.

An administrative history describes a park's conception and establishment, and ideally, its management to the present day. A park's legislative history—as well as planning, land acquisition and development, public relations, and ongoing management concerns—are emphasized in this document. Great Basin National Park does not have a written administrative history; park staff rely on a limited administrative overview from 1909 to 1986 that is included in the current historic resource study. Funding for this project has not yet been approved.

In addition to the administrative history, special supplemental studies are needed for important historical park topics such as mining, timber harvest, ranching, agriculture, grazing, settlement, and tourism and recreation. While secondary sources of information are available for many of these themes, all lack primary sources of professional caliber that park staff can use to bolster interpretation. Currently, no plans or pending requests have been made for these studies.

While there is not a historian on staff, historical research is conducted on an as-needed basis by regional Park Service staff or through collaboration with universities.

History at the park is interpreted for visitors through wayside exhibits, brochures and exhibits in the park's visitor centers, and online via the park's website. During the summer months, park rangers present interpretive programs that detail early exploration of the area, namely the expeditions of Jedediah Smith and Captain John C. Fremont. In addition, rangers lead tours of Lehman Caves, actively interpreting the history of Absalom Lehman and other early settlers to the area.

CULTURAL LANDSCAPES—EARLY ADMINISTRATION, MINING, AND TOURISM SITES REQUIRE ATTENTION

Cultural landscapes include natural and human-made features, illustrating the ways people have adapted to and altered their surroundings through time. Great Basin National Park has identified four sites as cultural landscapes: Baker Ranger Station, Johnson Lake Mine Historic District, Lehman Caves, and the Saint Lawrence Mine. A parkwide cultural landscape inventory was conducted in 2003, but it lacks the depth of analysis and evaluation needed to adequately manage the identified landscapes. To provide further information, the park conducted an additional cultural landscape inventory on the Johnson Lake Mine Historic District in 2008; regional staff are currently writing this report. The team that conducted the 2003 cultural landscape inventory did not assess a fourth location, the Saint Lawrence Mine. Though their report noted the former lead and silver mining operation as a potential cultural landscape for further study, the site is located outside the park's boundary. The Baker Ranger Station and Johnson Lake Mine Historic District sites were both listed in the National Register of Historic Places prior to the cultural landscape inventory process; Lehman Caves may be eligible but has not been evaluated for the register.

The Baker Ranger Station is a 2.5-acre complex that served as a base for the U.S. Forest Service, which administered the area prior to the creation of the national park. The station is composed of several buildings and the associated landscape from the 1930s, representing Depression-era construction. Lawn and vegetation, a nursery orchard consisting of trees grafted from the Lehman orchard, irrigation canals, corrals, and fences help retain the feeling of an early 20th-century U.S. Forest Service ranger station. The wide-open qualities of a rural outpost are integral to the landscape. The visitor center and residential complex recently built nearby were carefully situated and designed to be compatible with the Baker Ranger Station, through the use of building styles that complement the surroundings and landscaping that features native plants. The Baker Ranger Station is an actively used historic district; its buildings provide housing and storage (see the "Historic Structures" section on page 26 for information). The park needs a more in-depth study for the site to guide routine grounds maintenance and to ensure its spatial qualities are preserved.

The Johnson Lake Mine Historic District, on the eastern slope of the Snake Range, comprises the remains of a tungsten mining operation Alfred Johnson established in 1910. The site is remote, situated at an elevation of nearly 11,000 feet, and is accessible only by a 7.4 mile round-trip hike (which gains more than 2,700 feet in elevation). Included in the site are the ruins of four log cabins; a stamp mill building; a log stable; an earthen dam; roads and trails; and associated landscape features, including a corral, an aerial tramway, a pipeline, and mine entrances. The mine's setting, in a pine/aspen forest surrounded by mountain peaks, is unchanged from the time of its establishment nearly a century ago. While mining activity at Johnson Lake continued sporadically following the end of World War I, it was permanently halted in 1935 after a snow slide damaged much of the infrastructure. The abandoned and deteriorating mine elements are a testament to boom and bust cycles of mining in the American West. Enough of the structures remain to allow visitors to visualize the mining process.

Natural processes and decay threaten the Johnson Lake site. Park staff must regularly cut back limber pines to prevent them from encroaching on the landscape and to decrease fire risk. The park has replaced rotting timber foundations on some structures with rock foundations and stabilized leaning walls and sagging roofs.

A cultural landscape inventory for the Johnson Lake Mine Historic District is currently being written. Additional research regarding the district includes a Park Service Teaching with Historic Places lesson plan, available as an interpretive tool online. Using the plan, students explore how tungsten was mined and used at the turn of the 20th century, as well as learn how archaeologists piece together the past using artifacts and other archaeological evidence.

The Lehman Caves are an important and unique part of the history of recreation at Great Basin National Park. The famous caverns have seen continuous visitor improvements ever since Absalom Lehman placed simple stairs there in 1885. The Civilian Conservation Corps worked there in the 1930s, improving trails, removing graffiti from walls, and creating a new tunnel entrance. In 1941, electrical lighting was installed to emphasize and illuminate cave formations. Stone walls and stairs, minimal paths, and carefully placed light fixtures harken back to the early recreational period of the park. Inscriptions left behind by cave explorers, dating back to 1885, reinforce this quality.

There is no cultural landscapes program at Great Basin and the park does not employ a cultural landscape architect. Instead, the Park Service's Pacific West Regional Office provides expertise and completes projects on an as-needed basis. The park needs cultural landscape inventories and reports, which are used to iden-

BOWERSOX

Visitors can experience the stunning formations within Lehman Caves and learn about the history of cave exploration on guided tours offered throughout the year.

tify and develop specific projects to improve the landscapes, for both the Baker Ranger Station and Lehman Caves. Funding requests have been submitted for preparation of these reports.

HISTORIC STRUCTURES—MAINTENANCE AND PRESERVATION PLANNING NEEDED

Great Basin's 24 historic structures represent the history of the park through physical evidence of mining, tourism, agriculture, and early park administration. Eighteen of the historic structures are in "good" condition; the remaining six are in "fair" condition. Nineteen structures at Great Basin are listed in the National Register of Historic Places, associated with five different sites: Johnson Lake Mine Historic District; Baker Ranger Station; Rhodes Cabin; Lehman Orchard and Aqueduct; and Osceola (East) Ditch. Additional structures include the Young Canyon Stone House, Tilford Spring Cabin, Pole Canyon Safe, Pole Canyon Dugout, and Robison Corral, all associated with agricultural and ranching development. Another important site, Lehman Caves, has not been evaluated for the National Register.

To date, the park has completed two historic structure reports, both for stabilization work at the Johnson Lake Mine site. There are currently no funding requests for additional reports.

Threats to historic structures in the park are primarily natural—hot desert sunshine, heavy snow loads in winter, and encroaching vegetation that increases the risk of fire. No general funding is available for maintenance and upkeep of historic structures; however, the park received funding to repair five historic log buildings, listed in "poor" condition, at the Johnson Lake site, and crews also cut back vegetation there. Vandalism of historic structures has not been an issue at the park, due in part to its

remote location and the low proclivity of backcountry users to vandalize.

The Baker Ranger Station complex includes six structures listed in the National Register: office; barn; warehouse; garage and storeroom; corrals; and paths and driveway. They are representative of the functionally simple structures used by the Forest Service in the Intermountain West. The park's chief of maintenance makes repairs (window repair, roofing repair, and painting, for example) as needed, but the park would like to establish a routine maintenance schedule for the complex, currently in the funding process.

Park staff use several structures at the Baker Ranger Station site. The garage and storeroom were remodeled and updated to serve as a residence for the fire manager, while the warehouse is used to store firefighting equipment and vehicles, and the barn is used for general storage. The office serves as the headquarters of the Great Basin Heritage Area Partnership, a multiagency group.

Located just outside of Lehman Caves, the Rhodes Cabin is the most visited historic structure in the park. Built in the 1920s to provide accommodations for visitors to Lehman Caves National Monument, the cabin was moved from its original location in 1960 and placed on a concrete foundation nearby. Although the move compromised some of its historic integrity, the cabin was placed in the National Register of Historic Places in 1975, due to its association with early tourism at Lehman Caves. Interpretive displays inside the cabin describe its history; this continued use of the structure helps ensure it is regularly maintained and preserved.

Located just east of the Lehman Caves Visitor Center, the Lehman Orchard and Aqueduct was also listed in the National Register in 1975. The orchard is significant for its ties to early agricultural and horticultural development in the Snake Valley, and for its historic association with Absalom Lehman. He settled in the Snake Valley around 1867 and had established a fruit orchard and a dairy by 1875. The seven apricot trees and one peach tree that remain perpetuate heirloom varieties of fruit from the time of early settlers. Three-fourths of the aqueduct, which irrigated the orchard by carrying water 2 miles from Lehman Creek, remain today. Portions of the aqueduct have been reconstructed and are visible along the Mountain View nature trail near the caves. The orchard was dissected by construction of the park road and parking lot in 1947. Park staff, with the guidance of an orchard management plan, actively maintain the orchard.

The Osceola (East) Ditch complex includes the Osceola (East) Ditch, Osceola Ditch Tunnel, and the Stella Lake Rock Dam. The ditch, built in 1889–90, carried water 18 miles from Lehman Creek and its tributaries on the east side of the Snake Range to gold mining operations on the western slope of the Snake Range at Osceola. Though water no longer runs through it, the ditch is still visible and marked in places by rock foundations, deteriorated remnants of wooden flumes, and a 600-foot length of tunnel; it has been adapted to serve as a hiking trail. The Stella Lake Rock Dam was constructed to increase the amount of water stored to supply the ditch during dry seasons.

Great Basin National Park does not employ a full-time historic architect, but relies on specialists at the regional level as needed. Park planning documents do not provide adequate guidance for historic structures protection—Great Basin's 1993 statement for management identified gathering base information on historic sites as an objective, through research and inventory, yet the park's resource management plan, revised in 2000, gives minimal attention to historic structures. The park is currently preparing a cultural resource management plan, and a routine maintenance schedule for the Baker complex is in the funding process. Funds are also needed for historic structure maintenance projects at both the Baker Ranger Station and Johnson Lake Mine sites.

ARCHAEOLOGY—SURVEYS NEEDED TO DOCUMENT RESOURCES SUCH AS CAVES, ROCK ART, AND DENDROGLYPHS

Great Basin National Park is home to archaeological sites ranging from the Paleo-Indian period (12,000–9,000 BC) to the more recent past, including rock art, artifact and lithic (stone) scatters, and cave shelters. Sites from the period of Euro-American settlement are associated with mining activities, ranching and grazing, logging, mapping, and tourism.

At this time, a mere 3 percent of Great Basin has been systematically surveyed to professional archaeological standards. Those areas that have been surveyed are the original Lehman Caves National Monument, the Baker Administration Site, developed campground areas, and most recently (2004–2005), springs in the 1,825-acre Mill Creek watershed. Survey crews discovered undocumented historic and cultural artifacts in the springs examined. A request to fund an archaeological crew for a three-year (2011–2013) continuation of the springs documentation has not yet been funded. The archaeological overview and assessment of Great Basin is outdated (1988), but the park has not requested funding for a new report.

Identified archaeological sites are entered into the Park Service's Archeological Sites Management Information System database annually. To date, 177 sites at Great Basin have been entered. Of these, 147 were listed in "good" condition; 15 were listed in "fair" condition; 11 were listed in "poor" condition; and 4 were listed as "destroyed." Existing archaeological data for the park are also entered into the Integrated Cultural Resources Database developed by the Western Archeological and Conservation Center. The database shows great potential as a user-friendly system of computer files, geographic coordinates, and maps to assist in the management of archaeological resources within the park.

Seventeen known rock art sites in the park include nine petroglyph (art carved into rock), seven pictograph (art painted on rock), and one combined site. Upper Pictograph Cave at Grey Cliffs is the primary rock art site the park interprets. The Fremont people who inhabited the area between 1000 and 1300 AD probably painted the drawings at Grey Cliffs. Seventy-six different symbols on 23 panels, painted in red pigment, decorate rock walls inside and outside the cave. These symbols include trapezoidal human-shaped forms that depict Fremont kachinas and animal forms and graphics, such as abstract dots and lines.

Rock art sites are vulnerable to degradation by natural causes. Surface deposits build up on paintings, which fade each time they are cleaned; the rock substrate itself is also subject to gradual erosion. Natural threats are difficult to mitigate, adding urgency to the need to fully document all known sites in the park. Fire damage is another concern. Although funding has not been available to thin and prune vegetation specifically for the protection of archaeological sites, natural resource managers have devoted portions of their fire-control funds to reduce the risk of fire around Grey Cliffs. Additionally, the park has requested funding to

The Baker Ranger Station complex, which dates to the 1930s, served as a base for the U.S. Forest Service. This agency administered the area before Great Basin National Park was created.

MICHAEL TIMMONS

identify rock art sites for fire management and appropriate protection procedures.

Visitor use may also threaten the park's rock art. Some use Pictograph Cave as an outdoor bathroom, while others draw or etch new symbols at the Baker Creek cave and rock shelter sites, or deliberately scratch at the pictographs there. Small signs have been placed near the Baker Creek cave and rock shelter sites, asking visitors not to enter, but a trail counter installed in the area recorded at least 250 unauthorized entries in 1998. The park has issued citations to individuals found in the sites, but only as the result of chance encounters with violators. While currently there is a lack of law enforcement guidance to protect these sites, an Archaeological Resources Protection Act plan is currently being developed at the Park Service's Pacific West Regional Office. To aid this planning, the park will prepare a report on the condition of known archaeological sites in the park in 2009.

The park has proposed archaeological documentation of Lehman Caves to record human modifications to the caves since their discovery. This project would include mapping of early improvements made in the 19th century and during the Civilian Conservation Corps era of the 1930s. Photographic documentation of name inscriptions dating back to 1885 would also be included. Because of the natural process of water seepage, mineral deposits in the caves are obscuring these inscriptions; documentation should be conducted as soon as possible, before the writing is completely concealed. The park is still waiting for funds for this project.

Carvings on aspen trees (dendroglyphs), left behind by Basque, Peruvian, and Scandanavian sheepherders, are visible in parts of the park. Threats to these resources include fire and natural death of the aspen, a tree with an average life span of 50 to 70 years. Park staff are engaged in efforts to document the dendroglyphs with photography. In 2006, Great Basin received a small emergency grant for dendroglyph documentation in the Strawberry Creek watershed. A more extensive three-year survey of aspen stands in all 23 watersheds of the park has been proposed, and is scheduled for funding in 2010. Due to natural death of the trees, survey and documentation is paramount to preserve the cultural history these trees record.

No funding currently exists for a permanent archaeologist in the park, though a term archaeologist is currently on staff. With this position, the capacity for assessment and documentation of archaeological sites has increased; in fact, site condition assessments for all archaeological sites were completed in 2008. This term position will be made permanent in 2010 through an increase in the park's base funding.

MUSEUM COLLECTION AND ARCHIVES—STORAGE INADEQUATE, COLLECTIONS UNCATALOGED

Museum and archival collections at Great Basin include 155,359 items, which are housed both at the park and off-site. The primary repository for the park's prehistoric artifacts is the Western Archeological and Conservation Center in Tucson, Arizona.

Museum items housed at the park are stored in a 475-square-foot modular building. The park has requested funding to purchase new shelving and storage cases for the collections. The *Checklist for the Preservation and Protection of Museum Collections*, a tool to measure a park's conditions against Park Service standards for museum collection storage, protection, and management, was last completed in 2007; all items were accounted for, but only 60 percent of the checklist standards were met, mostly due to deficiencies in storage conditions.

As most of the collection is located off-site, the park does not employ a museum curator but has access to curators within the Park Service's Mojave Network (six regional park units that share expertise) and at the regional level. At this time, they are the park's only

sources for curatorial assistance and park staff consult them as needed. Because the park lacks any on-site staff to enter new data into the Automated National Catalog System, a systemwide database of collections information, staff are discouraged from bringing in any new artifacts discovered at Great Basin. The addition of an archival/museum technician would allow the park to catalog newly discovered and existing items in a timely fashion, as well as provide better care for the irreplaceable collections, but funding requests for this position were submitted and declined. In total, 60 percent of the Great Basin museum and archival collections remain uncataloged.

When Great Basin hired its first cultural resources manager in December 2003, the park archives were in disarray. Since that time, staff at the Western Archeological and Conservation Center have been processing the archival collection, and while the backlog remains significant, progress has been made. In 2007, 15,415 archival items were cataloged, significantly reducing the park's backlog percentage.

A 1998 survey of collection users found that researchers wanted better access to Great Basin artifacts, through a finding aid and improved computer and online databases. Researchers may view museum and archival collections stored at the park under supervision, but in most cases, researchers go to the Western Archeological and Conservation Center to conduct Great Basin research.

In 2005, the park opened a visitor center in Baker, Nevada; support from the Great Basin National Park Foundation made this facility possible. It features exhibits, an informative film, and opportunities to interact with rangers and to purchase educational items. Items from the natural history collections that describe major habitats, threatened species, global climate change, glacial geology, and bristlecone pines are part of visitor center displays. Cultural history items displayed represent American Indians, frontier settlement, ranching and agriculture, and mining history. In addition, there is a new exhibit currently being installed that will contain a timeline describing more than 12,000 years of human habitation in the Great Basin, including occupation and use by Paleo-Indian, Fremont, Shoshone, and Paiute peoples, as well as by miners and ranchers. The display includes three-dimensional representations of historic structures such as pithouses, wickiups, log cabins, and sheepherder camps; pictographs, petroglyphs, and dendroglyphs will also be displayed. When the Baker visitor center opened, the former visitor center near the entrance to Lehman Caves was redesigned to focus interpretation on the caverns, and cave-related artifacts are featured in exhibits there.

The park's current museum management plan was written in 1999 and staff acknowledge that it is too outdated to be useful. The Scope of Collection Statement, reviewed in 2005, guides management of the museum and archival objects.

There are a number of funding requests in place to improve the protection of the park's museum and archival collections. The park has requested funding for new shelves, cases, and appropriate containers to alleviate deficiencies in storage space, as well as funding for managing museum collections in order to make them more accessible for scholarly research, which would include the digitization of all park museum records. The park has also requested funding to develop a museum emergency response plan and a new museum management plan for both the museum and library collections.

ETHNOGRAPHY (PEOPLE AND CULTURES)—GREAT BASIN NATIONAL HERITAGE ROUTE DESIGNATED

Before Great Basin was established as a national park, many groups of people lived on and used the resources of the land, including Paleo-Indians, Great Basin Desert Archaic peoples, and the Fremont. At the time of contact with

Euro-Americans, the Western Shoshone inhabited the immediate area around Great Basin, while some members of the Southern Paiute tribe occupied areas to the south.

The Shoshone lifestyle persisted until the 1870s, when increased Euro-American settlement led to economies based on farming, ranching, and mining. In 1875, conflict escalated into what was referred to locally as the "White Pine War." The incident drove some 160 native Shoshone northward to Deep Creek from where they had assembled at Absalom Lehman's ranch. Gathering others along the way, the drive through the Snake and Spring Valleys virtually depleted the area of its American Indian population. Later census figures showed that small numbers of Shoshone/Goshutes (inhabitants of Spring Valley) had returned to the Baker area and lived there into the 1930s.

The park consults regularly with six affiliated tribes, including the Ely Shoshone of Nevada, the Kaibab Paiute of Arizona, the Southern Paiute Tribe of Utah, the Indian Peaks Band of the Southern Paiute of Utah, the Skull Valley Goshute, and the Confederated Tribes of the Goshute Reservation of Utah. In 1998, the park worked with these groups as well as others to successfully repatriate the remains of 21 individuals—determined to be of American Indian ancestry from the Shoshonean occupancy period—discovered in Lehman Caves. The remains were reinterred in accordance with the wishes of tribal leaders.

In addition to native peoples, other traditional users associated with Great Basin include ranchers and sheepherders. Relationships with these groups are strong. Fourth- and fifth-generation descendants of ranching families historically affiliated with the area have been instrumental in developing the Great Basin National Heritage Route—one of 40 congressionally established national heritage designations—in which conservation, interpretation, and other activities are managed by partnerships among federal, state, and local governments and the private sector.

Ethnographic resources at Great Basin are interpreted through evening programs with rangers, exhibits in the museum and at waysides, and through literature from the visitor center bookstore. A new exhibit in the Baker visitor center displays reproduction prehistoric artifacts. Traditional activities such as annual harvests of nuts from pinyon pine trees continue in the park today. Gathered in September, these nuts provided one of the most significant food resources for ancient peoples of the Great Basin. Members of the Ely Shoshone Tribe, as well as other visitors, gather the nuts each year.

Great Basin National Park needs an ethnographic overview and assessment to begin baseline documentation of ethnographic resources and guide future planning and protection efforts. The park's draft cultural resources management plan acknowledges that existing knowledge of ethnographic resources within and surrounding area of the park is lacking. Because there are no ethnographic studies in place for Great Basin, the park's planning does not adequately address ethnographic resources. With sufficient funds and other support, the park would have the potential to expand its ethnography program.

U.S. GEOLOGICAL SURVEY

Some of the park's aspen trees bear carvings left behind by sheepherders. The park is engaged in efforts to document these dendroglyphs. A three-year survey of aspen stands in all 23 watersheds of the park is scheduled for funding in 2010.

ALANA DIMMICK

Ranger-led interpretive programs are a popular way to learn more about park history and resources. The park needs two more permanent interpretive staff and three more seasonal staff to expand its visitor services and reach more visitors.

STEWARDSHIP CAPACITY—

FUNDING AND STAFFING—RESOURCE PROTECTION THREATENED BY LACK OF FUNDING, AND PERSONNEL

Stewardship capacity explores how well equipped the Park Service is to protect the parks. The most significant factor affecting a park's ability to protect its resources is the funding it receives from Congress and the administration. The net budget for Great Basin National Park was $2.45 million in 2008.

Cultural resource projects at Great Basin are funded using "soft money," generated by submitting project proposals through the Park Service's Project Management Information System process. Of the regular park budget, the only funding for cultural resources other than routine maintenance is the salary of the cultural resources manager.

Certain activities related to natural and cultural resources—considered to be of high importance by the park—cannot currently be conducted, due to staffing and funding shortfalls. These activities include development of an active cave management program for the park's more than 45 wild caves, general park geospatial analysis, and sufficient backcountry patrols.

Although funds from the Natural Resource Challenge, a Park Service program, allowed the

park to increase its natural resources staff from one full-time permanent employee and two part-time employees to five full-time permanent employees, key positions still remain vacant at Great Basin. These include cave management specialist, hydrologist, and geographic information systems (GIS) analyst. Other vacant positions include purchasing agent and protection specialist (ranger) positions. The park also requires additional administrative support for interpretation, protection, and resource management. Due to the lack of a cave management specialist, the park is unable to monitor impacts from visitors, nor is it able to complete and implement a cave management plan. Without a GIS analyst, spatial analysis for all divisions (resource, protection, and maintenance) remains undone. Also due to vacancies, the functions of the two protection specialist (ranger) positions—minus safety officer duties—have been passed on to the park's chief ranger. This includes direct supervision of field staff, serving as emergency medical services coordinator, structural fire coordinator, and law enforcement specialist/training officer. This limits the number of projects the chief ranger can complete, due to increased responsibilities and workload.

Park managers would like to be able to provide more campground talks and extended visitor center hours, but with only about ten full-time equivalent interpretive staff, the park is unable to increase the level of visitor services offered. An additional two permanent interpretive staff and three seasonal staff would allow the park to expand its visitor services.

PLANNING—EXISTING PLANS NEED UPDATING, WHILE ADDITIONAL PLANS ARE UNDER WAY

Great Basin's general management plan, which ensures that the park has a clearly defined direction for resource preservation and visitor use, was written in 1992 and has been scheduled for an update. Great Basin is on the list to adopt the Park Service's new format, the resource stewardship strategy (which will replace resource management plans), in 2011. Great Basin also

U.S. GEOLOGICAL SURVEY

The Lehman Caves include rare shield features such as those shown here. Because the park lacks a cave management specialist, it cannot monitor impacts to caves from visitors, and it is unable to complete and implement a cave management plan.

MICHAEL TIMMONS

A covered kiosk at Wheeler Peak provides park information to visitors.

has a current strategic management plan that focuses on the park's capability to set and meet long-term goals through a resource assessment of its fiscal and human resources. According to Park Service policy, however, although it shares some elements in common with a general management plan, a strategic plan is not a substitute for a general management plan, due to its lack of comprehensive resource analysis, consultation, and compliance.

Other plans park staff use include a grazing management plan for sheep (1988), water resources management plan (1994), fisheries management plan (2000), aquatic monitoring plan (2002), and fire management plan (2005).

Additional plans are in progress at Great Basin. The park is developing a draft vegetation management plan, which would deal with issues such as non-native species control. Other plans in progress include a bighorn sheep management plan, sensitive wildlife small mammal management plan, water quality management plan, abandoned mine reclamation plan, and integrated pest management plan.

RESOURCE EDUCATION AND OUTREACH—NEW VISITOR CENTER WELCOMES AND INFORMS

The first stop for most guests to Great Basin National Park is its new visitor center, located on an 80-acre administrative site in the nearby town of Baker. Because it is a popular starting point for visitors, the facility plays an important role in education and outreach. Here, visitors can view exhibits, watch an informative film, purchase media on various topics, and interact with park rangers. The park also operates a second visitor center at the entrance to Lehman Caves; this facility is devoted to education and interpretation of cave features and history.

In addition to a stop at a visitor center, guests have other opportunities to learn about park resources. Twice a year, Great Basin publishes *The Midden*, a resource management newsletter available within the park, online, and by written request. Park staff provide guided tours of Lehman Caves all year (except on Thanksgiving, Christmas, and New Year's Day), and rangers provide evening programs in the summer months. In addition, the park's Sky Islands Forest Trail meets wheelchair accessibility standards, allowing those with disabilities to experience a trail in the park; handicapped accessible campsites are also available.

In 2006, Great Basin National Park reached 92,816 visitors through its visitor centers and a variety of interpretive programs, educational programs, and special events. This exceeds the park's annual visitation because some visitors tour both visitor centers as well as participate in programs. As mentioned on page 33 of the "Funding and Staffing" section, the park needs additional permanent and seasonal interpreters to allow for expanded visitor services, including more interpretive programs.

Staff at Great Basin National Park participate in outreach with the surrounding community through emergency medical services, fire response, and providing a venue for group meetings.

EXTERNAL SUPPORT—PARTNERSHIPS AND VOLUNTEERS PROVIDE NEEDED SERVICES

Great Basin National Park has partnered with various organizations in its resource monitoring and management efforts, allowing park managers to meet goals with limited staff and funding. These partners include the Great Basin National Park Foundation, a nonprofit organization formed to promote and support projects that enhance the values of Great Basin National Park. Formed in 1998, the foundation was instrumental in obtaining funds for designing and constructing the $4 million visitor center near Baker.

Trout Unlimited has been one of the strongest supporting membership organizations of Great Basin National Park. In addition, the Desert Research Institute, a part of the Nevada System of Higher Education with nearly 500 researchers, staff, and students, conducts research around the world, including at Great Basin National Park. The park has also benefited from a relationship with the Great Basin Bird Observatory, which has conducted bird surveys and research. Recently, the Southern Nevada Grotto, a nonprofit caving organization based in Las Vegas, provided 200 hours of volunteer time to conduct a survey of Lehman Caves to produce a much-needed updated cave map. The Student Conservation Association regularly provides volunteers that donate hundreds of hours of service every year to Great Basin. The Nevada Conservation Corps has provided funding for trails.

Because of its remote location, the park has fewer volunteers than larger, more accessible national parks, but Great Basin's volunteer workforce is no less dedicated. In 2007, volunteers donated 8,862 hours, maintaining trails, assisting with research, and staffing the information desk. The park's fee supervisor coordinates volunteer activities.

WHAT YOU CAN DO TO HELP:

- **Participate in park planning efforts.** The public is invited to provide input on all park plans and studies. Check www.nps.gov/grba for information on Great Basin planning work and ways to participate.
- **Support or become a member of a group helping to protect the park,** such as Great Basin National Park Foundation (www.greatbasinfoundation.org), NPCA (www.npca.org/support_npca), and other regional organizations.
- **Volunteer.** Great Basin is looking for dedicated people who can lend a helping hand. To learn about opportunities, contact the park's volunteer coordinator at 775.234.7331, extension 213.
- **Become an NPCA activist and learn about legislative initiatives and protection projects affecting parks.** When you join our activist network, you will receive Park Lines, a monthly electronic newsletter with the latest park news and ways you can help. Join by visiting www.npca.org/takeaction.

ALANA DIMMICK

The Sky Islands Forest Trail is a wheelchair accessible route featuring interpretive signs that describe the surrounding high alpine conifer forest.

APPENDIX: METHODOLOGY

To determine the condition of known natural and cultural resources at Great Basin National Park and other national parks, the National Parks Conservation Association developed a resource assessment and ratings process. The assessment methodology can be found online at NPCA's Center for State of the Parks website: www.npca.org/stateoftheparks.

Researchers gather available information from a variety of sources in a number of critical categories. The natural resources rating reflects assessment of more than 120 discrete elements associated with environmental quality, biotic health, and ecosystem integrity. Environmental quality and biotic health measures address air, water, soils, and climatic change conditions as well as their influences and human-related influences on plants and animals. Ecosystems measures address the extent, species composition, and interrelationships of organisms with each other and the physical environment.

The scores for cultural resources are determined based on the results of indicator questions that reflect the National Park Service's own *Cultural Resource Management Guideline* and other Park Service resource management policies.

Stewardship capacity refers to the Park Service's ability to protect park resources, and includes discussion of funding and staffing levels, park planning documents, resource education, and external support.

For this report, researchers collected data and prepared technical documents that summarized the results. The technical documents were used to construct this report, which was reviewed by staff at Great Basin National Park prior to publication.

NPCA's Center for State of the Parks represents the first time that such assessments have been undertaken for units of the National Park System. Comments on the program's methods are welcome.

KELLY COURKAMP

Remotely located, visitation to Great Basin National Park generally ranges from 69,000 to 90,000 people each year. Visitors experience the park's dramatic landscapes and dark skies, and learn about the region's human history.

ACKNOWLEDGMENTS

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OTHER REPORTS AVAILABLE

Adams National Historical Park (MA)
Andersonville National Historic Site (GA)
Andrew Johnson National Historic Site (TN)
Apostle Islands National Lakeshore (WI)
Appomattox Court House National Historical Park (VA)
Assateague Island National Seashore (MD, VA)
Big Bend National Park (TX)
Big Hole National Battlefield (MT)
Big Thicket National Preserve (TX)
Biscayne National Park (FL)
Bryce Canyon National Park (UT)
Cabrillo National Monument (CA)
Canyonlands National Park (UT)
Catoctin Mountain Park (MD)
Channel Islands National Park (CA)
Charles Pinckney National Historic Site (SC)
Chesapeake and Ohio Canal National Historical Park (DC/MD/WV)
Death Valley National Park (CA)
Denali National Park and Preserve (AK)
Fort Laramie National Historic Site (WY)
Fort Necessity National Battlefield (PA)
Fort Pulaski National Monument (GA)
Fort Sumter National Monument (SC)
Fort Union Trading Post National Historic Site (ND)
Frederick Douglass National Historic Site (DC)
Gateway National Recreation Area (NY)
Glacier Bay National Park and Preserve (AK)
Great Smoky Mountains National Park (TN/NC)
Harpers Ferry National Historical Park (WV)
Hawai'i Volcanoes National Park
Hopewell Furnace National Historic Site (PA)
Indiana Dunes National Lakeshore (IN)
Isle Royale National Park (MI)
Joshua Tree National Park (CA)
Keweenaw National Historical Park (MI)
Knife River Indian Villages National Historic Site (ND)
Lewis and Clark National Historical Park (OR)
Lewis and Clark National Historic Trail (various)
Little Bighorn Battlefield National Monument (MT)
Longfellow National Historic Site (MA)
Missouri National Recreational River (NE)
Mojave National Preserve (CA)
Nez Perce National Historical Park (WA, ID, MT, OR)
Olympic National Park (WA)
Pictured Rocks National Lakeshore (MI)
Point Reyes National Seashore (CA)
Redwood National and State Parks (CA)
Rocky Mountain National Park (CO)
Saint-Gaudens National Historic Site (NH)
San Juan Island National Historical Park (WA)
Santa Monica Mountains National Recreation Area (CA)
Shenandoah National Park (VA)
San Antonio Missions National Historical Park (TX)
Sleeping Bear Dunes National Lakeshore (MI)
Vicksburg National Military Park (MS)
Virgin Islands National Park
Virgin Islands Coral Reef National Monument
Waterton-Glacier International Peace Park (MT-Alberta)
Zion National Park (UT)

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