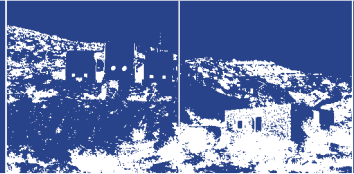


STATE
♦ OF THE ♦
PARKS®

november 2003

BIG BEND NATIONAL PARK

A Resource Assessment



NATIONAL PARKS CONSERVATION ASSOCIATION





Big Bend National Park preserves a portion of the Chihuahuan Desert, an ecosystem that goes largely unprotected in Texas and Mexico. The park encompasses shrublands, grasslands, high-elevation woodlands, and riparian areas.

Cover Photo: Lawrence Parent

STATE OF THE PARKS® Program

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. Only 10 percent of the National Park Service's budget is earmarked for natural resources management, and less than 6 percent is targeted for cultural resources management. In most years, only about 7 percent of permanent park employees work in jobs directly related to park resource preservation. One consequence of the funding challenges: two-thirds of historic structures across the National Park System are in serious need of repair and maintenance.

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 policy-makers, 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.

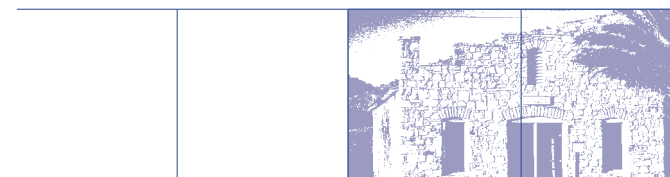
For more information about the methodology and research used in preparing this report and to learn more about the State of the Parks® program, visit www.npca.org/stateoftheparks or contact: NPCA, State of the Parks® program, P.O. Box 737, Fort Collins, CO 80522; Phone: 970.493.2545; E-mail: stateoftheparks@npca.org.

The National Parks Conservation Association, established in 1919, is America's only private, nonprofit advocacy organization dedicated solely to protecting, preserving, and enhancing the U.S. National Park System for present and future generations by identifying problems and generating support to resolve them.

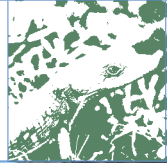
- * Nearly 300,000 members
- * 7 regional offices
- * 32,000 local activists



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REPORT SUMMARY



Melissa Powell

Kayaking is a popular activity in the park. However, reduced flows in the Rio Grande can compromise river recreation and affect species that depend on the river for survival.

DESERT LANDSCAPE AND HISTORY AT RISK
Big Bend National Park was created in 1944 to preserve a portion of the Chihuahuan Desert, an ecosystem that otherwise goes largely unprotected in Texas and Mexico. The park features broad expanses of Chihuahuan Desert shrubland and grassland interspersed with smaller areas of high-elevation woodland in the Chisos Mountains, near

the center of the park. Riparian and wetland areas hugging the Rio Grande and associated with springs throughout the park represent geographically small but ecologically valuable contributions to the park, while deep canyons along the river are among the park's most striking features.

The black bear (*Ursus americanus*), mountain lion (*Felis concolor*), and javelina (*Peccary angula-*

tus), along with bats, turtles, frogs, toads, and 450 species of birds, either reside in the park or use park resources. The area's rich and varied human history is clearly evident through widespread archaeological and historical sites.

Big Bend may appear pristine, but historical land uses have caused extirpation of several native species, considerable soil erosion, and a general decline in the condition of both natural and cultural resources. Insufficient funds prevent the Park Service from hiring staff needed to preserve historic structures, archival documents, and other cultural resources. Air and water pollution stemming from outside the park and ever-growing demands for water from the Rio Grande are seriously degrading visibility and water resources within the park. The results? Diminished visitor experiences and widespread effects on all species that rely on the river for survival.

STATE OF THE PARKS® ASSESSMENT

In this report, the National Parks Conservation Association (NPCA) incorporates findings from an assessment by its State of the Parks® program to describe the current condition of Big Bend National Park's natural and cultural resources and many of the stewardship challenges ahead.

In the chart on the following page, up arrows indicate conditions will likely improve over the next ten years, down arrows indicate conditions will likely deteriorate during that time, and flat arrows indicate no change is likely.

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 natural and human influences over long periods of time, in many cases, before a park was established. The intent of the State of the Parks® program is to document the current status of park resources and determine which actions can be taken to protect them into the future.

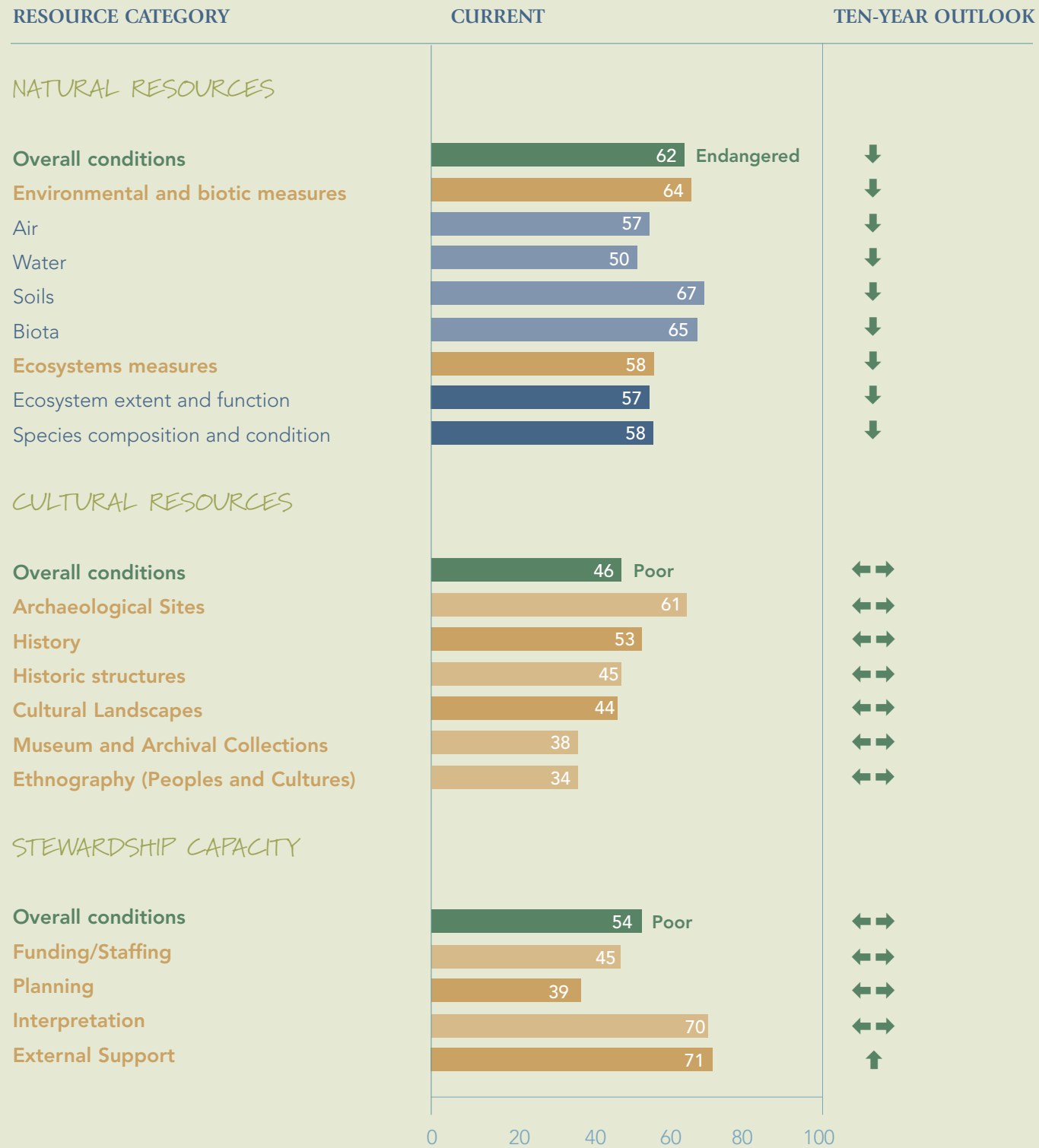
BIG BEND AT A GLANCE

- Big Bend National Park protects more than 801,000 acres of Chihuahuan Desert landscape, recognized by the World Wildlife Fund for its rich biodiversity. Big Bend and nearby protected areas comprise the largest block of protected land in the Chihuahuan Desert.
- Federally threatened and endangered animal and plant species find refuge in the park, including the black-capped vireo, Big Bend mosquitofish, Mexican long-nosed bat, Chisos Mountain hedgehog cactus, Lloyd's mariposa cactus, and cory cactus.
- Big Bend boasts a rich history: Mescalero Apaches and Comanches roamed the lands in bygone times, and over the past 500 years, six different nations—Spain, France, Mexico, Republic of Texas, Confederate States of America, and the United States of America—have claimed parklands as their own and have left behind rich archaeological evidence.
- Scores of sites in the park are potentially eligible for the National Register of Historic Places. Big Bend also contains seven historic districts and at least 19 distinct cultural landscapes.

KEY CHALLENGES

- The once-wild Rio Grande, forming 118 miles of the border between the park and Mexico, is seriously degraded by upstream diversion of its waters and by pollution on both sides.
- Emissions from coal-fired power plants and other industrial sources in the United States and Mexico have dramatically diminished air quality and visibility at the park.
- Big Bend harbors 1,465 recorded archaeological sites, but only 3 percent of the park has been intensively surveyed. It is estimated that 10,000 to 20,000 archaeological sites actually exist in the park.
- While numerous historic structures and ruins in the park testify to the area's former residents, the Park Service lacks the resources needed to document the condition of these structures. Funding and staffing shortfalls have allowed a number of these nationally significant structures to fall into disrepair.
- The park faces an acute shortage of financial and staff resources required to carry out complex resource protection and visitor services responsibilities. Big Bend's 2000 Business Plan identifies an annual operational funding shortfall of \$6.1 million and the need for about 70 additional full-time equivalent staff members.

Note: The assessment methodology for natural resources includes evaluation of more than 120 discrete elements for which information is not always available. The extent to which data requirements for the assessment methodology are met is called information adequacy and provides a basis for interpreting the ratings. Information adequacies for the assessment categories of Environmental and Biotic Measures, Ecosystems Measures, and Overall were fair to good for the park at 63, 82, and 71, respectively.



RATINGS

Current overall conditions of Big Bend’s known **natural resources** rated 62 out of 100. Ratings were assigned through an evaluation of park research and monitoring data (see appendix). Reduced flows and degraded water quality in the Rio Grande, as well as air pollution and resulting acid deposition, are major factors contributing to the park’s poor natural resource rating and negative ten-year outlook.

Increasing human populations throughout the Rio Grande watershed are placing unprecedented demands on the river’s water, causing a dramatically reduced flow from historical levels. Agricultural runoff and industrial and municipal wastes are degrading the quality of the water. Some of the industrial sources that pollute the Rio Grande also contribute to air pollution at the park, but the most significant sources of air pollution are power plants located far from the park. The pollutants—deposited on the landscape to the detriment of the park’s natural resources—decrease visibility, obscure scenic vistas, and impact soil quality.

Cultural resources at Big Bend rated 46 out of 100. The park currently has only one cultural resources specialist; additional cultural resources staff are needed to care for the park’s museum and archival collections, historic structures, and archaeological sites and to complete historical and ethnographic research. Just 3 percent of the park has been surveyed for archaeological sites, many historic structures are in disrepair, and the majority of archival items have not been catalogued—the result of funding and staffing shortfalls.

Big Bend’s current overall **stewardship capacity**—the Park Service’s ability to protect park resources—rated 54 out of a possible 100. This score reflects both inadequate funding for staff, planning, and interpretation and relatively high scores for the park’s partnerships and external public support. Big Bend is sorely in need of funding for critical staff positions to better protect its natural and cultural resources.



More than 50 species of reptiles are found in Big Bend, including snakes, turtles, and lizards.

BIG BEND IS SORELY IN NEED OF FUNDING FOR CRITICAL STAFF POSITIONS TO BETTER PROTECT ITS NATURAL AND CULTURAL RESOURCES.

KEY RECOMMENDATIONS

NPCA believes it is essential that the National Park Service, Big Bend partners, and local supporters join with decision-makers and legislators to overcome funding and staffing shortfalls at the park and address widespread air and water quality issues. To help ensure that the goal of resource protection is achieved, efforts must be directed at the following priorities:

Natural Resources

- Congress and the state of Texas should aggressively enforce existing air quality regulations and immediately act to reduce sulfate, nitrate, and particulate emissions from regional U.S. power plants.
- Congress and the state of Texas should urgently mandate and fund a comprehensive regional examination of the Rio Grande watershed to determine flow diversions, consumption, point-source pollution, and irrigation return flow quantity and quality and develop measures to increase overall flow and water quality in the Rio Grande.
- A joint U.S.–Mexico International Commission should be established to formulate working agreements and plans to address restoration of the integrity of the Rio Grande and its tributaries, improve regional air quality, control or eradicate invasive non-native species, and establish trans-border cooperation for natural resources protection. The commission should also capitalize on the successful past and ongoing cooperative programs for natural resource protection, particularly the Sister Parks work plans. The principal goal of the commission should be to develop a plan to establish an International Park to better protect natural and cultural resources, encourage environmentally sound economic development, and institute cooperative border control in the park.
- The Park Service should conduct a comprehensive natural resource inventory of all plant and animal species.
- The Park Service should formulate and implement a comprehensive monitoring plan to examine and document the effects of nitrate and sulfate deposition from atmospheric pollution on Big Bend's natural systems, especially soils, waters, and sensitive biota.



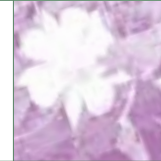
Cultural Resources

Congress should:

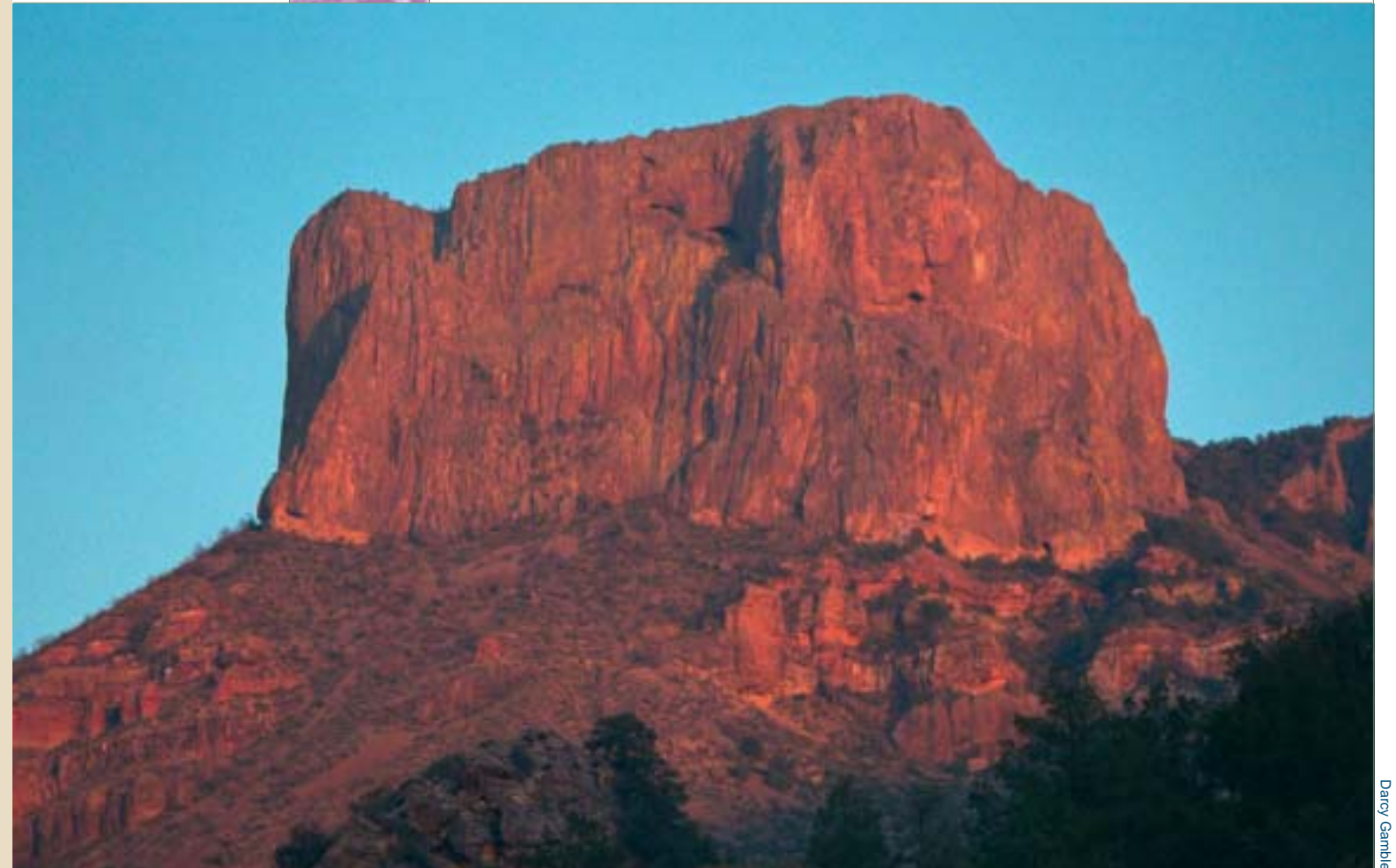
- Allocate funds for the construction of a research center and a new museum and archive storage facility.
- Increase park operations funding so that additional cultural resources staff can be hired (see Stewardship Capacity recommendations for details).
- Fund both a site sampling survey to gather information on archaeological sites throughout the park and an effort to complete the park's Archaeological Overview and Assessment.
- Provide funds to hire a research project coordinator who would be responsible for developing research partnerships with local universities to gather cultural resources information. The park's historical research needs are well suited to graduate student projects.

Stewardship Capacity

- Congress must increase park funding to support the following critical staff positions: museum curator, archaeological technician, wildlife technician, research coordinator, hydrology technician, historic preservation specialists, and biological technicians. Additional backcountry rangers in law enforcement are also needed to deal with illegal border crossings and resulting resource damage.
- Congress must appropriate funding for Big Bend to complete important resource management plans, specifically the Archaeological Overview and Assessment, an Ethnographic Overview and Assessment, a Comprehensive Interpretation Plan, and a Vegetation Management Plan.
- Additional funds must be appropriated for the volunteer program to help cover expenses and support the construction of additional volunteer housing.



GEM OF THE CHIHUAHUAN DESERT



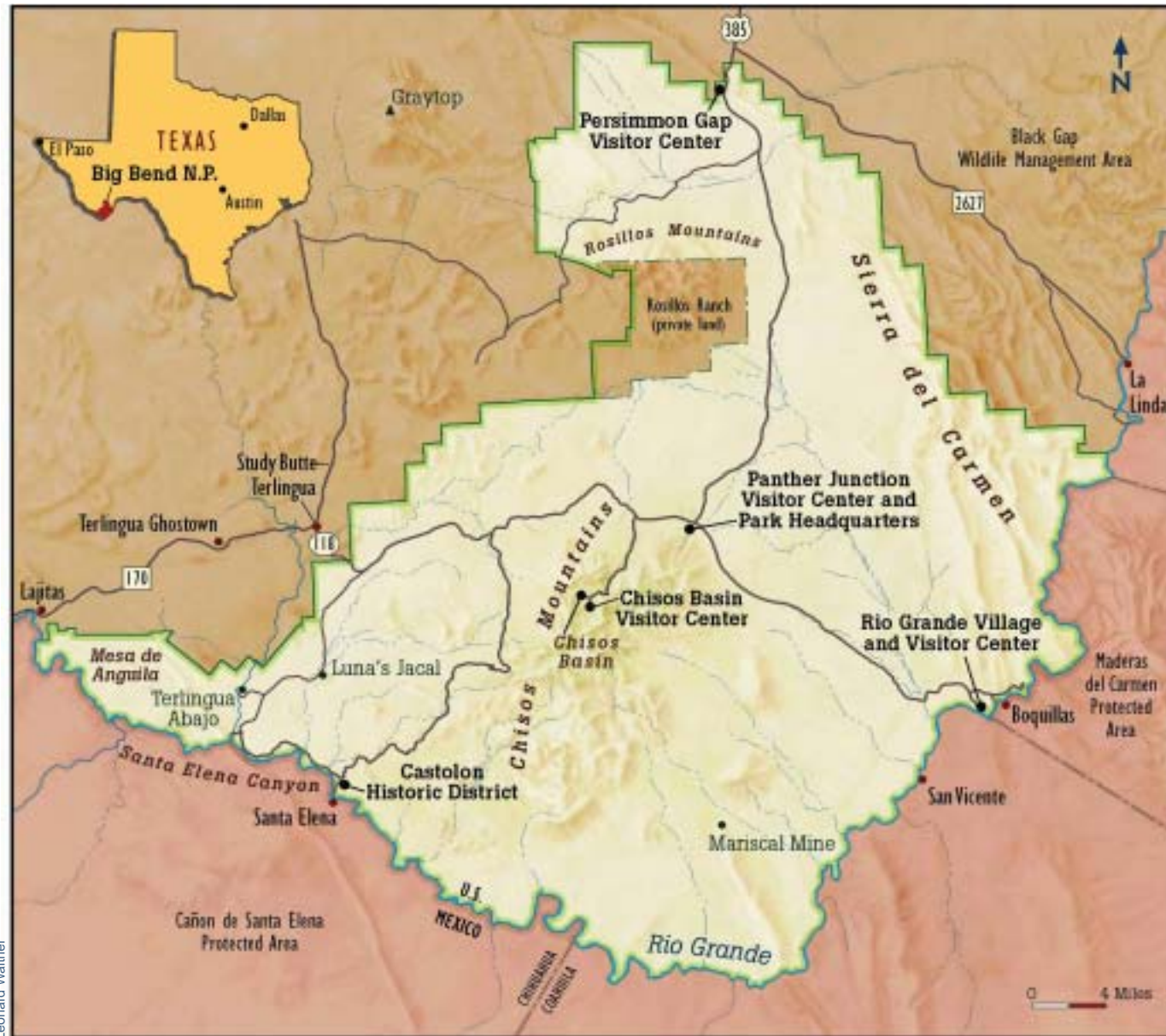
Sunset highlights Casa Grande Peak in center of park.

From rugged 7,800-foot Chisos Mountain peaks to delicate blooms of the Chisos Mountain hedgehog cactus (*Echinocereus chisoensis*) on the desert floor, Big Bend National Park is a land of extremes. Temperatures in excess of 100 degrees Fahrenheit are common in summer; temperatures below freezing are not uncommon in winter.

The Big Bend region, which is rich in natural and cultural resources, is named for the way the Rio Grande changes course from a southeasterly flow to make a long, sweeping bend to the north.

Located deep in western Texas along the Mexican border, the remoteness of the park and its high summer temperatures make Big Bend one of the least discovered of all U.S. national parks. The eighth largest park in the lower 48 states at more than 801,000 acres, it attracts an average of 308,000 visitors a year—somewhat higher in 2001 and 2002 at nearly 330,000 people but still significantly short of the millions of visitors who flock to parks such as Yellowstone, Yosemite, and Great Smoky Mountains. Some might view the remoteness of the park as a drawback, but it is this isolat-

BIG BEND NATIONAL PARK



ed quality that gives the park a superlative natural quiet and dark night skies.

Visitors are rewarded with a stunning sampling of Chihuahuan Desert landscape—shrublands, grasslands, high-elevation woodlands, riparian and wetland areas along the Rio Grande and more than 350 springs. Noted by the World Wildlife Fund as a place of globally outstanding biodiversity, Big Bend provides varied habitat for 78 mammal species, 56 different reptiles, 11 different amphibians, 165 but-

terfly species, and more than 1,300 species of vascular plants.

Impressively, 450 species of birds frequent the park, earning Big Bend designation as a Globally Important Bird Area by the American Bird Conservancy. Visitors may well enjoy sightings of the peregrine falcon (*Falco peregrinus anatum*) or federally endangered black-capped vireo (*Vireo atricapillus*).

For 10,000 years, American Indians, early

explorers, miners, ranchers, and farmers have inhabited the Big Bend region. Archaeological sites and historic structures throughout the park bring to life past cultures and contribute significantly to historical research, including studies of Hispanic farmers and soldiers sent to maintain peace during border unrest in the early 1900s. Mariscal Mine, once the source of one quarter of this nation's mercury, stands as a reminder of quests for mineral wealth.

Established in 1944, Big Bend National Park was set aside to protect the natural and cultural features of an area high in biodiversity and rich in human history. Unfortunately, many of the park's resources are now highly threatened by water and air pollution and insufficient funding and staffing.

ELEVATION AND PRECIPITATION SHAPE THE LANDSCAPE

Big Bend is a land of varied topography—from its lowest elevation of 1,690 feet along the Rio Grande to the “sky islands” of the Chisos Mountains, rising near the middle of the park to 7,825 feet. Receiving more precipitation than the surrounding desert, the Chisos peaks support small forests, home to plant and animal species that cannot survive in the park's lower, drier desert climate. The Rosillos Mountains, Mesa de Anguila, and Sierra del Carmen also lend topographical relief to the desert landscape.

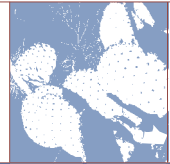
Precipitation levels rise along with the topography, creating several vegetation zones. Shrub desert, laying claim to nearly half of the park's acreage, is a low elevation, mostly arid community made up of shrubs, cacti, and succulents that are widely spaced, often with little or no understory. Averaging less than ten inches of annual precipitation, shrub desert supports low-water plants such as creosotebush (*Larrea tridentate*), yucca (*Yucca* spp.), ocotillo (*Fouquieria splendens*), lechuguilla (*Agave lechuguilla*), and numerous cacti. This vegetation zone is large and essentially unfragmented, occurring in one contiguous block and surrounding a large section of higher-elevation grasslands

and woodlands in the middle of the park.

As elevation and precipitation levels increase nearer the Chisos Mountains, shrub desert gives way to sotol grassland, named after one of its characteristic plants, the sotol (*Dasyliirion* spp.). These grasslands, ringing the higher elevation woodlands, were harvested over decades as hay for livestock, up to the time the park was established. Research shows that sotol grassland was overgrazed, resulting in changes in plant community structure and greatly reduced productivity. Self-restoration is compromised by soil compaction, coupled with the extreme desert climate. The effects of ranching also include water diversions and stock ponds that concentrate runoff, create gullies, and erode portions of remaining native grassland.

Pinyon pine (*Pinus cembroides*), junipers (*Juniperus* spp.), and oaks (*Quercus* spp.) dominate the landscape above 3,700 feet in the Chisos Mountains. Cooler temperatures, more rain, and occasional snow create a hospitable environment for black bears and other animals that would not otherwise be found in the park. Only 2 percent of the park is forested, but it is the forests that sustain a significant portion of the park's diverse plant life and habitats for many wildlife species.

PEAKS OF THE CHISOS MOUNTAINS
NEAR THE MIDDLE OF THE PARK
CONSTITUTE “SKY ISLANDS” —
MOUNTAIN AREAS OF SMALL
FORESTS THAT PROVIDE KEY HABI-
TAT FOR MANY SPECIES UNABLE
TO SURVIVE IN THE LOWER, DRIER
DESERT CLIMATE.



THE BIG BEND ASSESSMENT



Past land uses such as livestock grazing damaged much of the fragile desert ecosystem, damage still felt today.

NATURAL RESOURCES— HISTORIC AND CONTEMPORARY DEGRADATION

The assessment rated the overall condition of **natural resources** at Big Bend National Park a **62** out of a possible 100. These ratings reflect evaluation of more than 120 discrete elements associated with environmental quality, biotic health, and ecosystem integrity. Environmental quality and biotic health measures address the influences of air, water, soils, and climate-change conditions, as well as human-related influences, on plants and animals. Ecosystem measures address the extent, species composition, and interrelationships of organisms and the physical environment for indicator or representative terrestrial

and freshwater communities. The low overall score reflects the effects of adverse historical land use practices, air and water pollution, and threats to native biodiversity from pollution and invasive non-native species.

Mining for mercury from 1900 to 1943, extirpation of species as a result of hunting, and introduction of destructive non-native animals such as feral hogs (*Sus scrofa*), coupled with overgrazing of grasslands by ranching operations, have scarred the landscape and reduced biodiversity. Non-native plants such as tamarisk (*Tamarix spp.*), Johnson grass (*Sorghum halepense*), Russian thistle (*Salsola tragus*), and buffelgrass (*Cenchrus ciliaris*) are degrading natural plant habitat and displacing native plant species. Air pollution, from both distant and regional power plant emissions, and

increased land development along the Rio Grande, which is causing dramatic reductions in water flow, promise to degrade park resources even further.

REDUCED VISIBILITY AND ACID DEPOSITION

Sulfur and nitrogen oxides, and particulate carbon oxides arriving on the winds from coal-fired power plants and industrial and municipal sources in both the United States and Mexico, build a haze that hangs over Big Bend's landscape, obscuring the wide scenic vistas many visitors seek. On certain days of the year, mostly in summer, the park experiences the worst visibility of any western national park and the highest concentrations of sulfate of any western site monitored by the Interagency Monitoring of Protected Visual Environments program.

These pollutants affect more than air quality; they also affect the park's waters and the quality of grassland soils. Sulfate and nitrate pollution makes rainwater more acidic, which leads to acid deposition on the land, lowered soil pH, and changes in soil nutrient levels. In a study of Big Bend's grasslands, soil pH dropped from an average of 6.7 to 5.9 in just four years, and seasonal spikes in soil nitrogen levels corresponded to seasonal pulses in atmospheric nitrate levels in rainwater. Such changes in soil pH and nutrient levels can lead to shifts in the composition of plant species. Because sources of these pollutants are widely scattered throughout the United States and Mexico, clean-up is complicated.

WATER FLOW AND QUALITY—SEVERELY DIMINISHED

Water quality and flow in the Rio Grande is a critical cross-boundary issue. The river begins in Colorado's San Juan Mountains and flows south to the U.S.-Mexico border at El Paso/Ciudad Juarez, where it turns southeast before continuing on to the Gulf of Mexico. The Rio Grande's watershed totals 182,000 square miles and is home to approximately ten million people, 80 percent of

IN 1978, CONGRESS DESIGNATED 196 MILES OF THE RIO GRANDE—69 OF THEM IN THE PARK—AS PART OF THE NATIONAL WILD AND SCENIC RIVERS SYSTEM, BUT MANY OF THE VALUES THAT EARNED THE RIVER THIS DESIGNATION HAVE BEEN SEVERELY COMPROMISED.

whom live in Mexico. By 2010, the number of people on the U.S. side of the border is projected to increase 86 percent over 1990 levels, while populations in Mexican border cities are expected to double or triple. These dramatic increases will put additional pressure on an already overtaxed river system.

In 1978, Congress designated 196 miles of the Rio Grande—69 of them in the park—as part of the National Wild and Scenic Rivers System, but many of the values that earned the river this designation have been severely compromised. Dams and diversions, pollution from mining operations, and inadequate sewage treatment continue to degrade this once majestic river, and the results are felt inside the park. In 2001, peak flows in the Rio Grande upstream of the park were just half of what existed a century earlier, before major impoundments and diversions were in place. High demands for water often drain the river to the extent that there is no flow downstream of El Paso/Ciudad Juarez until the Rio Conchos empties into the riverbed 100 miles upstream of the park. And the Rio Conchos also faces extreme degradation from agricultural, industrial, and municipal wastes.

Industrial activities along the Rio Grande contribute prominently to water quality degradation. In Mexico, more than 900 *maquiladoras* (factories) are located near the U.S. border, largely because of trade provisions in the North American Free Trade Agreement that allow for easy export to the United



The Rio Grande in Mariscal Canyon.

IN 2003, PORTIONS OF THE RIO GRANDE WITHIN BIG BEND NATIONAL PARK STOPPED FLOWING FOR THE FIRST TIME IN RECENT MEMORY.

States. These factories use the river as a source of water and as a largely unregulated dumping ground for wastes.

Reduced flows also contribute to water quality problems. Salinity is increasing, on the way to a 30 percent increase from 1969 levels. Arsenic, lead, copper, and mercury levels exceed U.S. Environmental Protection Agency standards for protection of aquatic life, and concentrations of metals in fish tissues are higher than in most parts of the country. Ambient sediment and water toxicity exceed aquatic life protection levels, and harmful chemicals such as DDE (from the breakdown of DDT, a pesticide now banned in the United States) have been found in the water.

An additional blow to the river ecosystem stems from infestation of non-native plants such as tamarisk and buffelgrass. In one study, these invaders made up between 25 and 40 percent of riverbank vegetation. They are also major invaders in the wetland spring areas of the park, where park staff are focusing on control of non-native plants.

THREATS SHADOW DESERT OASES

More than 350 perennial springs, constituting “mini oases” across Big Bend’s largely arid landscape, are of enormous importance to the area’s plant and wildlife communities. Dense plant assemblages near the springs stand in stark contrast to more sparsely vegetated surroundings and provide habitat for a number of birds and food for other park animals. In addition to tamarisk and buffelgrass, non-native Bermuda grass (*Cynodon dactylon*), rabbitfoot grass (*Polypogon monspeliensis*), and nutria (*Myocastor coypus*), an introduced rodent that is destructive to wetland areas, threaten native plants associated with the springs.

Feral hogs, first observed in the park in 1998, are another unwelcome visitor to the natural spring oases: They trample vegetation, disturb the soil in root zones, wallow, create trails, destabilize banks, and pollute the water. One study indicated that feral hogs had affected 12 of 22 springs in the northern part of the park. These animals also compete for food with native species such as deer and bears.

IMPERILED SPECIES—RECOVERY FOR SOME

Big Bend is a refuge for numerous threatened and endangered species and species of concern—including mammals, birds, reptiles, amphibians, trees, shrubs, and a number of cacti. Most of these species are still threatened by habitat loss, changes in precipitation, invasive non-native species, and poaching, but some are on the road to recovery.

Black bears are a case in point. Hunted heavily and poisoned through predator control programs, the black bear was extirpated from the Big Bend area by the 1950s and placed on the Texas endangered species list in 1987. Bear populations across the bor-

der in Mexico persisted, and some of those bears eventually moved across the border to repopulate the park, albeit at low levels. In the winter of 2000–2001, an estimated four or five bears resided in the park, but a growing number of sightings indicate more bears may be using the park. A study of bear habitat quality concluded that the population capacity of the Chisos Mountains is 25 to 30 bears. This island of bear habitat, however, must be accessible to other mountain ranges in Texas and Mexico for the animals to persist in Big Bend. This means that measures must be taken both within and outside the park to ensure wider protection of bear habitat.

The desert bighorn sheep (*Ovis canadensis*) was also extirpated from the park and from all of Texas. About a dozen sheep have moved into the park following recent reintroductions to the Black Gap Wildlife Management Area on the northeastern border.

The peregrine falcon, whose populations were decimated by DDT poisoning, makes its home in the park. A monitoring program begun in 1976 has documented a rise in the number of nesting falcon pairs—from three in 1976 to 15 in 1993 and 1994. Fewer pairs have been found in Big Bend in recent years, but peregrine falcon populations in the Rocky Mountain and Southwest regions of the country are recovering well.

NATIVE SPECIES IN JEOPARDY

Reduced annual flows, fewer flood events, and general water quality degradation are having widespread impacts on the flora and fauna that depend on the Rio Grande for survival. Four of 36 known native fish species have been extirpated. One (*Gambusia gaigei*) of the remaining native species is critically endangered, and the U.S. Fish and Wildlife Service has identified eight others as species of concern. The American eel (*Anguilla rostrata*) and Atlantic sturgeon (*Acipenser oxyrinchus*), both ocean breeders, no longer make the upstream migration to the park because the Amistad and Falcon dams block their movement. Eleven non-native fish now inhabit the river, com-

INTERNATIONAL COOPERATION ESSENTIAL TO BIG BEND REGION

Big Bend National Park’s location on the U.S.–Mexico border makes cooperation with the Mexican states of Chihuahua to the west and Coahuila to the east of paramount importance for resource protection. It would greatly enhance resource protection in the park and surrounding areas for the United States and Mexico to cooperate on natural and cultural resource management projects, attempting to find solutions to problems on both sides of the border. Numerous issues, including control of invasive non-native species and management of wide-ranging species such as black bear, would benefit from increased cross-border collaboration.

In fact, limited but successful cooperation is being demonstrated via existing projects defined under the Sister Park work plans with adjacent Cañon de Santa Elena and Maderas del Carmen protected areas in Mexico. Although the Sister Park agreements do demonstrate that meaningful cooperative natural resource protection can be achieved, they fall short of providing the authority and scope to fully and holistically address the widespread and imminent trans-boundary concerns detailed in this report.

Talk of an international park spanning the border between both countries first arose in the 1930s. Although this concept has not come to fruition, Mexico did establish (in 1994) the two protected areas—Cañon de Santa Elena and Maderas del Carmen—in Chihuahua and Coahuila. Totalling 1.2 million acres, these areas encompass private lands; thus, conservation efforts are not as concerted as they would be in a public national park.

Visitor experience would also benefit from international cooperation. Until recently, part of the visitor experience at Big Bend included crossing the international border into towns on the Mexico side. This allowed park visitors to experience Mexican culture, while providing economic benefits to the Mexican people. This border crossing is no longer allowed because of increased security as a result of terrorist threats. It is unfortunate both for park visitors and for the Mexican people who reap the economic benefits of this tourism.

NPCA recommends creation of a joint U.S.–Mexico International Commission to formulate working agreements and plans to address restoration of the integrity of the Rio Grande and its tributaries, improved regional air quality, control or eradication of invasive non-native species, and trans-border cooperation for natural resources protection. The commission should develop a plan to establish an International Park to better protect natural and cultural resources, ensure environmentally sound economic development, and institute cooperative border control within the park.



Javelinas, or collared peccaries, are common in Big Bend National Park. They are the only wild, native, pig-like animal in the United States.

REDUCED ANNUAL FLOWS, FEWER FLOOD EVENTS, AND GENERAL WATER QUALITY DEGRADATION ARE HAVING WIDESPREAD IMPACTS ON THE FLORA AND FAUNA THAT DEPEND ON THE RIO GRANDE FOR SURVIVAL.

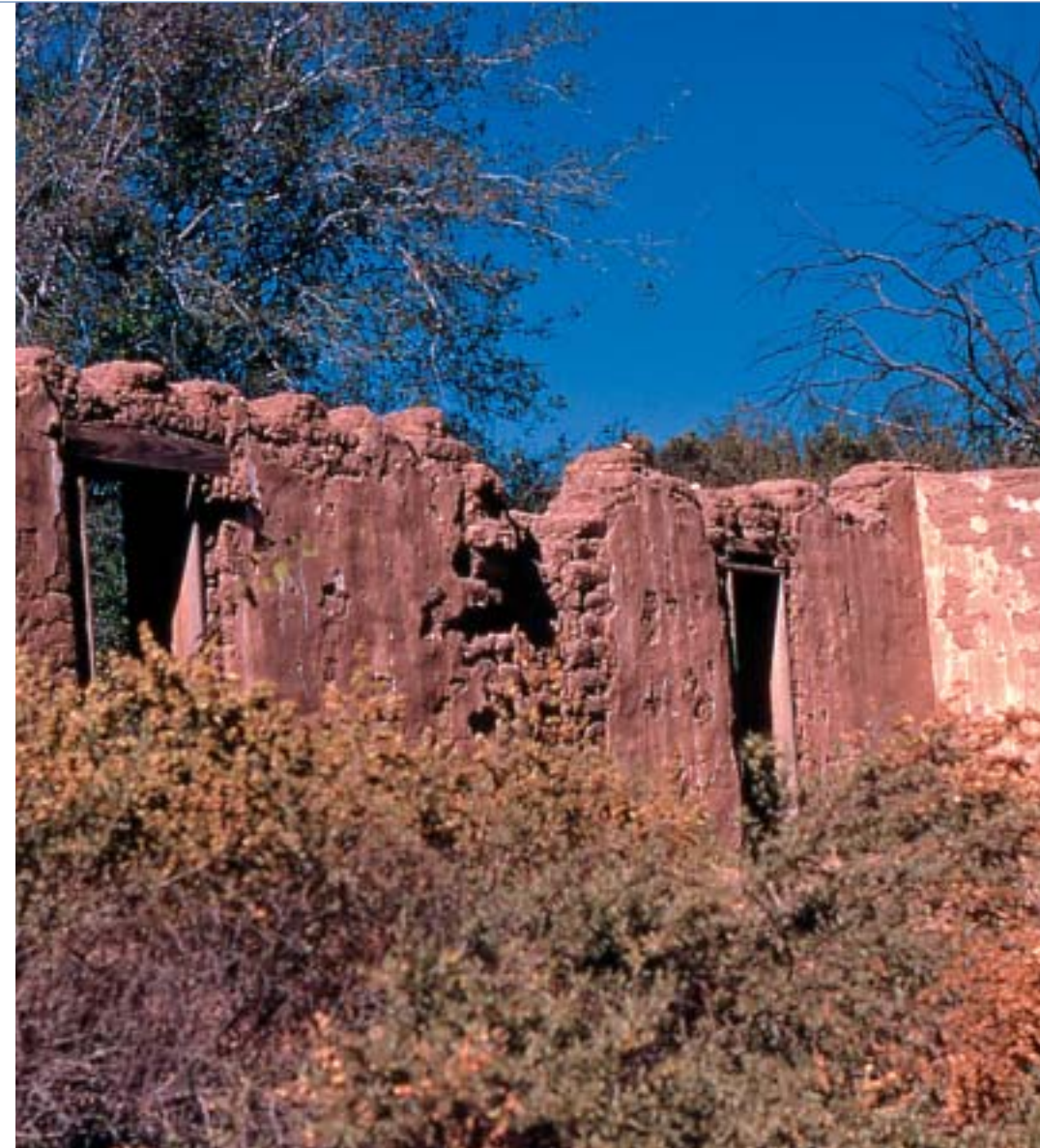
peting with native fish for limited resources.

The only wild population of the federally endangered Big Bend mosquitofish (*Gambusia gaigei*) resides in a natural habitat near Rio Grande Village; two other populations are housed in hatcheries. Past farming activities and park development, as well as competition with another mosquitofish—*Gambusia affinis*—have led to the endangerment of the Big Bend mosquitofish. Park staff have made a concerted effort to restore wetland habitat for the Big Bend mosquitofish by removing a road, picnic area, and other developments and controlling non-native tamarisk.

The Big Bend slider (*Trachemys gaigeae*) is a rare turtle found only along the Rio Grande and Rio Conchos. Severely reduced water flows resulting in the drying up of portions of this animal's habitat are compounded by hybridization with the non-native elegant slider (*Trachemys scripta elegans*), in part because the reduced river flow favors the elegant slider. Non-native turtles and non-native/native hybrids have been found in the park, causing great concern for the integrity of the Big Bend slider population.

Of the 14 native mussel species that have historically populated the Rio Grande, not a single live colony was found in recent surveys in the park. Freshwater mussels are facing declines in rivers throughout North America as a result of flow alteration, pollution, and non-native species—many of the same challenges facing the Rio Grande.

The Chisos Mountain hedgehog cactus is a state and federally listed threatened species because of limited habitat, encroachment by non-native species, and possible collection by people who prize the species for residential landscapes throughout the Southwest. The extent to which illegal collection poses a problem for the hedgehog cactus is not known.



Remains of old house at Sam Nail Ranch.

CULTURAL RESOURCES—BEAUTIFUL, UNDERSTAFFED, AND SUFFERING

Big Bend scored an overall **46** on a scale of 0 to 100 for **cultural resource** conditions, including archaeological sites, cultural landscapes, history, historic structures, museum and archival collections, and peoples and cultures (ethnography). 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 historic resources.

The region that includes Big Bend National Park has long been a place where cultures have

mixed harmoniously and clashed violently. The park's cultural resources represent the tapestry of human presence that began in the Late Paleo-Indian period (8500 B.C.) and continued through the prehistoric era to the start of Spanish explorations in 1535 A.D. to the present. Mescalero Apache, Comanche, Mexican, and Anglo-American peoples used and lived on the land now called Big Bend National Park. Rock art, archaeological sites, ruins, historic buildings, and historic vernacular landscapes are evidence of military, mining, industrial, tourist, and agricultural uses, illustrating the important role of humans in the history of the Big Bend region.

Despite the value of these cultural and histori-

HISTORY—UNDERSTANDING THE RESOURCE

Preserving the historic structures in the park is the most important step toward their protection. To make sound preservation decisions, a comprehensive historical context is needed to bring meaning and understanding to the structures. Historical studies are also needed for 18th and 19th century Mexican settlements, mining activities, gravesites and cemeteries, regional herbology, husbandry, and ruins. Big Bend lacks a historian and research project coordinator to carry out these studies.

Additional historical research at Big Bend is necessary to inform resource planning and decision-making, and it is the key to educating visitors about the park's cultural resources. Past research started this process. For example, visitors to Mariscal Mine learn about mercury mining at a major historic site—once producing one-quarter of U.S. mercury. At Hot Springs historic district, visitors learn of prehistoric occupation through pictographs and petroglyphs, and they can find information on how homesteaders sought cures for disease in the naturally warm water.



Mariscal Mine, a National Register Historic District, is located deep in the park's interior. This mine once produced one-quarter of the United States' mercury.

cal resources and the dedication of park staff, Congress has failed to appropriate sufficient funding for cultural resource protection programs. Consequently, all of the park's cultural resources are in relatively poor condition.

RESOURCES GO UNPROTECTED

The need for additional staff is the thread that ties together all cultural resources management issues at the park. A 1999 updated internal National Park Service study (Cultural Resources Management Assessment) indicated that approximately 24 people were needed to properly manage and protect Big Bend's cultural treasures and comply with agency standards and legislative mandates. Despite this recognized need, the park has only one staff member devoted to the care and management of its cultural resources.

Big Bend's cultural resources manager is a trained archaeologist, but his responsibilities extend to historic preservation, cultural landscapes management, park ethnography, all federally mandated compliance issues, and American Indian relations. Currently, 60 to 80 percent of the manager's time is spent on federally mandated archaeological compliance projects, leaving little time to address all other cultural resources in the park.

MUSEUM AND ARCHIVAL COLLECTIONS—SUFFERING FROM LACK OF STAFF AND STORAGE

The park's museum and archival collections suffer greatly from staffing shortfalls. Except for a brief period during 2000 and 2001, the park has had no museum curator in its nearly 60 years of existence. Thirty-eight percent of museum collection items have not been evaluated or catalogued, making it difficult for park staff and external researchers to access them. An unknown number of museum collection items reside in facilities throughout Texas, and these have not been documented, further complicating the collection management process. The park's archival items (original histori-

cal documents) comprise 28 percent of all collection holdings; 86 percent of those items have not been catalogued, to the detriment of historical research. Big Bend is in desperate need of a curator to attend to museum and archival collections.

The park's museum collection consists of natural history, paleontological, archaeological, and historical specimens including thousands of stone objects from prehistoric times. The majority of objects and archival documents are stored in the Bally Building, essentially a 25- by 35-foot box. This overcrowded storage facility sits in a floodplain, posing a potential threat to its valuable contents. Big Bend's 2000 Business Plan identified a new research center and curatorial facility as the park's number one funding need, but Congress has yet to allocate funds for such a facility.

HISTORIC STRUCTURES — SHORTFALLS LEAD TO RESOURCE NEGLECT

Big Bend is full of historic structures that help tell the story of people who have inhabited the Big Bend region. Sixty-nine of the park's structures are on the National Park Service List of Classified Structures, and 51 of those are listed in the National Register of Historic Places, but hundreds of historic ruins and buildings in the park have not been evaluated for their potential for listing.

Time has not been kind to many of these structures. A prime example is Luna's Jacal (hah-KAHL), a nationally significant earthen abode built by pioneer Mexican farmer Gilberto Luna, who constructed this shelter for his family in the later half of the 19th century. Located near the Comanche War Trail, the jacal illustrates human adaptation to the harsh environment of the Big Bend region. Temperatures inside the structure are 15 to 20 degrees cooler than outside, thus providing respite from the intense heat of Chihuahuan Desert summers during the nearly 100 years that the Luna family resided in the Big Bend area. Time and neglect have allowed the roof of Luna's Jacal to collapse, and park visitors



Luna's Jacal, an earthen abode built in the 19th century, is listed in the National Register of Historic Places. The park has been unable to repair the roof of this nationally significant structure because of lack of funds.

EROSION, WEATHERING, VANDALISM, ILLEGAL COLLECTING, FLOODING, COLLAPSE, AND BENIGN NEGLECT THREATEN BIG BEND'S CULTURAL LANDSCAPES.

CURRENT RECORDS DOCUMENT 1,465 ARCHAEOLOGICAL SITES IN THE PARK, BUT ONLY 3 PERCENT OF THE PARK'S AREA HAS BEEN SURVEYED. SOME RESEARCHERS SUGGEST THAT THE ACTUAL NUMBER OF ARCHAEOLOGICAL SITES MAY BE BETWEEN 10,000 AND 20,000, WITH 25 TO 30 PERCENT OF THEM ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES.

are no longer allowed to enter the structure to experience cooler temperatures.

The park is in need of funds for a historic preservation specialist to coordinate monitoring, protection, and maintenance activities for all historic structures in the park. Additional staff, attention, and money can help ensure that places like Luna's Jacal are preserved for future generations.

CULTURAL LANDSCAPES — ADDITIONAL RESEARCH NECESSARY

American Indians, farmers, ranchers, military personnel, and more have contributed their own cultural histories to the Big Bend region, carving cultural landscapes in rock, soil, and water. Such cultural landscapes are settings in the natural world that reveal the ties between people and the land.

There are at least 19 potential cultural landscapes in the park; 11 of them are identified in Big Bend's cultural landscapes inventory. One, Chisos Mountain Basin, showcases Civilian Conservation Corps camps, used while young men built the first

all-weather access road into the Chisos Mountains. Another in the Castolon Valley testifies to early American Indian farming and hunting and also to Anglo-American and Mexican ranchers looking for a hospitable place to raise livestock.

Erosion, weathering, vandalism, illegal collecting, flooding, collapse, and benign neglect threaten Big Bend's cultural landscapes. Most at risk are National Park Service developments in the Chisos Basin and Rio Grande Village that were part of the Park Service's Mission 66 initiative in the 1950s and 1960s. Because of frequent visitor use at these sites, routine maintenance and development upgrades are common. These activities proceed without the assistance of the cultural resources manager, often compromising the historic integrity of the sites.

The park's cultural resources specialist champions work at Terlingua Abajo, an abandoned Mexican farming village, but has no time to work on the other cultural landscapes. Support from the Park Service regional office in Santa Fe, New Mexico, consists of just one person who is responsible for cultural landscape inventories throughout the region, which includes more than 80 park units. Big Bend is not scheduled for additional cultural landscape work over the next several years. NPCA highly recommends that Congress fund additional cultural landscape experts at the regional level to enable more work at Big Bend and other parks in the region.

PEOPLE AND CULTURES — STUDIES NEEDED

Policy directing the study of ethnography in the National Park Service calls for consideration of current peoples who have traditional ties (for two generations or more) to Big Bend. These people are to be included in interpretive and resource management decisions when such decisions affect places or objects to which they ascribe cultural value.

The park needs a cultural anthropologist to help jump-start its ethnography program. The cultural resources manager currently addresses ethno-

graphic issues as they arise, but does not have time to establish long-term relationships with affiliated peoples, an important component of protecting the places and objects they value.

Studies must be conducted to determine Big Bend's ethnographic potential, including a Cultural Affiliation study, followed by an Ethnographic Overview and Assessment. This research will provide the basis and strategy to manage and protect ethnographic aspects of the park's resources.

ARCHAEOLOGY—ADDITIONAL STAFF NEEDED

Although knowledge of the park's archaeological resources is limited, it is clearly understood that a wealth of prehistoric and historic sites are in various stages of deterioration. The extent of the damage is unknown because there are too few cultural resources staff to undertake necessary studies.

Current records document 1,465 archaeological sites in the park, but only 3 percent of the park's area has been surveyed. Some researchers suggest that the actual number of archaeological sites may be between 10,000 and 20,000, with 25 to 30 percent of them eligible for listing in the National Register of Historic Places. Just two sites are listed in the National Register, and only three have been evaluated for listing.

A comprehensive site sampling survey would go far to inform park staff about the extent of Big Bend's archaeological resources and provide baseline information for a park-wide Archaeological Overview and Assessment. Funding for such a survey has not been identified. At the least, the park needs a full-time archaeological technician to determine the condition of sites and prevent further deterioration from erosion, vandalism, and looting. Damage has occurred at the few sites on the National Register and at sites that are potentially eligible for listing.

In summary, cultural resources at Big Bend would greatly benefit from staff additions—a historian, archaeological technician, regional cultural landscape expert, historic preservation specialist,



Darcy Gamble

Ruins at Terlingua Abajo, an abandoned Mexican farming village, are being studied by the park's cultural resources specialist.

curator, archivist, and an applied ethnographer. Congress, as the primary funding source for national parks, must look to these needs to protect Big Bend's cultural and historical resources that illuminate the proud history of many generations and cultures.

IN SUMMARY, CULTURAL RESOURCES AT BIG BEND WOULD GREATLY BENEFIT FROM STAFF ADDITIONS—A HISTORIAN, ARCHAEOLOGICAL TECHNICIAN, REGIONAL CULTURAL LANDSCAPE EXPERT, HISTORIC PRESERVATION SPECIALIST, CURATOR, ARCHIVIST, AND AN APPLIED ETHNOGRAPHER.



The park's four visitor centers provide information to more than 250,000 visitors each year.

STEWARDSHIP CAPACITY—SEVERE FUNDING AND STAFFING SHORTAGES

Overall, the park's **stewardship capacity** rated **54** out of 100. The rating was calculated by averaging the four component scores of stewardship capacity, then weighting the funding and staffing component at 40 percent of the overall score to reflect its importance. The low overall score reflects severe funding and staffing shortfalls at the park.

FUNDING AND STAFFING—SHORTFALLS COMPROMISE RESOURCE PROTECTION

One of the most significant factors affecting protection of park resources is the funding that a park receives from Congress and other sources. Of major

concern are operating funds, used to support daily activities such as resource protection, interpretation, management, law enforcement, administration, and routine maintenance.

According to Big Bend's Business Plan—an analysis of operating funds from fiscal years 1980 through 2000—park funding has increased at a compounded annual growth rate of 5.3 percent. However, when adjusted for inflation, base funding has actually increased at a meager 1.5 percent per year, and most of those increases occurred between 1980 and 1984. Since 1984, nearly 20 years ago, real annual growth in the budget, when adjusted for inflation, is barely discernible—just 0.4 percent.

At the same time, personnel and program costs also rose—but at a faster rate. The result? Budget shortfalls. Big Bend's budget for fiscal year 2003

was \$4,930,200, but unfunded operating needs totaled nearly \$6.1 million. The 2000 Business Plan also concluded that an additional 69.5 full-time equivalent employees are needed to supplement the staff of 99. Such shortfalls, combined with increasing legislative mandates such as compliance with the Clean Water and Clean Air acts, make fulfilling even basic resource protection duties problematic.

Resources and park infrastructure suffer under funding shortages. Big Bend has no money to hire a museum curator, historic preservation specialists, or a permanent archaeological technician; historic structures suffer from weathering and neglect; and cultural resources studies are deferred. There is no money for a needed wildlife technician, a hydrology technician, biological technicians, or a research coordinator. Limitations in funding mean no construction of a new research center and curatorial facility; delayed upgrades to the Chisos Basin sewage treatment plant, Panther Junction water treatment system, and Rio Grande Village water treatment system; and no redesign and rehabilitation of the Chisos Basin campground.

As a park on an international border, Big Bend has the additional challenge of illegal border crossings, including trespassing livestock and drug traffickers. Insufficient funds for additional staff, particularly backcountry rangers, makes this situation especially difficult. In 2002, staff dealt with 951 illegal crossings and confiscated 6,380 pounds of marijuana, increased numbers that may be the result of tightened security at other locations along the border. Although most people illegally crossing into the park are not dangerous, some drug traffickers carry weapons and pose a potential threat to park staff, further supporting the need for backcountry rangers.

In addition to presenting a law enforcement challenge, illegal border crossings are a resource protection concern. Most people who cross illegally between Mexico and the United States do not use established roads or trails. Instead, they travel across the backcountry, creating new trails, damag-

ing fragile vegetation, threatening archaeological sites, leaving behind trash, and polluting springs. To prevent this resource damage, the park must limit the number of people illegally traveling between the two countries. Backcountry rangers, as well as cooperation with federal agencies such as the U.S. Bureau of Immigration and Customs Enforcement and U.S. Bureau of Customs and Border Protection, are critical for park protection.

PLANNING—NEW GENERAL MANAGEMENT PLAN IN THE WORKS

To properly care for ecological, geological, archaeological, and historical resources, park staff rely on a library of resource planning documents to direct decision-making and management activities. A new General Management Plan is currently being written to replace the outdated plan—more than 20 years old—representing a significant advance in park planning.

Big Bend has numerous planning documents to deal with specific natural resource topics such as fire management, water resources, and wildlife, many of which are current. But an updated Resource Management Plan to address natural and cultural resource issues has been put on hold, and a detailed Vegetation Management Plan is needed to address invasive non-native plants and guide the work of the Chihuahuan Desert Exotic Plant Management Team. Most cultural resource plans are not current and do not provide park staff with the necessary information to make decisions about proper protection. Some important plans—like the Ethnographic Overview and Assessment—are totally absent because of funding constraints and staffing shortfalls, while the park's Archaeological Overview and Assessment is outdated and in need of additional work.

EXTERNAL SUPPORT—PARTNERSHIPS CRUCIAL TO PARK'S SUCCESS

Big Bend enjoys many partnerships with outside organizations and individuals that contribute their services to day-to-day operations. In 2002, 205

INTERPRETATION—SMALL STAFF REACHES MANY VISITORS

Providing park visitors and the general public with opportunities to increase their knowledge of national park natural and cultural resources is a fundamental goal of the National Park Service and an important stewardship tool. At Big Bend, the interpretive program is in high demand, especially during the busy spring season. The park's small interpretive staff pursue their many and varied responsibilities with vigor but without sufficient funding. The park's 2000 Business Plan identified the Visitor Experience and Enjoyment Division, which includes interpretive services, as having the second greatest funding shortfall among the park's five functional areas (visitor experience, facility operations, maintenance, management and administration, and resource protection). In 2000, Visitor Experience and Enjoyment spent \$1.6 million and had 25 full-time equivalent employees, a shortfall of nearly \$1.3 million and 18 full-time positions.

Nevertheless, Big Bend interpretive staff strive to reach a majority of the park's visitors through educational materials and interpretive programs. In fiscal year 2002, staff contacted 276,263 visitors—the majority of people who visited the park—by means of personal services that included contacts at visitor centers, informal and formal interpretation, junior ranger programs, and other educational endeavors. Interpretive staff receive information on current research findings and other scientific reports to share with visitors. They serve as an important bridge between the resource management team and visitors who want additional information on a variety of natural and cultural resource issues.

The vermilion flycatcher is one of 450 species of birds that can be seen in the park. Birdwatching is a popular activity at the park.



people volunteered 35,299 hours, an impressive total considering the remoteness of the park. In fact, the number of interested people exceeds the number of volunteers that park staff can support given current funding and limited housing. The volunteers act as campground hosts and visitor center personnel and assist with park interpretation and special resource protection projects—partly fulfilling responsibilities that would otherwise be assigned to park employees, if funds permitted.

Big Bend also benefits from its partnerships with Friends of Big Bend National Park and Big Bend Natural History Association. Impressive accomplishments of the Friends include spearheading legislative approval for a Texas license plate supporting the park, donating money for the construction of a new entrance station at Persimmon Gap, funding a number of research projects and equipment, and raising money to support trail maintenance. To date, the organization has donated more than \$150,000 to the park.

The Natural History Association has been affiliated with Big Bend for nearly 50 years, operating the park's five bookstores, educating visitors about the park through seminars and printed materials, and supporting interpretive programs and research. In fiscal year 2003 alone, the association provided more than \$81,000 in support of research grants, visitor services, volunteer housing, and other activities. The group is also working on a project that may prove to be a first in the National Park System—a partnering with the Park Service and Forever Resorts (the park concessioner) to build employee housing in Study Butte at the western edge of the park. The units will house Park Service, association, and Forever Resorts employees.

PARTNERSHIPS AID RESEARCH

In Big Bend, with its vast array of natural and cultural resources, limited funding, personnel, and time hamper the park staff's ability to accomplish many research tasks. These shortcomings are part-



Sunset through the Window, a popular vista in the park, is obscured by haze from human-caused pollution.

ly overcome through partnerships with other federal agencies and universities. The partnerships ensure that each year, a host of research projects are conducted in the park, ranging from investigation of the effects of historic mining and documentation of amphibian distribution to careful unearthing of archaeological sites.

In fact, Big Bend is one of the most frequently studied parks in the National Park System, with more than 60 research permits issued in 2002. Information gleaned from research contributes to park staff's knowledge of the resources they are charged to protect.

As the findings of the State of the Parks® assessment presented in this report show, Big Bend National Park holds varied and special natural and cultural resources important to this country's heritage. Additional funding from Congress to meet the needs identified in this report's recommendations and in the park's most recent business plan will go far to ensure that these treasures are protected for the benefit of future generations.

APPENDIX: STATE OF THE PARKS®

ASSESSMENT PROCESS

To determine the condition of known natural and cultural resources at Big Bend National Park and other national parks, the National Parks Conservation Association developed a resource assessment and ratings process. It examines current resource conditions, evaluates the park staff's capacity to fully care for the resources, and forecasts likely conditions over the next ten years.

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 (EBM) address air, water, soils, and climatic change conditions, as well as their influences and human-related influences on plants and animals. Ecosystems measures (ESM) address the extent, species composition, and inter-relationships of organisms with each other and the physical environment for indicator, representative, or all terrestrial and freshwater communities. The ratings elements, their definitions, and the methods employed in their scoring are described in full in the document entitled Natural Resources Assessment and Ratings Methodology, which can be found online at NPCA's State of the Parks® website.

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 cultural resource management policies of the Park Service.

Stewardship capacity refers to the Park Service's ability to protect park resources. Information is collected and circulated to park staff and peer reviewers for analysis. An overall average based on a 100-point scale is used to determine the ratings, based on numerous benchmarks. An overall score is obtained by weighting the funding and staffing component at 40 percent, recognizing its critical importance, and the remaining three elements at 20 percent each.

For this report, researchers collected data and prepared a paper to summarize the results of the research. The draft underwent peer review and was also reviewed by staff at Big Bend National Park.

NPCA's State of the Parks® program 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.



Coyotes are common throughout Big Bend National Park.

ACKNOWLEDGMENT

NPCA thanks the staff at Big Bend National Park who reviewed the factual accuracy of information used in this report. We also thank peer reviewers for their valuable comments and suggestions.

A special note of appreciation goes to those whose generous grants and donations made the report possible: The Houston Endowment, Inc., Ben and Ruth Hammett, Alec Rhodes, Mr. and Mrs. L.E. Simmons, Tracy and Gene Sykes, and anonymous donors.

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