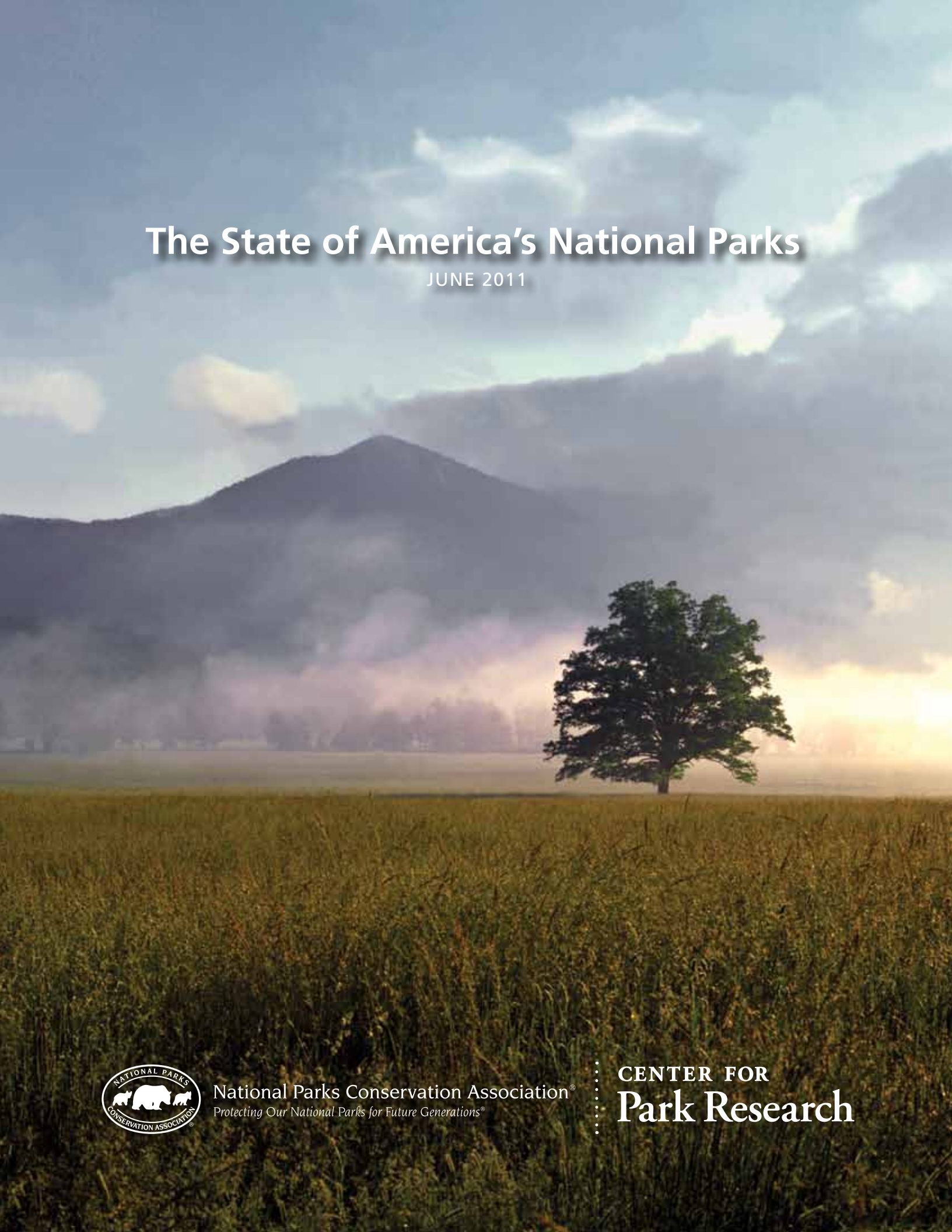

The State of America's National Parks

JUNE 2011

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

CENTER FOR
Park Research

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

SINCE 1919, NPCA 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-three regional and field offices
- More than 120,000 activists

CENTER FOR Park Research

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 increases in motorized recreation. Park officials often lack adequate information on the condition of critical resources within their parks, and knowledge about system-wide issues is also incomplete.

The National Parks Conservation Association initiated the State of the Parks program in 2000 to assess the condition of natural and cultural resources in individual national parks. To date, 80 parks have been studied. Recently, the Center for State of the Parks (CSOTP) turned its attention to issues affecting the National Park System as a whole. Because of this change in focus, CSOTP changed its name to the Center for Park Research (CPR). The Center for Park Research delivers scientific information on systemic issues affecting national parks and their solutions. The goal of the new center remains the same: Provide information that will help policymakers, the public, and the National Park Service improve conditions in national parks, celebrate successes, and ensure a lasting legacy for future generations.

To learn more about the Center for Park Research, visit **www.npca.org/cpr** or contact:

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A special note of appreciation goes to Steven A. and Roberta B. Denning, whose generous support made this report possible. The national park resource assessments that contributed to this analysis were made possible by numerous foundations and individuals who are acknowledged in those reports (see www.npca.org/cpr).

Cover: Morning light illuminates Cades Cove in Great Smoky Mountains National Park. ©Kirkendall-Spring Photographers
Left: Botanists in Redwood National and State Parks take a core sample from a 350-foot-tall redwood tree. ©Michael Nichols/National Geographic Stock

Introduction: Investing in Park Resources

America's national parks are a profoundly empowering idea: landscapes of awe-inspiring beauty, humble structures where American democracy was born, cathedral forests nourishing seeds for the intricate web of life. Our national parks give us the chance to appreciate the living creatures we share the earth with and relearn the history that makes us who we are. Our parks are battlefields in the struggle for human freedom, witnesses to powerful geological forces, settings for cryptic biological processes, and classrooms for new generations of Americans. Collectively known as "America's best idea," our national parks are the places we go for reflection, inspiration, and connection to the natural, historic, and cultural world.

Our national parks also hand us a lesson in humility and responsibility. They belong to all Americans, but they depend on us for survival. We are responsible for their health and for their future.

Our nearly 400 national parks draw waves of visitors—and rightly so. But we have sometimes focused more attention on serving these visitors than on protecting the parks' resources. Visitors' immediate and pressing demands too often eclipse the conservation of the natural and cultural resources the parks were established to protect.

To draw attention to this situation, in 2000 the National Parks Conservation Association (NPCA) developed the Center for Park Research (formerly the Center for State of the Parks) to analyze national park resources and their conservation challenges—at individual parks and across the park system as a whole.

The Center for Park Research: Measuring Park Resource Conditions

Over the past century, the Wilderness Act, the National Historic Preservation Act, and the Redwoods National Park Expansion Act of 1978 have bolstered conservation efforts in America's national parks. As well, a full complement of environmental laws—from the Clean Air Act and Clean Water Act to the National Environmental Policy Act—have promoted the ecological health of the parks. The National Park Service report, *State of the Parks–1980: A Report to Congress*, along with other efforts like *The Vail Agenda* of 1991 and the *National Parks Second Century Commission Report* of 2009, highlighted the challenges and opportunities facing our national parks.

Left: Dry Tortugas National Park, located 70 miles west of Key West, Florida, protects Fort Jefferson and the surrounding coral reefs and sea grass. ©Anirav/Dreamstime.com

NPCA launched a series of State of the Parks resource assessments aimed at producing the first comprehensive survey of natural and cultural resource conditions in America's national parks.

Despite these efforts, the on-the-ground condition of national park resources has continued to be inadequately understood. In response, NPCA launched a series of State of the Parks resource assessments aimed at producing the first comprehensive survey of natural and cultural resource conditions in America's national parks. NPCA knew that gathering systematic information on park resources would strengthen the organization's education and advocacy efforts on behalf of individual national parks, but equally important was the potential for offering a view of resource conditions in the National Park System for Congress, the administration, and the American public.

Between 2001 and 2010, Center for Park Research staff gathered information on 80 parks, a 20 percent sample of the 394 parks in the National Park System. The assessments identified issues that challenge both the immediate and long-term integrity of natural and cultural resources. Their distribution has helped broaden awareness of the condition of park resources among policymakers, stakeholders, the public, and the National Park Service itself.

As the 2016 centennial of the Park Service approaches, the Center's assessments represent the most comprehensive overview yet performed on resource conditions in America's national parks. The findings are sobering: National park cultural resources are often ignored and consistently underfunded, many natural resources are being degraded, and throughout the Park System, conservation efforts are failing to keep pace with the forces that threaten resources.

The goal of the Center for Park Research's decade-long effort has been to understand

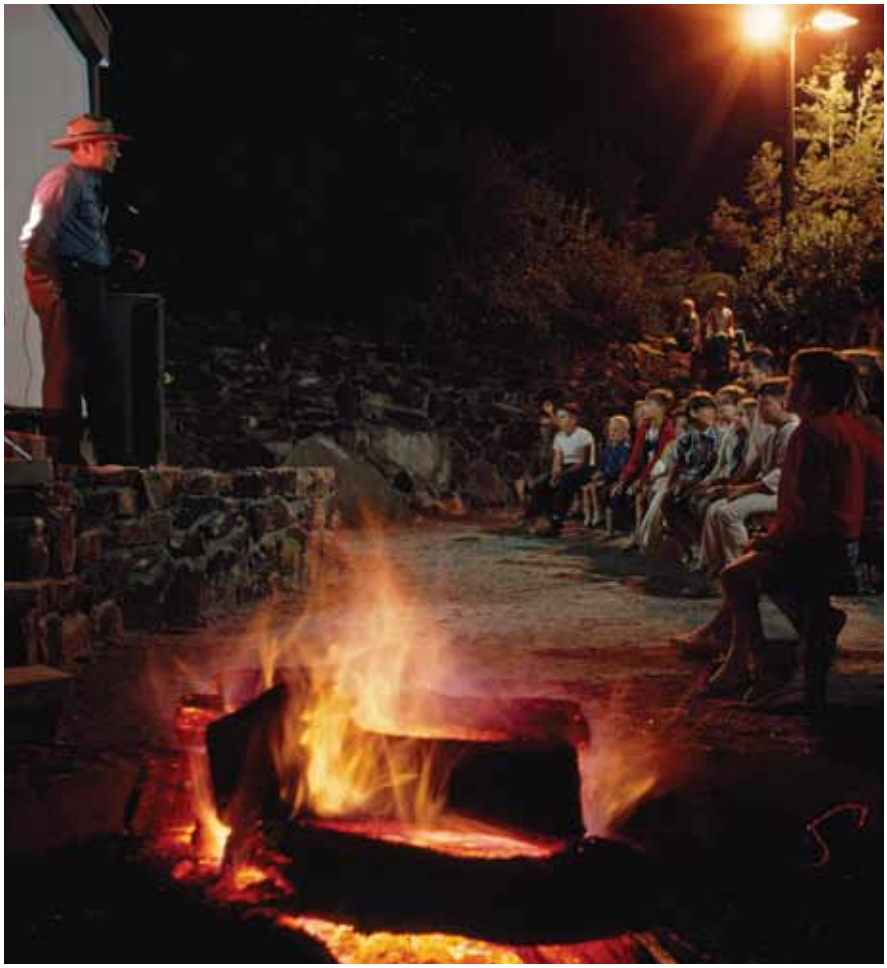
Below: This historic structure in Yosemite National Park now serves as a museum and bookstore. Adaptively reusing historic structures helps protect them from decay and enriches visitor experience. ©Jarno Gonzalez Zarraonandia/Shutterstock

the condition of natural and cultural resources in our national parks and—based on the threats and successes identified—recommend strategies to expand National Park Service successes and improve park health. This publication presents the results of these efforts.

While the full list of findings and recommendations that must be addressed for parks to adequately conserve their treasures can be found in the last chapter of this report, several overarching themes rise to the top:

- New national park units should be established and some existing parks should be expanded to increase the diversity of the country's natural and cultural heritage represented within the park system.
- Additional funding must be secured to provide adequate research, monitoring, and staffing.
- Parks should function as habitat and heritage hubs within larger, landscape-level conservation efforts.
- Air pollution, invasive species, and other threats must be reduced to mitigate the impacts of climate change.
- Cultural resources should be granted importance equal to natural resources.

Unless we implement these strategic changes, our natural and cultural landscapes may not survive for the enjoyment of future generations.



Left: This interpretive program in Big Bend National Park combines tradition (a campfire) with technology (a projector and screen). ©James L. Stanfield/National Geographic Stock
Top: National park resources must be protected and preserved for their own intrinsic value and for their value to park visitors. ©Dana Romanoff Photography, LLC
Above: Park wildlife, such as this coyote in Yellowstone National Park, benefit from landscape-level conservation efforts. ©Richard Seeley/Shutterstock

National Parks Assessed by the Center for Park Research

Adams National Historical Park (MA), 2001

Alcatraz Island (part of Golden Gate National Recreation Area) (CA), 2010

Andersonville National Historic Site (GA), 2004

Andrew Johnson National Historic Site (TN), 2008

Apostle Islands National Lakeshore (WI), 2007

Appalachian National Scenic Trail (various), 2010

Appomattox Courthouse National Historical Park (VA), 2008

Assateague Island National Seashore (MD, VA), 2007

Big Bend National Park (TX), 2003

Big Hole National Battlefield (MT), 2007

Big Thicket National Preserve (TX), 2005

Biscayne National Park (FL), 2006

Bryce Canyon National Park (UT), 2005

Cabrillo National Monument (CA), 2008

Canyonlands National Park (UT), 2004

Capitol Reef National Park (UT), Unpublished

Carl Sandburg Home National Historic Site (NC), 2009

Catoctin Mountain Park (MD), 2006

Channel Islands National Park (CA), 2008

Charles Pinckney National Historic Site (SC), 2008

Chesapeake and Ohio Canal National Historic Park (DC/MD/WV), 2004

Chickamauga & Chattanooga National Military Park (TN/GA), 2009

Cowpens National Battlefield (SC), 2010

Cumberland Island National Seashore (GA), 2009

Death Valley National Park (CA), 2005

Denali National Park and Preserve (AK), 2003

Effigy Mounds National Monument (IA), 2009

Fort Donelson National Battlefield (TN), 2009

Fort Laramie National Historic Site (WY), 2004

Fort Necessity National Battlefield (PA), 2004

Fort Pulaski National Monument (GA), 2007

Fort Sumter National Monument (SC), 2008

Fort Union Trading Post National Historic Site (ND), 2006

Frederick Douglass National Historic Site (DC), 2003

Gateway National Recreation Area (NY/NJ), 2007

Glacier National Park (MT), 2002

Glacier Bay National Park and Preserve (AK), 2008

Grand Canyon National Park (AZ), 2010

Great Basin National Park (NV), 2009

Great Smoky Mountains National Park (TN/NC), 2004

Harpers Ferry National Historical Park (WV/MD), 2009

Hawai'i Volcanoes National Park (HI), 2008

Hopewell Furnace National Historic Site (PA), 2005

Indiana Dunes National Lakeshore (IN), 2007

Isle Royale National Park (MI), 2007

Joshua Tree National Park (CA), 2005

Keweenaw National Historical Park (MI), 2007

Kings Mountain National Military Park (SC), 2010

Knife River Indian Villages National Historic Site (ND), 2006

Lake Clark National Park and Preserve (AK), 2009

Lassen Volcanic National Park (CA), 2009

Lewis and Clark National Historic Trail (various), 2006

Lewis and Clark National Historical Park (OR/WA), 2006

Little Bighorn Battlefield National Monument (MT), 2003

Longfellow National Historic Site (MA), 2005

Missouri National Recreational River (NE/SD), 2006

Mojave National Preserve (CA), 2005

Muir Woods National Monument (CA), 2010

Nez Perce National Historical Park (WA/ID/MT/OR), 2006

Ninety Six National Historic Site (SC), 2010

Olympic National Park (WA), 2004

Pea Ridge National Military Park (AR), 2009

Pictured Rocks National Lakeshore (MI), 2007

Point Reyes National Seashore (CA), 2009

Redwood National and State Parks (CA), 2008

Rocky Mountain National Park (CO), 2002

Saint-Gaudens National Historic Site (NH), 2004

San Antonio Missions National Historical Park (TX), 2008

San Juan Island National Historic Park (WA), 2007

Santa Monica Mountains National Recreation Area (CA), 2008

Scotts Bluff National Monument (NE), 2009

Shenandoah National Park (VA), 2003

Shiloh National Military Park (TN/MS), 2009

Sleeping Bear Dunes National Lakeshore (MI), 2007

Stones River National Battlefield (TN), 2009

Vicksburg National Military Park (MS), 2008

Virgin Islands National Park, 2008

VI Coral Reef National Monument, 2008

Wilson's Creek National Battlefield (MO), 2009

Zion National Park (UT), 2005

Left: These historic cabins are located along the Roaring Fork Motor Nature Trail in Great Smoky Mountains National Park. ©kurdistan/Shutterstock
Right: A brown bear waits to catch salmon at Brooks Falls in Katmai National Park and Preserve—one of the preeminent spots in the world to view these powerful animals. ©Randy Harris/Bigstock

Under Fire: The Condition of Natural Resources

National parks protect the United States' most majestic—and iconic—landscapes. From the grandeur of Yellowstone's Old Faithful to the Everglades' unique interplay of water and earth, our national parks contain some of the planet's most striking natural features. Here resides a myriad of fascinating life-forms: Microscopic organisms, immense humpback whales, delicate orchids, and the world's tallest trees all live within our parks. These natural resources amaze park visitors, who come to gasp at breathtaking views, observe wildlife and wild places, and reconnect to a natural world seemingly distant from their busy, modern lives. For some, simply knowing that such places exist is a comfort, whether or not they ever have the opportunity to visit them.

As important as they are to the wildlife that resides in them and the visitors who arrive by the busloads, our national parks are increasingly vulnerable to forces that degrade their resources. One culprit is the legacy of past wrongs: Traces of former logging, mining, and fire suppression efforts are still evident inside park boundaries. Parks are also affected by changes in the surrounding landscapes—loss of natural water flows, invasive species, and air pollution. Parks' boundaries are merely lines on a map, and the celebrated status of national parks offers little immunity to modern pressures beyond park gates. The Center for Park Research assessments clearly show that changes in the landscape can cause serious damage to natural resources within our national parks.

The National Park Service strives to honor its mandate from Congress to preserve and protect the resources under its stewardship. Certain efforts are successful. But in other cases, outside factors hinder efforts to manage and protect our parks. In some national parks, scenic vistas are obscured by air pollution that drifts in from near and far. Rivers and streams are dammed or diverted, resulting in unnatural or nonexistent water flows and altered riverbank plant communities. Noise from aircraft and nearby industrial activity infringes on the sounds of nature. Habitat fragmentation and invasive species from adjacent development harm native wildlife and plants. Some impacts are immediately apparent (such as haze from coal-fired power plants), while others (such as those posed by climate change) unfold over decades. Sometimes resources appear healthy to the untrained eye, and only with the aid of scientists or technical experts can problems be identified.

Left: A bison passes near the Emerald Pool thermal feature in Yellowstone National Park.
©Sascha Burkard/Shutterstock

"Fair" Isn't Good Enough

Between 2001 and 2010, the Center for Park Research examined resource conditions at 80 national parks spread across the system (see the appendices online at www.npca.org/cpr for a list of parks examined, an expanded explanation of resources evaluated, and an overview of condition ratings). Of these 80, the Center for Park Research examined natural resource conditions at 61 parks possessing sufficient natural resources information upon which to base an evaluation. To gather the information used in its evaluations, the Center reviewed National Park Service databases, examined reports and studies produced by or for the Park Service, conducted interviews with park and regional staff, and made on-site park visits.

Above: Some of our national parks' most visible cultural resources are the statues, monuments, and memorials to our nation's military past. This monument for the Tennessee artillery is located in Chickamauga and Chattanooga National Military Park in Georgia and Tennessee. ©Mike Talplacido

The assessment methodology 1) examined the **extent and function of park ecosystems**, including major park habitats, habitat fragmentation within the park, and important ecological processes (such as plant succession and wildland fire) that play a role in maintaining natural resources; 2) documented the **composition and condition of native plant and animal species**, including total species, the condition of native species, and the interactions between species; 3) explored the **factors affecting the condition of animal and plant populations** within the park, including land use history, climate, diseases, competition from non-native species, and poaching; 4) detailed **environmental factors, particularly air and water quality**, evaluating atmospheric pollutants (like sulfur dioxide) and indicators of water quality (like temperature and water chemistry). The process is covered in greater detail in Appendix B, which is available online at ww.npca.org/cpr; the compete natural resources assessment methodology can be found at www.npca.org/stateoftheparks.

Park resources ranged from "excellent," "good," or "fair," to "poor" or "critical." Park resources in "excellent" condition were determined to be intact, highly viable, and secure from threat. Resources in "poor" condition were considered imperiled. Most parks—40 out of 61—earned a "fair" rating (Figure 1), meaning they are somewhat degraded and vulnerable to continued degradation.

Human Impacts on Natural Resources

The Center for Park Research identified eight interrelated and service-wide challenges common to the current condition of natural resources: 1) land use that degrades natural resources, 2) natural processes that have been disrupted or curtailed, 3) species loss from past human activity, 4) the introduction of non-native plants and animals, 5) diminished water quality, 6) reduced water quantity, 7) degraded air quality, and 8) the impacts of climate change.

Historical and current adjacent land uses degrade resource conditions. National parks come in all shapes and sizes, from hundred-acre battlefields to multimillion-acre parks and preserves. No matter the size or the location, one major finding from our study is inescapable: Development and extraction on adjacent lands negatively impact the natural resources in national parks. Plus, parks continue to show the scars of past practices. These changes to the modern landscape, along with historical impacts, challenge and sometimes overwhelm resource management and protection efforts.

Our assessments found that land uses outside national parks often have a dramatic impact on the resources within parks. Based on available information from 53 (of the 61) park assessments, 18 parks showed significant impacts to resource conditions as a result of adjacent lands development, and 29 others indicated localized impacts of adjacent development. Only six had no significant resource damage from adjacent development.

Mining and oil and gas development on lands outside national parks have real effects on park natural resources. While conducting assessments, the Center noted park concerns over current or potential mining or oil and gas development in 13 of 61 parks, most of which were located in the Western United States. Roads, buildings, other infrastructure, and the daily operational activities associated with mining, oil, and gas enterprises can fragment wildlife habitat, generate noise that disturbs animals, create dust and emit pollutants that diminish air quality, and contaminate water sources.

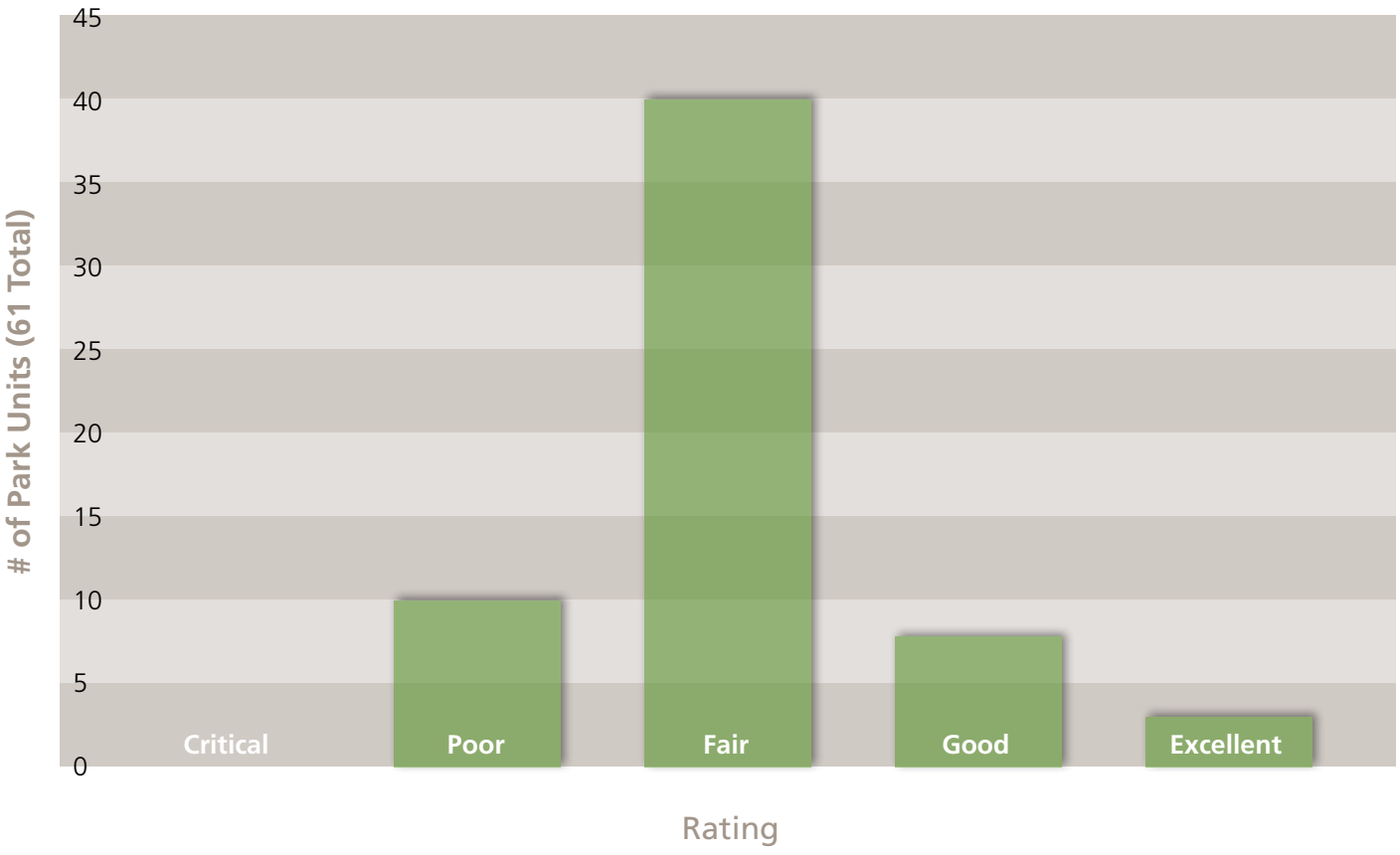
Many parks are not adjacent to active mines or oil wells, but many are close to significant urban and suburban development. In fact, 37 of 61 assessed parks indicated significant pressure from adjacent urban and suburban development. Roads are part of the pressure: At Pea Ridge National Military Park in Arkansas, for example, increased commuter traffic and population growth has resulted in more wildlife killed on the state highway that runs through the park.

With increasing urbanization comes the need to supply additional energy. The lands around the California desert parks—Joshua Tree and Death Valley National Parks and Mojave National Preserve—provide excellent opportunities for large-scale solar energy production, but construction of these facilities and associated infrastructure (including transmission lines) could fragment important migration routes for bighorn sheep and disrupt habitat of the endangered desert tortoise. Meanwhile, operation of these plants would likely strain already-scarce water resources, impair scenic vistas, and degrade stargazing opportunities.

Development and extraction on adjacent lands impact the natural resources in national parks.

Figure 1. The overall condition of natural resources within U.S. national parks assessed by the Center for Park Research.

Natural Resources Overall Conditions



Ongoing Oil and Gas Production

A few parks face oil and gas development within their borders. When Big Thicket National Preserve in Texas was established in 1974, subsurface mineral rights were privately held, and the federal government did not acquire these rights. Oil and gas exploration and extraction are still allowed in the preserve: As of May 2011, the preserve has 11 production operations that directly impact 22 acres, and 29 more wells have been drilled from outside into privately owned oil and gas holdings within the preserve.

Oil and gas exploration and production within the parks are of concern because spills can contaminate water and soil; air quality can be affected by increased vehicle traffic and accidental releases of volatile chemicals; vehicle and foot traffic can compact soil and change natural drainage patterns; wildlife movements and feeding and nesting activities can be disrupted; and vegetation must be cut or cleared along survey or seismic lines and pipelines, as well as on drilling pads. Visitor experiences and natural quiet can also be negatively affected by oil and gas activities within the parks.

Above and Below: Oil and gas development could jeopardize resources in Big Thicket National Preserve. Photos courtesy of Chuck Hunt/ National Park Service

Development on inholdings (parcels of non-federal land or occupancies located within national park boundaries) also threatens parks' natural resources. Within the National Park System's 84.4 million acres, there are millions of acres of privately held land. Fifty-four of the assessed parks include inholdings ranging in size from less than an acre to tens of thousands of acres. At Virgin Islands National Park, for example, nearly one-fifth (1,400 acres) of the park's terrestrial acreage is privately owned, resulting in the destruction of native vegetation and the introduction of non-native flowers and shrubs.

Lands currently managed by the National Park Service were often highly modified by human activities or suffered extensive resource extraction before being turned over to the Park Service, and in most cases those scars remain. More than half the parks the Center assessed reported resource impacts from previous agriculture or livestock grazing, or both. More than half of the parks had current resource issues resulting from past logging activities. Parks such as Michigan's Isle Royale and California's Redwood have second- or even third-growth forests where logging effects, coupled with fire suppression, have resulted in many trees of the same age interspersed with thick undergrowth—providing opportunity for catastrophic fires or insect kills. These forests also provide marginal habitat for animals and other plants historically found in the area. Thousands of old mines dot the landscapes of Death Valley National Park, Joshua Tree National Park, and Mojave National Preserve in California's desert country, leaving behind a legacy of tailings piles and contaminated runoff. In 17 of the parks assessed, we found that historical mining activity resulted in damaged plant populations and communities, degraded habitat for wildlife, and a legacy of soil contamination.

Fire suppression and flood control have degraded park ecosystems.
Ecosystems require natural disturbances to maintain habitat, control fuel loads, and maintain species diversity. In the past, wildfire in parks was viewed only as a destructive force: killing vegetation, harming wildlife, ruining scenery, and threatening structures and public safety. As a result, fires were usually suppressed. Flooding was considered destructive for the same reasons. Consequently, as people settled U.S. landscapes, they also diverted and impounded rivers to prevent floods, which changed the very character of local ecosystems, including some later incorporated into national parks.

Sixty-five percent of the parks surveyed experienced limited changes to ecosystem condition as a result of changes to the fire regime; one-fifth (22 percent) showed widespread changes to ecosystem condition due to changes in the fire regime in and around the park. One such example is Lassen Volcanic National Park in California, where forests once comprised of lodgepole pine (which depends on fire to regenerate) now include species such as red fir and mountain hemlock that are not adapted to fire. The changes in vegetation have caused population declines of Tehama deer and snowshoe hare.

Like fire, flooding is an important process in many ecosystems, delivering nutrient-rich river water and sediment that support vegetation on the larger floodplain. But like fire, floods can also be very destructive, damaging nearby urban and agricultural areas and killing people and livestock. Our assessments documented significant impacts to park resources due to changes in river flood dynamics for eight parks (out of 61). Large upstream dams have significant impacts, as do diversions of rivers and streams. In Lewis and Clark National Historical Park in Washington and Oregon, for example, dikes and ditches improved farmland and minimized the threat of flooding in the park's Fort Clatsop unit—but they also destroyed the extensive network of wetlands and wildlife habitat that used to dominate this landscape.

Above: Controlled burns, such as this one at Grand Canyon National Park, are often needed to ensure ecosystem health. ©Alan English

Top: Great Smoky Mountains National Park in Tennessee and North Carolina is home to delicate lady slipper orchids, but such orchids are no longer found at Catoctin Mountain Park in Maryland. ©William Britten/istockphoto
Above: Rocky Mountain National Park's elk population has exploded in the absence of predators such as gray wolves. ©Wally Gobetz

Parks suffer from a loss of species. With few exceptions, the historical complement of plants and animals once found in our modern-day parks is no longer present: Some species have disappeared, often before the parks were designated for protection. Hunting and trapping, eliminating predators, and annihilating "pests" such as prairie dogs have decimated some animal populations. Some plant species have been lost to disease or collecting by people; others have disappeared because the loss of key animal species produced changes to native plant communities.

Ninety-five percent of parks (58 out of 61 parks) assessed for natural resource condition had at least one animal or plant species known to be lost from the area. Large predators such as gray wolves, mountain lions, and grizzly bears have been lost across much of the American landscape and its parks. At the same time, lady slipper orchids are gone from Maryland's Catoctin Mountain Park, and more than 30 native plants have been lost at Hawai'i Volcanoes National Park. As a consequence, the list of park plants and wildlife for the majority of national parks around the country reflects only a portion of the flora and fauna that might have been present historically.

Our assessments documented changes in food web dynamics at 29 out of 35 parks (no information was available for the other 26), probably due to species loss. When top predators, such as mountain lions and wolves, are removed from an ecosystem, herbivore populations increase—overgrazing shrubs and cropping down grasses. One well-known example is the explosion of the elk population in Colorado's Rocky Mountain National Park after the gray wolf was removed.

But sometimes, the loss of a smaller species can have large impacts on an ecosystem. Prairie dogs' extensive burrowing aerates the soil, improves soil drainage, and channels rainwater from the surface to the water table. But their burrowing did not endear them to farmers and ranchers, who removed these "pests" with poisons. At parks such as Fort Union Trading Post National Historic Site in Montana and North Dakota, where native prairie restoration is a high priority, reintroducing the prairie dog would improve the likelihood of long-term ecosystem restoration.

At 22 of the 61 parks we assessed, National Park Service staff had reintroduced or were planning to reintroduce missing native species in efforts to restore natural processes in park ecosystems. Unfortunately, funding and staffing limitations hinder these reintroduction attempts.

Invasive plants and animals endanger park resources. According to the National Park Service, there are more than 6,500 invasive non-native species within our national parks, many of them plants. At the same time, not all non-native plants and animals in parks are management problems. At Utah's Capitol Reef National Park, for example, the Park Service maintains a historic apple orchard from an early Mormon settlement; domesticated goats are part of the cultural landscape at Carl Sandburg Home National Historic Site in North Carolina. But the Center's assessments revealed that non-native invasive plants and animals are a pervasive and widespread problem in the National Park System, because they outcompete native species for water, food, and habitat. Non-native invasives can also transmit diseases to native species, reduce biodiversity by edging out native plants, and alter fire frequency or intensity.

Whether introduced intentionally or accidentally, the problem of non-native invasive plants in national parks is widespread and significant. Of the 61 parks assessed, 52 parks—85 percent—reported that non-native invasive plant species were causing problems for park ecosystems. Tamarisk, a deciduous shrub native to Asia, has

Hawai'i Volcanoes National Park: Native Species Under Attack

The Hawaiian island chain is the most geographically remote in the world. The few plants and animals that were able to reach these far-flung islands evolved in the absence of large mammalian herbivores and predators for more than 70 million years. More than 90 percent of the animals and vascular plants of the Hawaiian Islands are found nowhere else. But at Hawai'i Volcanoes National Park, park staff battle an ark's worth of invasive non-native species brought to the islands during the last 200 years: Some 600 species of non-native plants, as well as feral goats, sheep, pigs, cats, rats, mongooses, and even mosquitoes and wasps threaten native species and ecosystems. In fact, managing invasive non-native species is the park staff's highest natural resource priority. More than 100 miles of fencing prevent sheep, goats, and pigs from accessing sensitive areas, and staff have removed invasive plants from tens of thousands of acres of parkland. Ensuring that invasive animals and plants stay out of areas where they have been eradicated requires constant vigilance and regular monitoring—both of which require continued funds and human resources.

The Park Service is also a member of the Three Mountain Alliance, a cooperative, multiagency landscape-level management effort to protect habitats. Park staff reach out to adjacent communities to educate residents about problems caused by non-native species, and staff encourage local residents to control non-native species on their property.

Below: Endemic nēnēs in Hawai'i are at risk from introduced predators such as mongooses. Photo courtesy of Kathleen Misajon/National Park Service.

Non-native invasive plants and animals are one of the greatest resource threats to the health of national parks, and controlling them should be a top priority for Park Service managers.

overgrown riparian areas in Canyonlands, Death Valley, Grand Canyon and other Western parks, replacing native trees such as cottonwoods and willows. Controlling tamarisk is a monumental challenge that often involves expensive and labor-intensive treatments.

Invasive non-native animals and fish also pose a threat to park resources. In the 61 parks in which we assessed the condition of natural resources, where sufficient information on this topic was available, non-native invasive animals are considered to be a problem—either in a limited area or as a widespread issue—in 37 parks (61 percent). At Cumberland Island National Seashore in Georgia, feral hogs overgraze salt marshes and dune-stabilizing grasses, root up the nests of federally protected loggerhead sea turtles, and consume turtle eggs. They compete with native wildlife for food, and their rooting destroys natural habitats, cultural landscapes, and archaeological sites. Park officials are taking measures to reduce the hog population. But because hogs reproduce twice a year, and with the island's dense vegetation hindering control efforts, it is difficult to reduce or eliminate feral hogs from Cumberland Island. Continued support for control efforts is critical for protection of the park's natural and cultural resources.

Non-native invasive plants and animals are one of the greatest resource threats to the health of national parks, and controlling them should be a top priority for Park Service managers. But because invasive non-native plants and animals do not abide by property ownership boundaries, efforts to control them often must proceed at a landscape level to achieve effectiveness. Cooperative efforts must include federal, state, and local government agencies, tribes, private landowners, and other interested groups working together to manage invasives that cross boundaries.

Water quality is degraded. Assessing a wide sample of national parks across the country, the Center examined available data for 25 different water characteristics, including temperature, sedimentation, and levels of metals, nutrients, and organic waste. In 28 of the 61 parks we evaluated for natural resource conditions, water resources were in "fair" condition; 23 had water resources in either "good" or even "excellent" condition. These results indicate that many park waterways are pure enough to maintain ecosystem function and visitor expectations, but some parks contain severely degraded aquatic habitats resulting largely from human activities and pollution of waters outside the boundaries of the park.

In Redwood National and State Parks, past logging activities along Redwood Creek, an important habitat for federally listed, threatened native fishes, opened up the forest canopy and reduced shade on the stream. Increased sunlight warms creek waters and makes them unsuitable for the native fish, which prefer cooler water. In Grand Canyon National Park in Arizona, the Colorado River's water temperatures are affected by Glen Canyon Dam, which releases icy-cold water from 50 to 200 feet below the surface of Lake Powell. Cold water is good for the introduced trout, but it harms native fishes, which rely on warmer waters to survive and spawn. Several native species have disappeared, and those that remain have low population numbers.

Nearly one-third of the parks assessed also had problems from an overabundance or lack of sediment resulting from development, agriculture, and other activities outside park boundaries. Extra sediment in waterways can be a problem because it can smother aquatic plants and animals, such as mussels, and limit the amount of light that penetrates lakes and streams to feed photosynthesizing organisms important in the food chain. At Effigy Mounds National Monument in Iowa, several habitats receive sediment from upstream agricultural areas outside the park during periods of heavy

rain. In a case where sediment is being lost, Indiana Dunes National Lakeshore, on the southern shore of Lake Michigan near Chicago, is beginning to lose its namesake dunes because adjacent shoreline development has altered the transport of sand and the processes of natural dune construction.

Rivers, lakes, streams, and other water bodies are susceptible to a wide variety of pollutants, from fertilizers and mine tailings to oil spills and acid rain. Where water quality problems arose, they sometimes reflected a legacy of past land use within the park boundary or, more often, indicated impacts from current adjacent land use and transport of pollutants into the park via water or airborne deposition. Big Hole National Battlefield in Montana has considerable nutrient pollution in the North Fork Big Hole River related to upstream agricultural crop production. At Isle Royale National Park in Lake Superior—99 percent of which is federally designated wilderness—inland lakes have elevated levels of mercury from atmospheric transport. Gateway National Recreation Area, located within the New York City metropolitan area, receives treated wastewater with elevated concentrations of industrial chemicals and pharmaceutical and personal care products. Research documenting the impacts of these chemicals is still emerging, but there is concern that some of these chemicals may be directly toxic, while others might have a more subtle impact on wildlife and human populations by disrupting individual hormone levels (estradiol, a hormone that is a component of birth control pills, has been detected in sediments in Gateway National Recreation Area).

Yet significant gaps remain in our understanding of water quality. Few data exist for many park habitats, particularly in large parks with many lakes and miles of streams. Also, data routinely collected do not include new contaminants of concern or measures that would indicate whether plant and animal populations in park waterways are thriving. Studies on these variables are rare or absent, and represent one of the gaps in our understanding of the complete condition of water resources in the parks.

Diminished water quantity impacts wildlife, plants, and people. The amount of water flowing through park streams and rivers has a direct bearing on the quality of those habitats and the value they provide for plants, aquatic and terrestrial wildlife, and people. Not all parks that were assessed experienced altered flows, but those that did reported a major impact: Altogether, eight parks indicated widespread impairment to park water flows, and eight parks documented resource concerns resulting from water diversion. At Point Reyes National Seashore in California, virtually all of the small streams within the park have been modified, and many were channeled and diverted to convert salt marsh into pastureland for cattle.

Groundwater extraction, even if done miles away, can also have significant impacts on national parks. Unfortunately, the Center's assessments did not often uncover sufficient information to evaluate the impacts of groundwater extraction, and most parks that did have information indicated no known problems. However, managers at Great Basin National Park in Nevada are questioning how the park's springs and seeps may be affected by groundwater diversions from the northeastern part of the state to the city of Las Vegas. The Great Basin case illustrates the fact that increasing water demands, particularly in the Western United States, will make water issues more prominent in the future. Pumping groundwater to satisfy industrial, agricultural, and residential needs will continue to deplete aquifers, which may produce significant impacts on critical park habitats, such as streams, seeps, and springs. Climate change effects are likely to exacerbate the impacts of these already damaging practices.

Above: The Navajo Generating Station, the nation's eighth largest coal-fired power plant, is just outside Glen Canyon National Recreation Area and only 12 miles from Grand Canyon National Park. ©Frontpage/Shutterstock

Brightening Horizons for Great Smoky Mountains National Park

Located along the border of Tennessee and North Carolina, Great Smoky Mountains National Park is the heart of one of the most biologically diverse ecosystems on the planet, and is home to some of the largest remaining forestland in the Eastern United States. For decades the Smokies have been plagued by air pollution—among the worst in the park system. Scenic views have been obliterated by haze pollution, trees and plants have been weakened and killed by acid rain, and "red alert" ozone pollution days have made hiking unsafe.

The Tennessee Valley Authority (TVA), which operates 59 coal-fired electricity-generating units throughout the Southeast, has been a major cause of air pollution in the Smokies. But the future looks much brighter for the park thanks to a recent agreement between TVA, NPCA, several states, and others that ends nearly 10 years of litigation over TVA's air pollution.

In April 2011 the TVA board of directors approved an agreement requiring TVA to:

- phase out 18 highly polluting coal-fired electricity-generating units by 2018;
- install new pollution-control technology on three dozen additional units;
- provide $350 million toward air pollution-reduction projects over the next five years, including funds for energy efficiency, renewable energy, and greenhouse gas emission reduction activities; and
- provide $1 million to the National Park Service to improve air pollution monitoring and response in the region.

Below: Park managers continue to work to improve air quality at Great Smoky Mountains National Park so visitors can enjoy sweeping views like this autumnal vista. ©Geir Olav-Lyngfjell/Shutterstock

Air quality threats persist. Clean air is not a luxury. It is a necessity for healthy life, not just for humans, but for plants, animals, and even small but important entities such as lichens. National parks, particularly those located in rural settings, are expected to have the most pristine air quality, best scenic views, and brightest stars. Some Americans are surprised to learn that national parks are exposed to the same pollutants from smokestacks and vehicles that dirty the air in urban areas, and the air quality in some national parks, including Shenandoah, Great Smoky Mountains, and Joshua Tree National Parks, is often just as degraded as it is in nearby cities. The Center's assessments found that air quality was "good" in 11 parks (18 percent) and "excellent" in 11 others. But 27 of the 61 parks assessed for natural resources (44 percent) demonstrated air quality resources in "fair" condition, 10 (16 percent) had "poor" air quality, and two (3 percent) had "critical" air quality problems.

Based on our findings, visibility concerns are widespread across the park system. Visibility integrates the overall impact of haze, particulates (commonly produced through combustion at coal-fired power plants or wildfires), and nitrogen and sulfur oxides. It is also affected by larger forces, like prevailing wind direction. The Park Service considers visibility a critical indicator of air quality issues because so many parks have scenic values. Grand Canyon National Park was one of six parks that indicated an extensive problem with visibility.

Ground-level ozone—which forms when nitrogen oxides and volatile organic compounds react in the presence of sunlight—poses concerns to human health and to park plants. It can stunt plant growth, damage leaves, and promote fungal activity that can weaken or kill plants. The Center's assessments identified limited ozone problems at 18 parks and found widespread ozone degradation at nine parks. At Shenandoah National Park at the time of the assessment, 40 species of plants were sensitive to ground-level ozone; 25 percent of those species exhibited damage symptomatic of ozone pollution.

Sulfur oxides and nitrogen oxides also plague some national parks. Four of the parks we examined—Indiana Dunes, Sleeping Bear Dunes, Great Smoky Mountains, and Joshua Tree—reported widespread problems resulting from these contaminants. The largest human-related source of sulfur dioxide originates from fossil fuel power plants, especially those powered by coal, and can result in acid deposition. Trees killed by acid rain produced by coal-fired power plants can be seen at Great Smoky Mountains National Park. Nitrogen oxides can lead to changes in the chemistry of streams and lakes that can upset the balance of aquatic life and even be lethal to some fish. Addressing the large-scale emissions from fossil fuel power plants and other major emitters is essential to the health of these parks.

Climate change affects parks' future. Park managers are now engaged in multiple efforts to understand and respond to global climate change, which is already beginning to affect the resources they manage. Climate change threatens the iconic flora and fauna of many national parks—the Joshua trees of Joshua Tree National Park, for example—the very species that helped propel the establishment of these parks in the first place.

It is important to recognize that climate change is more complicated than simple fluctuations in air temperature or losses of individual species; it is a landscape issue that affects the health of entire ecosystems, plant communities, and animal species that are already stressed by invasive species, poor air and water quality, and landscape fragmentation by urbanization and resource development.

Above: The Haleakalā silversword is a native Hawaiian plant found in several of the islands' national parks. Park staff protect the plants by erecting fencing, removing invasive non-native plants, and encouraging visitors to stay on trails. ©Marc Becker/123RF

Groundwater extraction, even if done miles away, can have significant impacts on national parks.

Few parks have completed (or even initiated) investigations into the effects of climate change on their resources. Available information indicates that, across the park system, quantitative data are rare but concern is high. At Apostle Islands National Lakeshore in Wisconsin, increased water temperatures may be encouraging algae growth, which decreases the amount of dissolved oxygen, degrades water quality, and limits species survival. At Isle Royale National Park, significant changes in the quantity of snow could impact moose-wolf dynamics and threaten the survival of both mammals.

In 1850, the area that would become Glacier National Park in Montana contained about 150 glaciers; today the park has just 26. Conservative climate change projections by the U.S. Geological Survey suggest that if current melting rates continue, there might not be any glaciers by 2030. The remaining glaciers and snowfields provide the frigid waters that irrigate habitat for several rare species, including the mist forestfly. In spring 2011, this aquatic insect was considered for protection under the Endangered Species Act. Unfortunately, the application was rejected for lack of funding to pursue definitive scientific data. If approved someday, the mist forestfly would become one of the first species to be listed solely due to its high susceptibility to the effects of climate change.

Parks must prepare for change by increasing data collection and analysis of climate change impacts on park resources, planning for change when managing resources within the parks, and working beyond their borders with other land managers to build resilience at the ecosystem or landscape scale.

The National Park Service is in a unique position among federal agencies to communicate to the public both the consequences of climate change and the opportunities to avert some of those consequences by reducing greenhouse gas emissions. Furthermore, national parks are also laboratories where researchers and scientists can study the effects of climate change and gather data from a variety of relatively intact habitats in order to make predictions about future changes. Climate change threatens our parks, but it is also an opportunity for the Park Service to demonstrate leadership in research, mitigation, and communication—to document those changes, mitigate them where possible, and communicate that information to the millions of people every year who visit and love these places.

Undoing Harm

The Center for Park Research's assessments of national parks provide a map of where we are and can guide us as we move forward. Natural resources are degraded at many of our protected public lands, and the Park Service faces many management challenges—from both inside and outside park boundaries.

Yet national parks are some of the few places left across the country where we actively seek to minimize the impact of humans on the natural environment. The parks' natural resources connect us to the beauty and complexity of the American landscape, providing the opportunity to experience the local and global diversity of plant and animal life and understand the critical ecological processes that influence that landscape. They give us a view into how we continue to impact the land with our near-constant change.

What we do with that view matters. In "Solutions to Resource Challenges" on page 34, we describe efforts across the park system that have successfully improved resource conditions. Identifying problems doesn't commit them to permanence: It opens the door to solutions.

The Land and Water Conservation Fund Is Key to Resource Protection

One of the parks' most valuable sources of funding is the Land and Water Conservation Fund (LWCF). Established in 1965, the LWCF covers the costs of federal, state, and local projects that preserve land, water, and historic resources. This fund is a critical means by which the National Park Service can protect the resources under its care and purchase inholdings and private lands along park boundaries. According to a 2009 NPCA report, *America's Heritage for Sale*, the National Park Service has identified 1.8 million acres of private lands worth nearly $2 billion that are high priorities for purchase from willing sellers.

Although the LWCF is authorized to receive $900 million annually in royalties from offshore oil and gas drilling, Congress typically approves just a portion of that amount for actual use in preservation and recreation projects. For example, between fiscal years 1965 and 2006, roughly $29 billion was credited to the LWCF account, but only $14.3 billion of that total was appropriated for use. Money is regularly diverted from the LWCF account to support other federal programs or budget priorities rather than being applied to conservation and recreation needs. LWCF should be funded at its fully authorized level to ensure the most robust financing possible for federal acquisition projects for the National Park Service. Making sure that the Park Service receives adequate funding is critical to ensuring that park staff have the means to protect our natural and cultural treasures from incompatible development.

Below: Santa Monica Mountains National Recreation Area in California would benefit from additional LWCF funds to purchase high-priority areas within the park's boundary. Photo courtesy of Tony Valois/National Park Service.

History Forgotten: The Condition of Cultural Resources

America's history lives on within our national parks. From Mesa Verde's cliff dwellings to the Gettysburg battlefield, our parks preserve the past so that visitors—from the United States and across the globe—can step back in time. Park visitors can stand where the Continental Congress gathered in Philadelphia to adopt the Declaration of Independence. At Civil War battlefields, visitors walk where soldiers stared down a line of cannons. More than any other American institution, national parks have the honor of preserving our history and interpreting the people, places, and events that form the rich tapestry of the American experience. In these venerated places, Americans can understand where we've been as a people and how our heritage affects where we're going.

That amounts to an extraordinary portfolio of significant American culture. Within the 394 national parks, the National Park Service holds in trust nearly 27,000 historic buildings, 3,500 historic statues and monuments, an estimated 2 million archaeological sites, and 123 million museum objects and archival documents—collections bested only by the Smithsonian Institution's assemblage of museums.

In addition to managing its own collections and properties, the National Park Service is also directed by law to assist many others who preserve America's heritage—other federal agencies, tribal governments, state and local governments, and the private sector through such nationally recognized programs as the National Historic Landmarks Program (the nation's premier and oldest list of nationally significant historic places) and the National Register of Historic Places (which now includes more than 1.3 million historic and prehistoric public and private properties). Annually, the National Park Service awards millions of dollars of federal matching grants, provides technical assistance, and administers a federal tax incentives program valued at more than $2 billion in private investment each year in the rehabilitation of historic commercial properties for the public benefit nationwide. The National Park Service is the closest thing the United States has to a heritage ministry.

Left: In 2010, nearly 560,000 people visited Mesa Verde National Park in Colorado. Protecting the resources that visitors go to parks to experience should be paramount throughout the National Park System. ©Dallas Clemmons

Top: These Japanese-American children were held with their families at the Manzanar War Relocation Center in California during World War II. Today Manzanar National Historic Site teaches visitors about this period of history. Photo by Dorothea Lange, War Relocation Authority, courtesy of the National Park Service. **Above:** The 18th-century Spanish missions of San Antonio Missions National Historical Park, which continue as functioning Catholic parishes, receive more than 1.5 million visitors each year. ©Stefan Witas/istockphoto

As such, the National Park Service bears a unique and unparalleled responsibility for the stewardship of America's cultural resources. Yet shouldering that responsibility is more challenging than ever. In researching the Park Service's responsibilities in our national parks, NPCA's Center for Park Research found that, despite a devoted and talented professional workforce, the parks' historic places, monuments, and collections suffer from decay and damage, inadequate budgets, congressional and agency inattention, and staff losses. In many parks, interpretive exhibits are dated, fading, and in poor condition. Many are based on outdated scholarship and fail to include such important stories as the roles of women, African Americans, American Indians, Hispanic Americans, and others. Artifacts molder for lack of funding and storage space. Historic buildings sit shuttered because of unsafe conditions. And battlefields often look nothing like the scenes soldiers saw during the battles. In 2011, which marks the 150th anniversary of the American Civil War, visitors to Vicksburg and Fredericksburg battlefields will encounter nearby private developments that mar the historic landscape, making it difficult to visualize what happened there a century and a half ago.

Inadequate funding, of course, is one culprit. But from the National Park Service's very inception, heritage preservation too often has played second fiddle to natural and scenic wonders—another, more systemic problem. Many people, including some within the agency itself, associate the National Park System primarily with natural wonders and wild landscapes and believe those places deserve top billing.

However, since its beginning in 1916, the National Park Service has been charged with protecting our nation's most important historic sites. The Reorganization Act (1933) and the Historic Sites Act (1935) expanded the Park Service's portfolio to include many of the nation's most historically significant battlefields, forts, and national monuments. By then, boasted Horace Albright, the agency's second director, the National Park Service got "into the history business."

More than 65 percent of the 394 national parks were designated to preserve places where the North American story took place, from prehistoric times to the present. Many of these are well known, such as the Spanish colonial missions of San Antonio, Texas, and Martin Luther King, Jr. National Historic Site in Atlanta, Georgia. Others are less famous though no less important—California's Manzanar National Historic Site and Louisiana's Cane River Creole National Historical Park, for example. All deserve exemplary stewardship. Yet the Center for Park Research found that the National Park Service is increasingly unprepared to meet its heritage preservation management challenges now and during its second century.

The Center's assessments of cultural resource conditions chart a course for change. By shedding light on the factors threatening our historic sites, artifacts, and stories, NPCA's Center for Park Research seeks to assist the National Park Service and its advocates with the massive task of protecting America's heritage for future generations.

Sagging Scores for Cultural Resources

Between 2001 and 2010, the Center for Park Research examined resource conditions at 80 national parks spread across the system (see the appendices online at www.npca.org/cpr for a list of parks examined, an expanded explanation of resources evaluated, and an overview of condition ratings). Of these 80, the Center for Park Research assessed the condition of park heritage properties and museum and archival collections in 77 parks. NPCA researchers consulted National Park Service cultural resources databases, examined reports and studies produced by or for the Park Service, visited parks in person, and conducted interviews with park and regional staff. When

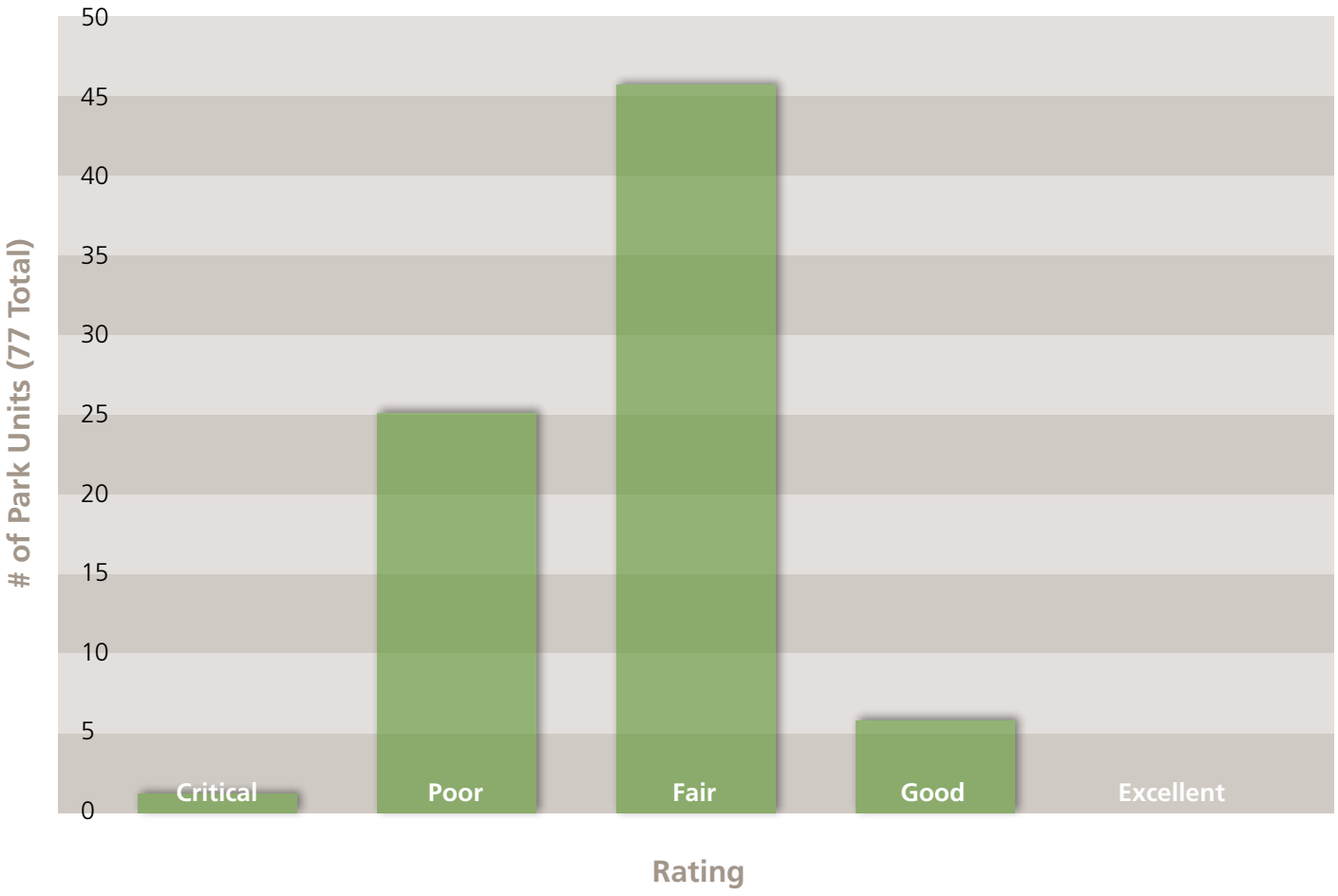
assessing the condition of parks' cultural resources, we employed a methodology based on the National Park Service's own *Cultural Resources Management Guideline*. The methodology analyzed the condition of archaeological properties, museum and archival collections, cultural landscapes, ethnography, historic structures, and the status of historical research.

Overall, researchers found that cultural resources in the National Park System—considered the most important to our country's heritage—are in serious trouble. In fact, these places and collections are being maintained in a condition well below the level that the National Park Service itself has deemed appropriate. In 91 percent of the parks we surveyed, cultural resources were found to be in "fair" or "poor" condition (see Figure 2). None merited an "excellent" rating. And the weaknesses are widespread. The problems affecting cultural resources occur across park designations and across regional divisions.

In 91 percent of the parks we surveyed, cultural resources were found to be in "fair" or "poor" condition.

For the most part, cultural resource scores were generally similar among all six cultural property types (archaeological resources, museum and archival collections, cultural landscapes, ethnography, historic structures, and historic research). Most categories trended toward a "fair" rating; however, scores in the ethnographic and cultural landscape categories received more "poor" ratings than "fair." Both the ethnographic

Figure 2. The overall condition of cultural resources within U.S. national parks assessed by the Center for Park Research.



and cultural landscape disciplines are somewhat recent additions to the parks' cultural resource programs. Consequently, these efforts have had less time to mature, which might explain the higher number of "poor" ratings. In fact, only 51 parks had ethnography programs with enough available information to determine scores.

Yet the two resource categories that have been part of park management for the longest time—archaeology and historic structures—did not score higher than the rest, as might be expected for long-established programs. Instead, they closely matched the distribution of overall scores. This suggests that the length of time a program has been in place does not necessarily correlate to the condition of the resources (the top-scoring categories were history and museum and archival collections—which aren't the longest-lived programs).

Cultural resources fared better at parks dedicated specifically to their preservation, rather than to the preservation of natural resources.

Finally, as might be expected, cultural resources fared better at parks dedicated specifically to their preservation, rather than to the preservation of natural resources. Among national military parks, national historic sites, and heritage-focused national monuments, the average overall cultural resources score is 72 out of a possible 100; for units with National Park designation—considered the highest level of resource protection in the system—it's only 58. Such findings suggest that unless cultural resources are the unit's priority, they suffer from neglect—even at otherwise well-run, well-maintained parks.

Below: Cultural resources at Shiloh National Military Park, site of Civil War battles, were found to be in better condition than those at many of the other parks assessed by the Center. Photo courtesy of the National Park Service.

America's Imperiled Heritage

The Center for Park Research assessment program identified six interrelated causes common to the condition of cultural resources in our national parks today: 1) lack of professional expertise, 2) lack of oversight and monitoring, 3) incomplete research, documentation, and planning, 4) lack of needed maintenance and conservation work, 5) lack of integration of resource information into interpretive programming, and 6) insufficient budgets.

There simply aren't enough qualified and trained people overseeing the parks' cultural heritage. During the past 10 years, the number of these individuals has declined by more than 25 percent. When cultural resource staff vacancies occur, they are too often left unfilled—leaving a gap in expertise and services. Some units have never filled critical cultural resource positions, but have relied instead on circuit-riding regional staff or independent contractors who undertake specific projects but provide no long-term oversight or care.

Only 4 percent of the more than 20,000 National Park Service employees nationwide are dedicated to cultural resources management, according to the National Academy of Public Administration's 2008 report *Saving Our History: A Review of National Park Cultural Resource Programs*. Of the parks assessed by NPCA, 65 percent lacked the minimum professional staffing needed to oversee museum and archival collections and address the growing backlog of museum objects. At Hopewell Furnace National Historic Site in Pennsylvania, there is no professionally trained archivist to care for the 185,000 items in the archival collection, 64 percent of which are not catalogued.

Each cultural resources discipline requires different expertise and training, yet very few parks the Center assessed have the unique complement of professionals needed to do the job. Regional offices are supposed to fill those gaps, but the Park Service's Midwest Regional Office, for example, which is responsible for 58 park units in 13 states, has only four professionally qualified historians and only one cultural anthropologist. And the Center found that 23 out of 60 assessed parks with historic structures scored 5 or less on the 10-point assessment scale for having staff trained in historic structure and building preservation maintenance.

For the existing workforce, budget cuts and competing management priorities have reduced or eliminated heritage preservation training, education, sabbaticals, and participation in the scholarly arena. Where the National Park Service once was viewed as a leader in heritage and cultural resources research, conservation, and management, today that distinction has disappeared. What's more, cultural resource specialists too often get drawn into general duties. Case in point: A curator at Appomattox Court House National Historical Park in Virginia is also expected to perform a host of collateral duties such as leading tours and manning the visitor center information desk—activities that steal time from his cultural resource maintenance projects.

When it comes to caring for the prehistoric and historic places, monuments, and museum collections in the Park Service's care, there is no higher priority than professionally trained staff. For example, storage facilities play an important role in the overall condition of museum and archival collections, but the Center's assessment found a stronger link between resource conditions and having adequate personnel: Trained museum and archives specialists can take action to mitigate the negative impacts of poor storage facilities, but a great facility cannot make up for a lack of cataloguing and conservation work by knowledgeable staff.

Above: When parks have available funds, specially trained staff in Museum Conservation Services at Harpers Ferry Center for Media Services provide expert care to some of the priceless objects within national park museum collections. Photo courtesy of Gary Tarleton/ National Park Service.

Top: Rangers discovered this graffiti on a large prehistoric rock art panel at Glen Canyon National Recreation Area. They apprehended and successfully prosecuted the offender. Photo courtesy of Cynthia Adams/National Park Service. **Above:** A trained professional removed the graffiti, allowing visitors to continue to admire the ancient inscription. Photo courtesy of Talela Florko/National Park Service.

Lack of oversight and monitoring can allow damage and deterioration, and lead to a loss of heritage. With too few park staff to watch over them, park prehistoric sites and battlefields are looted and destroyed, historic buildings are vandalized, and museum collections are left to deteriorate. At San Juan Island National Historical Park in Washington, illegal collecting of archaeological artifacts is known to occur, yet the park has no monitoring program in place to stop the problem. At Mississippi's Vicksburg National Military Park, regional archaeological employees have conducted six investigations of looting, but the park's limited documentation of resource conditions and lack of on-site monitoring have prevented prosecution. Yet, it's also clear that timely monitoring can, in fact, protect cultural sites, as a recent case at Glen Canyon National Recreation Area demonstrates. There, a concessions worker discovered graffiti on one of the park's rock art panels and reported the damage to park staff. Because the staff were properly trained and regularly monitored that site, they found the vandalism promptly and were able to find and identify the culprit, which led to a successful prosecution.

In many cases, however, resources can't be guarded—because they haven't even been identified or catalogued. In 2000, the National Park Service estimated that 43 million of its 80 million museum artifacts were uncataloged, and 28 million objects were at risk for decay or loss. At Gateway National Recreation Area in New York and New Jersey, the Center found that some of the park's National Register-listed properties were not even entered in the List of Classified Structures, a service-wide database of both historic and prehistoric structures.

Once cultural resources are identified and documented, cost-effective management demands regular and continuing oversight and monitoring to alert park administrators of any adverse change in condition. Capitol Reef National Park in Utah has the staff to conduct annual monitoring of the park's 25 historic structures, and the data are kept up-to-date in the List of Classified Structures. Comprehensive condition assessments for each structure are performed every five years, and all structures have been evaluated for eligibility for listing in the National Register of Historic Places. But that's the exception, rather than the rule. Generally, monitoring is infrequently completed—if undertaken at all. Fourteen of the 77 park units NPCA assessed had no records of monitoring activities for the museum collections. At Hawai'i Volcanoes, the most recent annual monitoring for historic structures was performed nine years before the Center for Park Research assessment; at Sleeping Bear Dunes National Lakeshore, it had been ten years since a complete monitoring update was completed. Forty-one parks (53 percent) were rated "fair," "poor," or "critical" in regard to annual monitoring.

At some park units, no annual monitoring programs exist, or there was no available information about it during the Center's assessments. For example, Big Bend National Park in Texas had no annual monitoring program in place for historic structures, even though the park has 69 structures either listed on or eligible for the National Register of Historic Places. At Big Bend, due to lack of staff and competing management priorities, inspections of historic buildings are conducted on a five-year rotational cycle only for the most heavily visited or publicly accessible structures. At Bryce Canyon National Park in Utah, information in the List of Classified Structures was more than five years old, and historic preservation staff members—who had been reassigned to general maintenance duties—were unfamiliar with it.

Routine monitoring does more than just amass a database of information for its own sake. It contributes to resource protection by deterring theft. It provides credible and actionable data for making the best decisions in an era of diminishing funding. By

contrast, the lack of monitoring sends parks into a downward spiral, because without up-to-date information, parks cannot compete for and acquire the funding they need to care for their cultural resources.

Incomplete research, documentation, and planning take a toll on resource health. The first step in cultural resources management is to identify, evaluate, and document the properties and collections in the Park Service's care. Unidentified and unevaluated resources simply cannot be appropriately preserved, protected, or interpreted. Many cultural and heritage planning documents (such as comprehensive interpretive plans, historic resources studies, ethnographic overviews and assessments, cultural landscape reports, and collection management plans) are inadequate, nonexistent, or out-of-date. Because these research and planning documents inform a park's larger planning documents, processes, and decision-making, their absence means that cultural resources continue to be ignored as park managers determine how to spend limited time and money. Simply put, unless the prehistoric and historic properties and collections have a seat at the planning table and are supported with authoritative proof of their importance and condition, they are not taken into account when decisions about park priorities and budgets are made.

Unidentified and unevaluated resources simply cannot be appropriately preserved, protected, or interpreted.

Over the years, each National Park Service cultural resources discipline has established nationally and professionally recognized foundation studies and planning documents that serve these interests for each park. A historic resource study and its accompanying report identify and describe the historical themes relevant to the park. An archaeological overview and assessment serves as the baseline for archaeological research in a park, describing the human history of the area, prior research, and likely themes for further research and survey. Historic structure reports describe the significance of historic buildings and structures, document their construction and use history, and provide guidance for appropriate preservation treatment. A cultural landscape report is similar to the historic structure report, but focuses on the designed, vernacular, or ethnographic landscapes of the park. The museum catalog identifies and describes each artifact in the park's care. Park archives are identified and described using somewhat different documents, but in national park units, archival collections are frequently catalogued in the same system used for museum artifacts. And finally, ethnographic overview and assessment studies identify and document park sites significant or sacred to traditional communities living nearby.

The Center for Park Research found that all of the parks it assessed were lacking the foundation studies identifying and documenting resources for one or more disciplines, or the reports were out-of-date or incomplete. Twenty-eight percent of the 77 national parks assessed had no historic resource studies. For many parks that did have historic resource studies, they were written when the parks were first established and had not been updated for decades, and oftentimes omitted significant historical themes or evolutions in scholarly research. For example, the 50-year-old historic resource study for Pea Ridge National Military Park in Arkansas does not include the pre-war transportation and communication history of the Telegraph Road and its role in the Trail of Tears, or the history of the Leetown hamlet adjoining the battlefield, where the wounded were tended after the battle.

Forty percent of the parks assessed by the Center for Park Research had no archaeological overview and assessment study. Case in point: Canyonlands National Park in Utah, which has many known prehistoric sites such as the Barrier Canyon rock art, has studied a few park areas known to have archaeological resources—but no comprehensive park-wide assessment has been undertaken. Similarly, at Lake Clark National Park and Preserve in Alaska, where survey and fieldwork can be conducted

only during the brief summer, an archaeological overview and assessment is critically needed to identify the highest-priority survey areas in the vast acreage of the park before rising water levels and glaciers melting due to climate change inundate or destroy important Athabaskan sites.

Sixty-six percent of the parks assessed by the Center for Park Research had no ethnographic overview and assessment nor comparable research. Moreover, a number of park units had no ethnography program in place, and of those, there were nine parks where an ethnography program seems highly appropriate. At Chesapeake and Ohio Canal National Historical Park in the Mid-Atlantic, for example, no ethnography program was in place at the time the park was assessed by NPCA even though American Indians and Free Blacks historically worked and lived along the canal, and their descendants are still present nearby today.

Sixty-eight percent of the parks assessed by the Center for Park Research had incomplete cultural landscape inventories. At Fort Donelson National Battlefield in Tennessee and Kentucky, a cultural landscape inventory and report are needed to guide restoration and maintenance of a battlefield where the visible remains of the historic scene are slowly being eroded or overgrown. Nearly half of the park units assessed by the Center for Park Research had no historic structure reports. Thirty parks assessed by the Center for Park Research had more than 40 percent of their museum and archival collections still uncataloged. At Olympic National Park in Washington, virtually all of the archival collection, consisting of more than 450,000 documents, was uncataloged at the time of the assessment in 2004.

Above: Parks such as Chesapeake and Ohio Canal National Historical Park are in need of ethnography programs to identify, document, and foster their connections to past and present cultures. Photo courtesy of the National Park Service.

Completing these critical foundation studies requires that parks first prioritize them. These priorities are established in park planning documents such as resource management plans, resource stewardship strategies, and general management plans. These documents reveal the emphasis that park management places on different resources and challenges in the park. For five of the cultural resources disciplines, the Center for Park Research asked how a park's resource management plan or other primary management planning document guides protection of the resources within each respective discipline. The Center for Park Research assessment program found that when planning documents give priority to cultural resource needs, resource conditions tend to be better.

The absence of resource documentation and planning documents denies our heritage the protection—and prioritization—it needs to withstand the rigors of time. More importantly, the National Park Service has failed to develop either a holistic national process for assessing cultural resources nationwide, or a strategic vision for its heritage and cultural resource management responsibilities. None currently exists; none is planned. Such shortcomings compromise the agency's intellectual relevancy. To occupy the forefront of heritage preservation, the National Park Service must engage the most current historical methods and interpretations—not outdated or incomplete sketches. By positioning itself at the leading edge of cultural resource protection, the Park Service will attract and keep the brightest minds in the business, those capable of guarding this great nation's heritage for the appreciation of future generations.

Deteriorated historic buildings and structures are the most visible example of the poor condition of parks' cultural resources. In 2003, the National Park Service estimated that more than 60 percent of the nearly 27,000 park historic structures nationwide were in need of repair and maintenance. These estimates were confirmed in the National Academy of Public Administration's 2008 report.

The Center for Park Research assessments echo such findings: Out of 77 parks assessed, 20 reported deferred maintenance costs in excess of $1 million each; West Virginia and Maryland's Harpers Ferry National Historical Park alone estimated $59 million in deferred maintenance and rehabilitation costs.

Many parks, however, do not even know what their deferred maintenance costs are; more than a dozen of the assessed parks with historic structures were unable to provide figures. So the recorded total for the system likely falls far short of the actual need. If the structures have no documentation to guide treatment, or their condition has not been monitored, park staff can only guess at the work that is needed. What's more, the Facility Management Software System used by the National Park Service to track and calculate deferred maintenance costs for all structures (historic and non-historic) does not adequately account for the unique materials and techniques required to maintain or restore historic structures, making it even more critical that thorough documentation is done before any work is performed, and that a qualified historic architect provides guidance for the work.

Because the National Park Service does not track deferred maintenance for all cultural resource property types, only for historic structures, the actual cost of work needed to bring all the cultural resources in all the parks up to good condition is unknown, but would likely be staggering. Nevertheless, it's a cost worth estimating—just as preserving national parks' historic places and material culture is a goal worth striving for. These

To occupy the forefront of heritage preservation, the National Park Service must engage the most current historical methods and interpretations.

Below: Historic structure reports are important for ensuring places such as the Century of Progress homes from the 1933 World's Fair—five of which are now located at Indiana Dunes National Lakeshore—are appropriately managed. ©Darel Heitkamp

The treasure trove of cultural resources contained in the parks will lose much of their meaning and value to the American public if they are not shared with park visitors and park advocates.

places are authentic; they are the real thing, in real place and time—something that no re-creation or virtual tour can supplant.

Resource information isn't always integrated into interpretive programming. Park interpretation focuses on the natural and cultural resources of each park, and uses them to tell the park's story. The incomplete documentation and inventory of cultural resources, and lack of professional staff to conduct research, means that information is not available to interpretation staff—and thus to the visiting public. Historic buildings that are not adequately researched, and museum objects that have not been catalogued and conserved, cannot be used to illustrate the American story our national parks are charged to preserve. The treasure trove of cultural resources contained in the parks will lose much of their meaning and value to the American public if they are not shared with park visitors and park advocates.

The Center for Park Research inquired how effectively cultural resources are integrated into park interpretive programming and found that 63 of the 68 parks responding evidenced significant deficiencies in at least one resource category. Archaeological resources fared the worst, with 80 percent of the park units rating no better than "fair." Only for the history category did more than half the park units assessed rank "good" or "excellent" for the inclusion of this key research into the park's interpretive planning and programs.

Making cultural resources an integral part of a park's interpretive themes must be established in budget priorities, management plans, and interpretive plans—and must be embraced by staff, from the superintendent down through the ranks. A long-standing division in the park system between "nature" parks and "cultural" parks (along with legislation for individual units that ignores cultural resources) has oftentimes demoted cultural resources as an interpretive theme in some park units. At Bryce Canyon National Park, for example, the Center for Park Research assessment found that former park management considered cultural resources to be of lesser priority than the park's natural resources, and therefore did not include them in interpretive programming.

At many small parks, staffing limitations mean that one individual may have responsibilities in both resource management and interpretation. At larger parks, these duties are usually assigned to separate teams; before cultural resources can be adequately included in interpretive programming, park staff other than cultural resources specialists and managers must understand the value of the resources. The Center's assessment process asked whether other staff and visitors understood the historic significance of park cultural resources. Park staff responded with a "good" rating at less than 25 percent of the parks assessed, and staff at more than half the park units did not feel they could answer the question. Such findings suggest that most cultural resources staff and park managers feel their stories are failing to reach their intended audience.

In order to accurately represent the American story and be relevant to all citizens, parks must look for opportunities to protect not only significant cultural resources important to different people, but to tell the complex stories related to the American experience. The National Parks Second Century Commission identified this expansion of the scope and interpretation of the American story as a key element in maintaining the National Park System's relevance in a changing country. The shortcomings noted by the Center for Park Research—concerning research and documentation, inventory and monitoring, adequate and credible professional

staffing, and resource maintenance—all affect a park's ability to effectively and professionally interpret cultural resources. These deficiencies must be addressed in order to present the full spectrum of stories the parks preserve.

System-wide Challenges Need System-wide Attention

The factors identified here build on one another. Monitoring the condition of resources cannot take place if initial research and documentation haven't been done; both steps require staff with the appropriate professional expertise. Parks find it difficult to garner funding for maintenance of historic structures without proof of the structures' importance and up-to-date condition reports. And if they secure funding, they need trained staff to perform the maintenance work to Park Service professional standards. Finally, this information must be shared in order to tell the story of America—but interpretation cannot happen if the research, inventory, and maintenance haven't been done or are woefully out-of-date.

In a number of instances, the National Park Service is doing an exemplary job of preserving and protecting the historic places and artifacts in its care. Championed by loyal, dedicated, and oftentimes overworked National Park Service professional staff, the task of fulfilling the agency's statutory mandate to preserve these places unimpaired while providing for the enjoyment and benefit of these places by the American public has become an ever-increasing challenge.

Cultural resources in the national parks are suffering system-wide neglect. Natural processes (such as age and erosion) and human-caused problems (such as vandalism) are not the primary problems; these threats can be mitigated through thoughtful and professionally credible research, planning, and partnerships. Certainly, budget and staffing shortfalls have stymied many such efforts. The greatest threat to parks' cultural resources is lack of focused management. Administrative inattention is oftentimes the underlying cause for so many "poor" and "fair" ratings.

There exists a pervasive assumption among the public, Congress, and some National Park Service administrators (past and present) that the primary mission of the agency is the protection and conservation of natural resources and scenic wonders—and that heritage properties and material culture are of secondary importance, or worse, a regrettable diversion of time and funding. While NPCA has helped get near-record funding increases for National Park Service operations over the past several years, funding and staffing levels for cultural resource protection and preservation programs have decreased by more than 25 percent during that same time.

Assumptions that subordinate history to scenery are due to be corrected. With two-thirds of the parks having been established because of their historic and cultural resources, and with significant cultural resources at all of the parks, it's time to give cultural resources equal billing. Moreover, as the National Park Service strives to reach new audiences and make our parks relevant to new generations, the enormous collection of heritage properties and collections contained within the parks may offer the best opportunity to connect all Americans—not just the nature lovers—with "America's best idea."

Above: In the early 1960s, visitors removed these pots and gourds from land that later became part of Canyonlands National Park. In 2002, the artifacts were returned to the park. Photo courtesy of the National Park Service.

Solutions to Resource Challenges: What Is Working in the National Park Service

Across the continent and extending into the Atlantic and Pacific Oceans, the National Park Service protects and interprets a wealth of natural and cultural resources. Yet when it comes to safeguarding these treasures, Park Service designation, by itself, is not a panacea. The Center for Park Research's decade of assessments at 80 of these parks shows the majority of parks' natural and cultural resources to be in "fair" or "poor" condition. Their degradation results from a range of factors—from land use history to system-wide funding limitations, from urbanization to climate change.

Even in the face of these challenges, dedicated national park staff have demonstrated a knack for holding the line in preserving and protecting natural and cultural resources. Many of the parks we visited have developed certain resource management approaches that address the particular challenges affecting that park—efforts that are often initiated by enterprising staff. Staff are enhancing resource conservation by leveraging existing Park Service programs, creating new partnerships, and injecting fresh energy into long-standing methods.

Innovation and commitment are obvious throughout the National Park Service. Employees are solving resource problems at park, regional, and system-wide levels. Where leadership, communication, and commitment intersect to improve resource conditions, the results become an inspiration for the administration, Congress, and the American public to redouble their support for our national parks and the people who protect them.

This chapter highlights model approaches uncovered in the Center's assessment program and in NPCA's work in parks across the country. These success stories serve as examples to light the way for future efforts and guide improvements to both emerging and long-term resource challenges described in "Under Fire" and "History Forgotten." Rather than presenting separate strategies for natural and cultural resources, we suggest four resource management approaches that work across the spectrum and provide examples of these initiatives in action.

Left: Removal of non-native species and a captive breeding program have helped restore Channel Islands' native island fox population. ©Ian Shive/Tandem

Proactive Restoration and Maintenance: Addressing Past Damage and Damage to the Past

Undoing natural and human-caused damage to resources and protecting them from further harm are among the most pressing needs the Center for Park Research found when conducting its assessments. Park staff, uniquely positioned to understand and protect the resources they see every day, play a pivotal role in restoring resources that have been degraded by previous human activities, preventing inadvertent damage from visitors, and ensuring the preservation of important historic artifacts and other cultural resources.

Above: Glacier Bay's vessel management plan helps prevent ships from striking marine mammals such as whales. ©Neta Degany/ istockphoto

Channel Islands National Park, 26 miles off the coast of California, is a place with unique flora and fauna due to its relative isolation from the mainland. These special resources suffered dramatically beginning in the mid-19th century, when Anglo-Americans, Europeans, and other immigrants brought livestock to some islands, introduced rabbits for food, and began extensive hunting and fishing. Grazing by livestock and rabbits destroyed native plant communities, accelerated soil erosion, and fragmented habitats. Hunting decreased the native sea otter populations, and the loss of this predator allowed sea urchin populations to grow and overgraze the giant kelp beds that fish rely on.

The National Park Service, working with partners such as The Nature Conservancy, has implemented a large-scale project with the goal of restoring the degraded ecosystems of Channel Islands. Teams have eradicated non-native horses, rats, pigs, sheep, cows, cats, donkeys, European honeybees, and rabbits from the islands and reintroduced bald eagles. While there is still much to do, these efforts have achieved important restoration milestones: Native grasses have taken hold in formerly degraded habitats, and the native island fox population (which once numbered just 70 individuals) has grown to more than 1,000. Meanwhile, the park is pursuing the restoration of a coastal wetland on Santa Cruz Island. The lesson offered by Channel Islands and other parks around the country is that restoration efforts, even in highly disturbed landscapes, can benefit native ecosystems and protect park resources.

In addition to restoring degraded natural resources, parks also shield resources from inadvertent damage by park visitors—the longstanding problem of the parks "being loved to death." Glacier Bay National Park and Preserve in Alaska needed to address the pressures on marine habitats from the burgeoning number of visitors arriving by boat. In 2003, the Park Service published a vessel management plan that limits the number of boats using park waters. The plan is based on scientific research and monitoring studies that focused on marine habitats and communities and emphasized marine mammals, particularly impacts of ships of all sizes on whales. The plan sets speed limits to prevent ship strikes on marine mammals, including the northern humpback whale. As Glacier Bay's approach demonstrates, scientific surveys and monitoring projects represent much more than mere paperwork: They inform important resource-saving practices.

Pea Ridge National Military Park in northwest Arkansas protects land that was under agricultural production at the time of the Pea Ridge battle in 1862. Wooded pastures and croplands were separated by miles of split-rail fencing to keep cattle out of the corn and hay. This fencing, as well as the sightlines and cover provided by different vegetation, was critical to the movement of troops and progress of the battle. But by the time Pea Ridge became a park in the mid-20th century, the fencing was long gone, and changes in vegetation obfuscated the views the soldiers saw, making it difficult for visitors to imagine the 1862 drama.

The park had good documentation of the placement of the fences and the vegetation cover, but always lacked the staff to undertake restoration work. So when a local corporation joined a national volunteer program for the parks, the staff at Pea Ridge took advantage of the large labor force to rebuild 14 miles of split-rail fencing and restore five miles of historic road traces. The efforts dramatically improved visitors' experience by helping them envision the landscape that influenced the Pea Ridge conflict. But the project also improved community relations between the park and local residents, since local volunteers returned to the park to show off "their" fences to family and friends. Park staff recognized the need to maintain that sense of engagement and ownership and continued to stay in touch with the volunteers while looking for additional restoration projects in which to involve them. Pea Ridge's example highlights creative ways park staff harness manpower when little exists at the employee level. In fact, the contribution of volunteers at national parks across the country was lauded at all the parks we assessed. In 2007, the latest year for which estimates are available, volunteers from communities near parks and from more distant areas provided more than 5.4 million hours of service.

In 2007, volunteers provided more than 5.4 million hours of service in national parks.

In 1993, the National Park Service's Historic Preservation Training Center in Maryland launched the Preservation and Skills Training program (PAST), designed to train park facilities maintenance staff in preservation techniques and philosophy, with the goal of having at least one trained preservation maintenance worker in every park unit. By the end of 2007, 140 staff had completed the program, representing 99 parks and regional offices. When an independent study was conducted in 2008 to evaluate the outcomes

Below: Volunteers have helped rebuild miles of split-rail fencing at Pea Ridge National Military Park. Photo courtesy of the National Park Service.

and return on investment of the PAST program, it found that 77 percent of program graduates said historic structures in their parks were in better condition as a result of their PAST training. In addition, PAST graduates shared their knowledge by acting as instructors on preservation projects and leading classroom training. The PAST program evaluation also indicated that having PAST graduates on staff led to earlier intervention and maintenance for historic properties.

All of these success stories highlight the importance of having trained staff who are committed to resource preservation and restoration. Even in small numbers, such professionals can have a big impact on the resources they care for.

Management approaches that consider parks as part of the greater landscape and community fabric are better able to achieve stewardship goals.

Collaboration, Communication, and Cooperation: Working Together to Protect Resources

As documented throughout this report, national parks rarely exist in isolation, and many challenges facing park resource managers stem from activities occurring outside park boundaries. As a result, management approaches that consider parks as part of the greater landscape and community fabric are better able to achieve stewardship goals. Our assessments found that parks that proactively reach out to other stakeholders—including park friends groups, other federal agencies, and local governments, businesses, and nonprofit groups—develop relationships that positively affect resources. Parks demonstrate varying ways to interact effectively with their neighbors, and these interactions often serve as an important aspect of resource management.

Below: Pictured Rocks National Lakeshore includes a buffer zone cooperatively managed by the Park Service and several other entities to promote resource stewardship and economic success. ©Dean Pennala/istockphoto

Along the shores of Lake Superior in Michigan, Pictured Rocks National Lakeshore was the first designated national lakeshore in the park system, and it is the only park with a buffer zone explicitly created by its enabling legislation. The legislation designated a strip of land along the lakeshore as federally owned and managed by the Park Service, while also creating an inland zone within the park boundary with acreage owned by several different entities (including the State of Michigan, corporations, and private citizens). The intent was to allow continued sustainable logging within the buffer while also protecting park lands. This arrangement requires that the park and its neighbors work together to promote resource stewardship goals and economic success. Local zoning regulations guide activity within the buffer zone, but the Park Service has a role in educating the zoning board and ensuring that land-use decisions adequately protect the resources of the lakeshore. In this case, the park's unique arrangement emphasizes cooperative management and requires significant interaction and collaboration between park staff and other public and private stakeholders.

Some parks partner with community organizations to maintain and use park structures, including historic properties. Valley Forge National Historical Park in Pennsylvania has had great success leasing one of its historic properties to a local Montessori school. While the property is historic, it is not part of the park's main interpretive theme, and the park had no interpretive or administrative use for the property's deteriorating buildings. The school has used private funds to rehabilitate the property in accordance with the Secretary of the Interior's historic preservation standards. What's more, tuition fees that parents pay include membership in the Friends of Valley Forge National Historical Park, which further links the school community to the park. Historic buildings are also being adaptively reused in the Park Service network of Research Learning Centers—supporting the research and scholarship needs of parks by providing housing and lab space while connecting researchers to students, teachers, schools, and visitors.

An outstanding example of partnership and collaborative management in the park system is the Appalachian National Scenic Trail, which is unique among other park units in several ways. It was established and constructed largely by volunteers, and volunteer efforts continue to maintain and protect it. The trail is managed by a consortium of private organizations and public agencies, most notably the Appalachian Trail Conservancy (ATC), which is responsible for day-to-day management of the Appalachian Trail, coordination of 30 independent trail-maintaining clubs, financial management and fund-raising for the trail, and maintenance and stewardship of the lands through which the trail passes. The ATC and other managing organizations coordinate with the National Park Service through a memorandum of understanding that outlines their responsibilities.

This partnership between the ATC and the Park Service represents the definition of synergy: Together the two organizations can accomplish much more than either could do alone. Being a part of the National Park System provides the Appalachian Trail with federal protection, skill sets, standards, and funding. Yet the Park Service could not maintain the trail without the tireless contributions of the ATC, its trail-maintaining clubs, and numerous volunteers, as well as the private funds poured into these efforts. The arrangement is considered a model for public-private collaboration in conservation and public agencies.

Above: The Appalachian Trail was built largely by volunteers, and volunteer efforts continue to maintain and protect it. ©Kathryn Case/ Appalachian Trail Conservancy

In a few cases, a park's enabling legislation mandates engagement between a park and its local community. Lake Clark National Park and Preserve, on the western shore of Cook Inlet in southwestern Alaska, must make provisions for Alaska Natives to receive hiring preference for park jobs and local residents to continue their traditional subsistence use of park lands. But with particularly strong programs in history and ethnography, Lake Clark National Park and Preserve goes beyond the requirements of its mandate to make Native voices a central part of park resource management and interpretation. Current projects include a study of Native place names and a cultural atlas that will include Native stories and essays in addition to historical maps and photographs. The park provides an exceptional model for integrating diverse peoples into interpretive programming.

Engaging local communities and partnering with other government entities, organizations, and private individuals allows the National Park Service to more effectively address resource management concerns and foster resource stewardship both within parks and outside their borders. At all of these parks, volunteers accomplished critical resource management work that could not have been done by park staff alone. Perhaps even more importantly, the parks gained a constituency of community residents who have a deeper understanding of the resources than could be gained through traditional interpretation programs.

Overall, however, few parks take advantage of the opportunities available to them through partnership programs. Greater communication and sharing of information about successful projects among parks could help resource managers make better use of these opportunities to interpret and protect park resources.

Top: Many Alaska Natives and other area residents rely on plants and animals at Lake Clark National Park and Preserve for subsistence. Photo courtesy of Page Spencer/National Park Service. **Above:** Lassen Volcanic National Park uses prescribed burns as a tool to restore ecosystems. Parks without fire crews can get help from regionally based Wildland Fire Modules. Photo courtesy of the National Park Service.

Tackling Technical Challenges: Teams of Specialists Provide Expertise and Support

Some resource challenges facing individual parks are too large or too complex for the staff at those parks to manage. Sometimes, enlisting volunteers can address the issue. Often, however, a park requires more than just able bodies; it requires technical expertise. The National Park Service has initiated programs where teams of specialists serve multiple parks. The idea behind this team approach is that personnel with certain expertise are vital to most parks, but not many parks can afford to employ specialized staff to deal with every problem. By establishing regional or centralized teams of people to provide this technical assistance, the Park Service can deploy core teams to serve multiple parks on an as-needed basis.

In 2000, the Park Service created regional teams of invasive plant specialists who work with park staff, contractors, service organizations, and volunteers to combat non-native invasive plants in national parks throughout the country. Because these teams serve parks within certain geographical areas, they develop a familiarity with the common invasive plants and get to know the most effective tactics and best management practices for treatment and restoration.

Demand is high for these Exotic Plant Management Teams. Of the 61 parks where we assessed natural resource conditions, staff in more than one-third of them indicated that regional Exotic Plant Management Teams had assisted them. For example, Georgia's Cumberland Island National Seashore offers visitors undeveloped sandy beaches and excellent opportunities for wildlife viewing. Like many other parks, several non-native plants were intentionally introduced and are now deemed an important part of the park's cultural landscape; however, these plants are unwanted in many of the park's natural habitats. With assistance from the Exotic Plant Management Team serving the

Southeastern United States, the park cleared nearly six acres of bamboo, tung oil tree, Chinese tallow, tree of heaven, and tamarisk. Continued funding is required to ensure that invasive non-native plants do not creep back into cleared areas and to pursue further invasive plant control work on the island.

The Park Service has taken a similar team approach with fire management, since not all parks can afford the staff and equipment to conduct prescribed burns and control wildfires. Wildland Fire Modules, teams of fire specialists based at nine parks around the country, assist parks that require prescribed fire to lessen fuel loads, restore vegetation and wildlife habitat, and combat invasive plant infestation. For example, the Wildland Fire Module based in Great Smoky Mountains National Park supported the staff of South Carolina's Kings Mountain National Military Park in reducing fuel buildup, thereby reducing the chance of catastrophic wildfire. In the process, they thinned the understory vegetation to re-create the historic views and feel of the landscape present at the time of the Revolutionary War battle that took place there.

Regional teams have not been formally developed within the Park Service's cultural resource program, but some informal arrangements do exist for parks with larger cultural resource staffs or particular expertise to assist other parks with similar resource issues. For example, the Ruins Preservation Team from Mesa Verde National Park in Colorado works on projects throughout parks of the Southwest, and the adobe specialists from Tumacácori National Historical Park in Arizona have assisted other

Informal arrangements exist for parks with larger cultural resources staffs or particular expertise to assist other parks with similar resource issues.

Below: Tumacácori's adobe structures are cared for by specialists who share their expertise with other parks. ©luchschen/istockphoto

Expanding the scope of regional teams and national centers from periodic assistance to a more robust training program would provide parks with access to the professional expertise they need on a regular basis.

parks with adobe structures. These efforts are part of the Vanishing Treasures initiative, a collaboration among park resource managers in the Southwest to preserve prehistoric and historic ruins by obtaining designated funding for these projects and helping preservation specialists train younger park staff to take over these responsibilities. Duplicating this initiative to create a formal system of regionally focused teams of specialists, similar to what exists for natural resources, would help address the challenge of making professional expertise available to parks and would provide the concentrated effort needed for large preservation projects such as historic structure or cultural landscape maintenance.

The PAST program for historic preservation, described earlier in this chapter, combines many of the features of the regional team approach with a base at a national center. The success of the PAST program in developing park-level professional expertise in historic preservation could be adapted for other cultural resource disciplines for which the National Park Service has a dedicated center, such as the Museum Conservation Services at Harpers Ferry Center for Media Services, the Olmsted Center for Landscape Preservation, and the National Center for Preservation Technology and Training. Developing training programs on the PAST model would allow the Park Service to leverage the expertise in these centers to train park employees to address critical cultural resource stewardship needs in their own parks.

Both regional teams and national centers address the need for limited, project-specific technical expertise in the parks. Our assessments found, however, that the need for technical assistance often extends beyond the completion of a project, and maintaining some level of expertise in the park is critical to the ongoing success of resource management efforts. Expanding the scope of these regional teams and national centers from periodic assistance to a more robust training program would leverage the investment the Park Service has made in establishing them and provide parks with access to the professional expertise they need on a regular basis.

Broadening Research: Harnessing the Power of Networking

The research parks conduct on natural and cultural resources informs smart management decisions. Ongoing work to monitor resource conditions and to evaluate the effectiveness of management efforts is a critical element of resource stewardship. Some parks have extensive science and research programs that are integral to their resource management efforts. Grand Canyon National Park is one of the best examples, with a strong archaeological research program and extensive natural resource research on park lands. The majority of parks across the system, however, cannot support extensive research programs, and many are unable to initiate even the most fundamental studies. Bridging this gap in research and knowledge, between the haves and the have-nots, remains a critical goal for the National Park Service.

Expanding the Inventory and Monitoring (I&M) Program is one way to bridge that gap. In 1999, the Park Service developed I&M to support the development of systematic monitoring efforts nationwide by collecting information on air quality, geologic resources, water quality, plant communities, and wildlife. The I&M Program has since become one of the standard-bearers in the National Park Service's endeavor to better understand the natural resources under its care, to use that understanding to manage and improve the condition of resources within parks, and to improve communication of those data to other agencies and the public.

Parks Do Their Part to Improve Air Quality

Throughout the National Park System, park staff are implementing shuttle systems to help improve air quality. In 2005, Muir Woods National Monument in California initiated a park-and-ride shuttle system that has helped alleviate crowded parking lots and improve air quality and visitor experience. The shuttles have reduced vehicle traffic to Muir Woods, thereby easing congestion, curtailing illegal parking along roadways, and reducing air pollution. During the summer at Denali National Park and Preserve in Alaska, visitors traveling past mile 15 on the park's 91-mile road are required to ride a shuttle bus rather than drive their own vehicles. There are also buses that provide narrated interpretation for guests, as well as buses designated for campers and backpackers. Not only is this service convenient for Denali's visitors, it helps to protect wildlife, increases visitor safety, and reduces air pollution from individual vehicles.

Above: A bull moose in Denali. ©Daniel Saxton
Below: Denali's shuttle minimizes traffic on the park's road and keeps both visitors and wildlife safer. ©TT/istockphoto

Above: The I&M Program provides crucial natural resources information at parks that focus on cultural resources but have natural resources, too, such as Stones River National Battlefield. Photo courtesy of the National Park Service.

Over the last decade, the I&M Program has accomplished two major tasks:

First, the program increased available scientific information concerning natural resources in national parks. While this is true in all parks covered under the program, it is particularly striking at the smaller monuments, historic sites, and battlefields that lack their own natural resources programs. For many of these parks, the technical information collected and reported via the I&M Program had never been compiled before. That compilation provided the majority of data used in our assessments of natural resource conditions. Simply put, the I&M Program plays a crucial role in providing information about natural resources and their condition in parks that lack strong science programs and a natural resource focus but often have relevant natural resources.

Second, the I&M Program provides a broad, regional view of issues affecting natural resource management. Its connections with numerous parks help place individual resources into a larger context, which is invaluable for parks large and small. Our park assessments demonstrated that many challenges to the condition of natural resources in national parks come from outside park boundaries. Thinking of parks in an overarching landscape context—as the I&M Program does—can help identify these landscape concerns, facilitate the collection of data to address these problems, and lead to beneficial management decisions. The National Park Service should continue to support and grow the I&M network approach. Although it requires a significant investment in time and resources, it will return positive scientific and management dividends in the future.

For cultural resources, the Systemwide Archeological Inventory Program (SAIP) has been similarly successful in collecting and interpreting resource data. Since 1992, the program has allocated funds for archaeological planning, survey, and excavation so that parks can increase the acreage they survey and the number of archaeological sites they can document. While SAIP's accomplishments vary from year to year, the average system-wide acreage surveyed each year is nearly 90,000 acres, almost double the average of 50,000 acres per year in the seven years prior to 1992. This improvement demonstrates the viability of the SAIP framework. Furthermore, our assessments show that SAIP has successfully addressed the pressing need for basic archaeological research at smaller parks that have no archaeological staff.

Archaeology in the parks has long relied on outside assistance for survey and excavation projects, especially from university archaeology departments that can provide expertise and field workers for projects of long duration. Historical research is also frequently outsourced. But other cultural resource disciplines have been less aggressive about developing relationships with universities and outside organizations. One avenue for forging such relationships is the Cooperative Ecosystem Studies Unit (CESU) national network. This network, administered on a regional level at major research universities, provides research services for federal land management agencies, linking them with universities and other research organizations. The CESU system provides very low overhead rates and occasional funding needed for the projects it administers, lessening the financial burden on cooperating partners such as parks.

Rocky Mountain National Park in Colorado recently used the CESU to contract with the historic preservation program of a nearby university to inventory its Mission 66-era structures. The project provided the park with the expertise and staff to complete the inventory, and it provided the students with a valuable real-world research and documentation experience. Colorado's Sand Creek Massacre National Historic Site

is also working with researchers from the CESU to conduct ethnographic research, and Wyoming's Fort Laramie National Historic Site has formed partnerships through the CESU to document historic structures and conduct research into construction techniques and materials used at the fort. But such projects aren't as commonplace as they should be. Better utilization of the CESU network by cultural resources managers and park superintendents would improve cultural resource protection throughout the system. Parks that have initiated successful projects through CESU contracts should share their experiences with parks that have not yet benefited from these partnerships.

Putting Dollars to Work

Protecting and preserving the precious natural and cultural resources that are the core of our national parks is an enormous responsibility, one that requires a significant commitment of staff, time, and money. All of the approaches outlined in this chapter require funding for personnel, materials, and other costs, even when the bulk of the work is provided by volunteers. As a case in point, park employees at California's Muir Woods National Monument cannot use all the volunteer assistance that is offered, because they do not have enough resource management staff to organize and supervise volunteer workers on much-needed projects such as rebuilding trails and protecting the park's cultural landscape.

Each year, Congress appropriates funds for the National Park Service to operate its parks and also its programs, which include the National Register of Historic

The Cooperative Ecosystem Studies Unit (CESU) national network provides research services for federal land management agencies.

Below: Through the CESU, Rocky Mountain National Park's Mission 66-era structures, such as the Alpine Visitor Center, were inventoried. ©Terry Alexander

As of fiscal year 2010, the National Park Service has an annual operating shortfall of more than $600 million. National parks are also facing a backlog of maintenance projects totaling nearly $11 billion.

Below: A lack of funds prevents parks such as Cumberland Gap National Historical Park from filling critical staff positions. Photo courtesy of the National Park Service.

Places and the Rivers, Trails, and Conservation Assistance Program. These annual appropriations account for about 88 percent of the budget; the remainder comes from park fees, volunteer support, and donations. The appropriated portion of the National Park Service budget comes from several major accounts, including the construction account, which provides for construction and maintenance of roads, facilities, and historic structures; the Land and Water Conservation Fund, which provides for strategic land purchases; and the Historic Preservation Fund, which supports cultural resource grant programs.

More than 80 percent of National Park Service appropriated funding goes to the operations account, which funds park personnel and the equipment and training they need to do their jobs in resource management, visitor services and protection, law enforcement, and facilities maintenance. The National Park Service as a whole has suffered from chronic underfunding of operations since the last major multiyear funding program, Mission 66, ended in 1966. This has led to unfilled positions, deteriorating resources, and diminished experiences for millions of park visitors. For example, at Cumberland Gap National Historical Park in Kentucky, Tennessee, and Virginia, several permanent positions remain vacant due to a lack of funds; these unfilled positions include a deputy superintendent to help manage the park and its nearly one million yearly visitors; a resource management specialist to ensure protection of the scenic, historic, and recreational resources at the park; maintenance mechanics and laborers who help maintain facilities; and park rangers to help guide visitors

and ensure their safety. Hawai'i Volcanoes National Park reported a shortfall of 63 employees in 2004, including law enforcement rangers, visitor center staff, and resource managers. Grand Canyon National Park reported needing more than $6 million in additional funding to fill the permanent full-time staff positions the park should have to meet visitor and resource protection, interpretation, law enforcement, and facilities management needs.

After years of chronic underfunding, in fiscal year 2008, Congress and the Bush Administration began a much-needed, 10-year program to gradually increase the Park Service operating budget in $100 million increments to ensure that, by their 100th anniversary in 2016, America's national parks would have the personnel necessary to protect and maintain resources and to provide a safe, enjoyable experience for visitors. However, the program stalled after only three years, leaving the vast majority of the job unfinished. As of fiscal year 2010, the National Park Service has an annual operating shortfall of more than $600 million. National parks are also facing a backlog of maintenance projects totaling nearly $11 billion.

A multiyear commitment to increased funding for park operations is necessary to improve resource management capacity and the condition of resources, and to provide the visitor experience that Americans and other visitors expect in our national parks. Congress has a fundamental duty to provide adequate appropriations for park operations. However, to assist with project needs to combat the snowballing effects of the maintenance backlog, congressional appropriations must be augmented with creative solutions. As described in this chapter, leveraging available funding through community programs and partnerships can help give parks the tools they need to achieve their resource stewardship goals. Other long-term funding options and solutions are still needed. The National Parks Second Century Commission recommended that increased appropriations be supplemented by new revenue sources such as a designated income stream from oil and gas leases on federal property, which could be used to address the maintenance backlog, and by a national parks endowment, a permanent source of funds that would be outside the annual appropriations process. Annual appropriations must still provide the majority of National Park Service funding, but an expanded, dependable funding base and increased community engagement are essential to sustaining the National Park System.

The Secret to Positive Examples

This chapter has described programs and initiatives in both natural and cultural resource management that are beginning to address the challenges we identified through our assessments. There are similarities between the programs used in natural resources and in cultural resources, such as system-wide frameworks for specific resource management tasks, regionally based teams or teams shared among parks, and collaborations with external partners and community members. There are also successful efforts at individual parks that may be transferable to other parks or scalable to the regional or system-wide level. The key to all of these positive examples is having knowledgeable park staff who can access the tools and support they need from across the entire range of National Park Service programs and networks. Sufficient funding is critical to getting and keeping those knowledgeable park staff and providing them with the means to efficiently manage resources. Our work throughout the park system shows that when staff have the necessary financial support and coordinated access to professional expertise, relevant scientific information, training, and a sufficient workforce, positive stories of resource management are plentiful.

Above: Conservators at Museum Conservation Services at Harpers Ferry Center for Media Services ensure the irreplaceable artifacts held in trust by the National Park Service, such as this 16th-century Spanish cannon from Fort Caroline in Florida, are well preserved. Photo courtesy of Gary Tarleton/National Park Service.

Beyond Park Borders: Landscape-Level Conservation

In January 2009, a lone male wolverine crept through the forest of Grand Teton National Park, Wyoming, and headed southeast on a long journey in search of a mate. Wildlife biologists tracking his radio transmitter watched for months as the wolverine traveled across the sagebrush areas of central Wyoming and meandered through the intact grasslands of the Shirley Basin. Members of the Eastern Shoshone and Northern Arapaho tribes may have glimpsed him as he crossed the 3.5 million-acre Wind River Indian Reservation in central Wyoming. The wolverine's path indicates that on Memorial Day weekend, late at night, he dashed across I-80 into Medicine Bow National Forest, and several weeks later, crossed the Colorado state line into Roosevelt National Forest. In late June, five months after he began, the wolverine slipped safely into Rocky Mountain National Park, 500 miles from where he started.

The wolverine's incredible journey between Grand Teton and Rocky Mountain is a testament to the species' need for large swaths of territory—and to the connectivity of the landscape between these two U.S. national parks. Male wolverines stake out breeding territories as large as 500 square miles, and access to adjoining blocks of habitat is crucial to the species' survival. As Robert M. Inman, director of the Greater Yellowstone Wolverine Program, told a reporter from *The New York Times*, wolverine conservation "has to be a multistate effort at the big landscape level. That's the way this species operates, and that's the way we have to think."

Thinking at a landscape level means acknowledging that few of our national parks are large enough, by themselves, to maintain successful populations of important park species. From Shenandoah in Virginia to Death Valley in California and from Big Bend in Texas to the Apostle Islands of Wisconsin, NPCA's Center for Park Research found that habitat fragmentation and loss of species were among the most serious challenges facing parks' natural resources. Simply put, parks cannot survive as isolated islands of habitat. They must be protected as part of larger landscapes.

Cultural resources also benefit from a view beyond park boundaries. Nez Perce National Historical Park, for example, traces the history and culture of the Nez Perce (Nimi'ipuu) American Indians in four Western states (Montana, Idaho, Oregon, and Washington). While the park also protects rare birds and patches of native shortgrass

Left: Conserving large landscapes and connections between protected areas helps preserve both natural and cultural resources. This is the John Moulton Barn, Mormon Row Historic District, in Grand Teton National Park. ©Dgrilla/Shutterstock

prairie, the larger story is related by the 38 units that connect the Nez Perce within this multistate landscape. This story allows modern visitors to connect cultural and natural resources to the physical and spiritual connections the Nez Perce have with the North American landscape.

The need to think beyond park boundaries is especially important in the face of our planet's changing climate.

Landscape connectivity also implies administrative connectivity: Only nine of the 38 units of Nez Perce National Historical Park are managed by the National Park Service; the others belong to federal, tribal, state, or local authorities. Creating administrative connectivity—building partnerships for common pursuit of mutual goals—is sometimes the most challenging factor in effecting landscape-level conservation. But convincing managers and private landowners to plan together and cooperate can bring great benefit to ecosystems and people alike.

The need to think beyond park boundaries is especially important in the face of our planet's changing climate. Alterations in precipitation and temperature are already prompting some North American species to change locations in order to remain within the habitat conditions they've adapted to through time. As climatic conditions continue to change, habitat within national parks may no longer be suitable for some of these species, forcing them to move toward areas that may not be protected and forcing other species to gravitate into the national parks—making large-scale conservation imperative in the 21st century.

Below: Roads fragment habitat and are dangerous for wildlife such as the desert tortoise. ©David Lamfrom/NPCA

The national park resource assessments carried out by NPCA's Center for Park Research during the past 10 years demonstrate that the biggest challenges the National Park Service faces as it advances toward 2016 and its second century of existence include the loss of biological diversity, the erosion of cultural heritage, and the extension of landscape fragmentation caused by the expanding human footprint and the impacts of climate disruption. Solutions to these challenges lie within the national parks and in the landscapes that surround them. Not enough mechanisms currently exist to encourage park staff to collaborate with other managers for the protection of jointly managed natural and cultural resources, but NPCA's Center for Park Research is encouraged by the National Park Service's move toward a new paradigm for national park protection: landscape-level conservation.

Weak Links in the Chain

Landscape-level conservation means integrating park lands into a larger conservation strategy that links national parks to one another and to adjacent protected lands. In the 20th century, U.S. park managers and conservationists tended to focus on individual protected areas, thinking primarily inside park boundaries. But ensuring that America's biological diversity and cultural heritage survive in the 21st century means acknowledging and reinforcing the crucial roles that national parks serve in greater landscapes of public and private lands. National parks must continue to serve as hubs for larger landscapes, catalysts for collaborative resource protection, economic drivers for surrounding communities, and connective pathways linking plant and wildlife habitat.

Center for Park Research assessments found that connecting national parks with surrounding landscapes is imperative for species preservation. If wildlife and plants on lands surrounding the parks die off, species in the national parks themselves become isolated from others of their kind. Migratory animals may be unable to reach breeding grounds or seasonal feeding grounds outside the parks. Young animals are unable to disperse in search of mates and may die without reproducing. When species lose their connections with the larger gene pool, maladapted traits are more likely to become permanent. Worse, isolated plant and animal populations may simply blink out.

Such fragmentation happens through habitat loss and development, which is projected to continue: The U.S. population will number an estimated 423 million by the year 2050, an increase of more than 37 percent over current figures. Not surprisingly, this growth can increase landscape fragmentation, since more people mean more roads, more resource extraction, more exurban sprawl, and more energy development.

Indeed, roads are one of the primary causes of fragmentation and loss of connectivity, as assessments by NPCA's Center for Park Research revealed. As the point of the spear that pierces natural and cultural landscapes, roads impact wildlife by diminishing and degrading habitat, by increasing mortality from collisions, by limiting animals' access to food, and by fragmenting plant and animal populations into smaller and fewer subpopulations. For animals willing to cross roads and highways, the attempt may end in injury or death (the National Park Service reported 12,577 wildlife-vehicle crashes inside national parks between 1989 and 2006, not including the countless number of animals run over but never reported). Remote roads on lands adjacent to parks, often used for logging and mining, provide access for poachers and all-terrain vehicle drivers who may engage in wildlife harassment and damage vegetation by going off-road. Inside national parks, roads threaten 21 federally threatened or endangered species, such as bighorn sheep, desert tortoise, Florida panther, and San Joaquin kit fox.

Top: Population growth and urbanization further fragment habitats. ©iofoto/123RF
Above: There were more than 12,500 reported collisions between vehicles and wildlife in national parks between 1989 and 2006, illustrating the dangers roads pose for wildlife—even within national parks. ©stockstudiox/istockphoto

Logging also disconnects the habitat of fish and wildlife, whether the activities are focused on selective logging of forest species or wholesale clear-cutting of forest. At Washington's Olympic National Park, NPCA's resource assessment indicates that as clear-cutting takes out old-growth forests on private, state, and national forest lands along park boundaries, the park is becoming more and more isolated—an island of protected habitat in an ocean of disturbance. Many species are unable to migrate across deforested lands. And clear-cutting leads to increased erosion and sediment washing into park waterways, choking out aquatic life such as salmon and steelhead trout, which also must pass through logged lands as they migrate between the national park and the ocean.

Above: The proposed Pebble Mine threatens unbroken landscapes surrounding Lake Clark National Park and Preserve, which is shown here. ©James D. Nations/NPCA

Mining operations, energy development, oil and gas pipelines, and energy transmission lines can all disrupt the connectivity of national parks and surrounding lands. The proposed Pebble Mine adjacent to Lake Clark National Park and Preserves in Alaska would catalyze an industrial mining district with a new port and roads bulldozed across unbroken landscapes surrounding Lake Clark and Katmai National Parks and Preserve. In the southern Appalachians, mountaintop mining is destroying headwaters and sending sediment downstream into Tennessee's Big South Fork National River and Recreation Area and other river-based parks.

Residential development also produces fragmentation: People like to build houses and vacation homes next to national parks. At Wilson's Creek National Battlefield in Missouri, the city of Springfield's creeping growth alters the visitor experience. And some units suffer encroachment from multiple forms of development: Eleven nonfederal oil and gas operations are extracting fuels from Big Thicket National Preserve in Texas; meanwhile, timber companies have sold off more than two million acres of nearby forest land since 2002, initiating a transformation to subdivisions and commercial properties. Although conservation groups have bought some of the land to create corridors between the park's disparate units, for the most part, lands that once served to connect wildlife populations and cultural history are morphing into residential yards (with dozens of introduced species) and paved development.

Beef cattle and sheep grazing on lands adjacent to—and sometimes inside—national parks can interrupt the connectivity of natural and cultural landscapes. Cattle trample riparian habitat, degrade water quality with urine and fecal matter, blunder through archaeological sites, introduce invasive species, compete with native wildlife for food, and transmit diseases to wildlife. In California's Mojave National Preserve, beef cattle consume plants critical to the diet and health of threatened desert tortoises. Bighorn sheep have been ravaged by diseases contracted from commercial livestock inside Death Valley National Park.

NPCA researchers following Park Service information about cattle grazing learned that more than 100 of the 394 existing national park units are still working to mitigate the negative impacts of overgrazing that occurred decades ago inside what are now national park boundaries and lands adjacent to parks. Thirty national park units still allow livestock grazing, although half of these do so to preserve historic context (such as in the Civil War-era farm fields of Gettysburg National Military Park in Pennsylvania). The other half permit privately owned beef cattle grazing, usually because grazing was grandfathered into the parks' authorizing legislation. Many more parks are impacted by cattle grazing on U.S. Forest Service land, Bureau of Land Management holdings, and private lands along their borders, with negative impacts on native species and degradation of natural and cultural resources.

Predator control on lands adjacent to national parks—ostensibly to protect livestock—removes or kills some animals that migrate through national parks and connected landscapes. Species such as the cougar of Joshua Tree National Park and Glacier National Park, and the wolves of Yellowstone and Grand Teton, do not recognize park boundaries and are sometimes subject to legal hunting or increased risk of "animal control management" if they wander outside the parks.

Fences also create problems for park wildlife that migrate seasonally in pursuit of food resources and habitat. One such case is the pronghorn antelope, the mammal that makes the longest overland migration in the continental United States. Twice a year, for more than 6,000 years, a herd of Wyoming pronghorn has moved between winter grounds in the Upper Green River Basin and summer grounds in Grand Teton National Park. The number of animals has decreased dramatically over the years, leaving only 300 pronghorn to make the biannual trek. Six of the pronghorns' eight migration corridors have been blocked by livestock fences, natural gas exploration, housing developments, and roads.

Climate change makes matters worse, exacerbating the impacts of landscape fragmentation and challenging traditional approaches to resource management as sea level and storm intensity levels rise. Changes in temperature and precipitation patterns across the United States are well documented. The 2009 U.S. Global Change Research Program points out that the average U.S. temperature has risen more than two degrees Fahrenheit since 1960. During those same decades, heat waves and drought have become more frequent and more intense in some regions of the United States. Trends indicate that northern areas of the country are becoming wetter, while some southern areas, particularly in the American West, are becoming drier.

National Park Service staff increasingly cite climate change as a problem in managing park resources. Resource specialists in Sequoia and Kings Canyon National Park in California worry that changing temperature and rainfall patterns may gradually doom the park's namesake trees. Migratory birds are returning north to national park nesting and feeding sites in the Midwest earlier than in past decades, sometimes in patterns that are out of sync with the availability of their plant or insect food sources. Increased water temperatures in national parks in southern Florida and the national parks of the U.S. Pacific islands are causing coral bleaching that has impacts on a variety of park marine life.

Cultural resources are not exempt from the impacts of climate change. Consider what's happening in Alaska: Archaeological sites in Bering Land Bridge National Preserve are being exposed and, in some cases, washed away as bluffs erode because of melting permafrost and wave action from intense storm surges. Low elevation coastal sites in Katmai National Park and Preserve are literally going under water as sea level rise caused by climate change gradually inundates the shoreline. Projectile points and woven baskets previously preserved in ice are being exposed to the elements as ice patches melt in high mountains of Wrangell-St. Elias National Park and Preserve and Lake Clark National Park and Preserve. The loss of these ancient artifacts and early human settlements leaves a gap in our understanding of the peopling of the New World. Farther south, in California's Channel Islands National Park, 6,600 years of human culture are being swallowed by the surf as rising sea levels flood ancient coastal villages along the park's island beaches. Elsewhere, historic structures are exposed to storms and forest fires, and submerged resources in coastal-marine parks suffer the impacts of ocean acidification.

National Park Service staff increasingly cite climate change as a problem in managing park resources.

In reaction to this litany of threats, National Park Service Director Jon Jarvis calls climate change "the greatest threat to the integrity of our national parks that we have ever experienced." But landscape-level conservation can ameliorate some of the negative impacts of climate change on national parks by providing pathways for some species of wildlife to move northward or upward in altitude in search of the temperatures and precipitation patterns they have adapted to over thousands of years. In a similar fashion, slower-moving plant species can disperse farther north or farther up mountainsides according to their required habitat conditions, if natural corridors and connectivity still exist.

Achieving Landscape-Level Conservation

Landscape-level conservation can help reduce the impacts that fragmentation and climate change provoke on America's national parks and surrounding lands. But identifying a solution is only the first step in making it happen. Land managers still face significant barriers in their quest to achieve connectivity, including the lack of scientific information about large landscapes, too little interagency collaboration, minimal existing strategies and a dearth of policy tools to implement large landscape conservation, and fragmented financial investments—especially at the federal level. But solutions do exist, and they involve *protecting, connecting,* and *restoring* large landscapes.

Top: The pika is an alpine species that could find itself with nowhere to go as temperatures warm and suitable habitat disappears due to climate change. ©Doug Von Gausig/istockphoto
Above: Parks such as Death Valley have been expanded in the past to protect significant resources in the surrounding landscape. New legislation could further grow California's desert parks. ©Jon Larson/istockphoto

Protecting park resources within park boundaries is not enough: It's also necessary to expand existing parks and create new protected areas to safeguard resources that would otherwise be subject to disruption or disappearance. Throughout the history of the National Park System, parks such as Grand Canyon, Denali, Death Valley, and Everglades have been enlarged through congressional legislation or presidential action under the 1906 Antiquities Act. A major goal of these expansions has been to protect significant natural and cultural resources in the surrounding landscape.

Some specific proposals to achieve this goal are already under way. Senator Dianne Feinstein is promoting legislation to add 74,000 acres to the California desert national parks—Mojave, Death Valley, and Joshua Tree—to conserve habitat, protect landscapes, and increase connectivity. The legislation also supports the proposed Sand to Snow and Mojave Trails National Monuments, which preserve critical wildlife corridors between the desert scrub and snowcapped San Bernardino Mountains, and between Joshua Tree National Park and the Mojave National Preserve. And in the 64,000 square-mile Chesapeake Bay watershed—the largest estuary in the United States and one of its most degraded ecosystems—federal, state, and local governments are joining with nongovernmental organizations to augment the region's 53 existing national parks, five national trails, and seven national heritage areas with new protected areas in key drainages and along the bayshore.

NPCA and a coalition of historic preservation and Civil War battlefield protection advocates are urging Congress and the administration to establish a national park unit at Fort Monroe near Hampton Roads, Virginia. This historic coastal fort includes two miles of undeveloped beachfront. It was also the landing site of the first enslaved Africans in the United States and, during the Civil War, a vital place of refuge for an estimated 10,000 escaped slaves.

Connecting national park units to other lands is another way to mitigate biodiversity loss, the erosion of cultural heritage, and the impacts of climate change. To that end, links must be established between national parks and national monuments, wilderness areas, wildlife refuges, marine reserves, conserved U.S. military lands, state

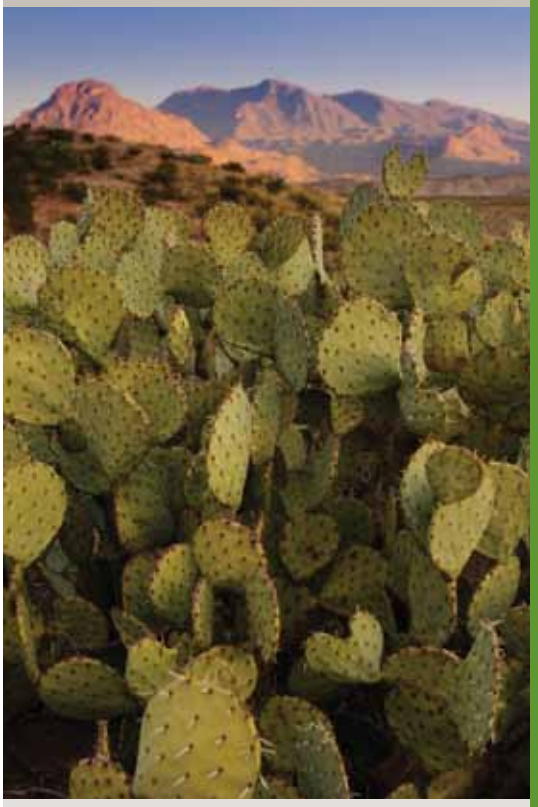
and municipal lands, and privately conserved lands of individuals, land trusts, and nonprofit organizations such as The Nature Conservancy and The Conservation Fund. Restoring the ecological health of waterways and natural areas surrounding national parks improves park resources, provides benefits for surrounding communities, and enables park wildlife to better withstand the stresses wrought by a changing climate.

Landscape-level conservation can even reach across international borders. The 16,000-square-mile Crown of the Continent ecosystem expands outward from its core national parks—Canada's Waterton Lakes National Park and the United States' Glacier National Park—to include the Great Bear Wilderness, Bob Marshall Wilderness, Scapegoat Wilderness, Blackfeet Reservation, and Flathead Reservation in the United States, and the Tobacco Plains Indian Reserve in Canada. This remarkable assemblage of high peaks, aspen glades, dense conifer forests, clear-flowing rivers, and native grasslands still harbors the native predator-prey relationships that existed when European explorers first arrived, making it one of only a handful of places in the world to largely escape post-industrial extinctions. The surrounding wilderness areas and Indian reservations provide important buffers that protect the core parks, but much work remains if this remarkable large landscape is to remain functionally intact during a time of changing climate.

NPCA and its Canadian partners are working "transboundary"—across the border, across the Continental Divide, across land-management jurisdictions, and across culture—to implement a host of specific protections throughout the 18 million-acre Crown of the Continent ecosystem. They include expanding protected places, protecting private lands through fee acquisition and conservation easements, and connecting habitats through linkage zones to ensure that wide-ranging wildlife can migrate when stressed by changing climate and landscape fragmentation. Already, important species such as wolves and bull trout are coursing through those corridors, re-establishing their cultural and ecological significance in historic landscapes.

The connectivity achieved in the Crown of the Continent should serve as a model for other landscape-level conservation projects. On the southern border of the United States, national and local groups are partnering to promote the Big Bend-Río Bravo complex of nine Texas and Mexican conservation areas as "a natural area of binational interest," with Big Bend National Park at its core. In rural Maryland, Catoctin Mountain Park (where presidential retreat Camp David is located) anchors the Catoctin Forest Alliance, a friends group working to connect Cunningham Falls State Park, two municipal watersheds, and other forested state lands and private lands across 100 square miles and 18 historic sites. The landscape-level conservation area provides wildlife habitat, recreation, interpretation, and clean water to tens of thousands of people in Frederick County, Maryland, and a million recreational visitors each year.

In areas where conservation units lie more distant from one another, corridors of natural habitat can connect one protected area to another. These corridors may be entirely terrestrial, or they may include waterways and associated riparian areas. For example, the Captain John Smith Chesapeake National Historic Trail creates a 3,000-mile aquatic corridor designed to protect cultural landscapes and natural shorelines alike in the Chesapeake watershed. And in the Northern Rockies, corridors are needed to link the Greater Yellowstone Ecosystem with the Crown of the Continent, thereby connecting Yellowstone and Glacier National Parks as part of the larger Yellowstone to Yukon Conservation Initiative.



Above: Big Bend National Park in Texas is one of several protected areas along the United States' border with Mexico, an area where binational cooperation is critical for conservation. ©Douglas Wilson/istockphoto

Imagine any major highway with all the bridges washed away. That's what animals face when they can find no corridors connecting national parks and other natural areas.

While some wildlife corridors extend for miles through landscapes that are often degraded, others can be as short as a path over or under a busy highway, connecting disparate patches of wildlife habitat in the form of wildlife bridges, overpasses, and underpasses. One of the first such projects in the United States was carried out on Florida's Alligator Alley to protect the endangered Florida panther. Twenty-four underpasses designed to restore water flow to Everglades National Park also allow panthers and other wildlife to safely bypass this high-speed highway. The underpasses have halved the mortality of Florida panthers from an average of four per year to fewer than two.

Corridors can also exist in the sky. Assateague Island National Seashore provides critical stopover habitat for peregrine falcons and Neotropical songbirds. Shorebirds by the tens of thousands use Assateague's ocean beaches and other intertidal habitats to forage and rest during spring and fall migrations. By providing nesting and forage sites, such U.S. national park units help keep alive tens of thousands of migratory birds that make flights between our coastal states and the Caribbean, Latin America, and Canada.

For all the benefits that corridors can bring to landscape-level conservation, scientists have discovered that adjacent connectivity is even more important than corridors, especially as an adaptation to climate change. National parks benefit from having well-managed national forests, wildlife refuges, or conservation-friendly private lands directly along one or more of their borders. Because species move in different patterns, direct

Below: National seashores provide protected beaches for migratory birds such as these royal terns at Cumberland Island National Seashore in Georgia. ©Peter Pattavina/ istockphoto

connectivity to contiguous protected lands along national park boundaries will always be more successful at preserving species than narrow wildlife corridors established through disturbed landscapes.

Restoring plant and animal habitats emerged as a crucial need in the national parks NPCA assessed in the Great Lakes, one of the largest freshwater resources on Earth. The watershed is home to 16 National Park System units, such as Pictured Rocks National Lakeshore, Isle Royale National Park, and Keweenaw National Historical Park. Both the Great Lakes and the region's national parks suffer from similar threats: invasive plants and animals, such as purple loosestrife and zebra mussels; contaminants from industrial landfill leachate, urban runoff, and boat-related pollution; and landscape changes due to clear-cutting, mining, urban development, and agricultural activities.

Predators must also be restored to their original habitats. Taking the top-level predators—wolves or cougars, for example—out of a landscape throws the entire ecosystem out of balance. It allows for an unnatural expansion of mid-level carnivores, such as foxes and coyotes, and so on down the chain. In the landscape that includes Rocky Mountain National Park in Colorado, elimination of wolves to accommodate cattle ranchers, together with landscape fragmentation and the loss of wildlife corridors, has created an unsustainable population of elk within the national park. The National Park Service response has focused on how to artificially lower the number of elk within park boundaries, when the logical solution is to reconnect the park to the surrounding landscape and reintroduce wolves. Case in point: When wolves were reintroduced to Yellowstone in 1995, they not only decreased the number of elk, they also prompted them to move away from the riverbank to their original habitat along the base of the mountains, allowing new willow and aspen trees to sprout along the river and bringing back songbirds, beavers, and a wealth of other vegetation and wildlife.

Bridging the Gaps

Information gathered in national parks across the United States by NPCA's Center for Park Research indicates that our parks cannot survive into the future in isolation. Fortunately, during the past few years, several groups of respected scientists, business leaders, park managers, and policy analysts have presented strategies and tactics designed to make landscape-level conservation possible. Foremost among their publications are *Advancing the National Park Idea*, a 2009 National Parks Second Century Commission report, and *America's Great Outdoors*, a federal report released in February 2011.

NPCA's recommendations build on these landmark reports to suggest a potential roadmap for the crucial work that must be done to protect, connect, and restore America's natural and cultural heritage through the paradigm of landscape-level conservation. Developing the vision, the political will, and the economic incentives to put these steps into action is a crucial element in the protection of America's national parks and the natural and cultural resources they are intended to preserve.

NPCA's park assessments and other analyses show that restoring the ecological health of landscapes beyond park boundaries not only improves conditions for park plants, fish, and wildlife, but also provides numerous benefits for surrounding communities—clean water, fresh air, flood and fire protection, outdoor recreation, and tourism—all of which have significant economic value.

The State Of America's National Parks: Key Findings And Recommendations

The natural and cultural resource assessments carried out by NPCA's Center for Park Research identify the most serious resource challenges facing America's national parks. Primary among them are the loss of biodiversity, degradation of cultural resources, declining air and water quality, landscape fragmentation, climate disruption, and insufficient funding. Some of the actions required to mitigate these challenges are already known. Park staff and park protection groups are working to find additional solutions. Here, we present the major findings from NPCA's park resource assessments and our recommendations for addressing the problems they identify. As the National Park System approaches its second century of existence, it is vital that the administration, Congress, and Park Service leadership act on these opportunities to defend the natural and cultural resources our national parks are designed to protect.

Left: A host of landscape-level restoration measures are being considered to improve the health of the ecologically important resources within Everglades National Park, which have suffered from inappropriate development and habitat alteration. ©Josh Rinehults/istockphoto

Findings and Recommendations

Natural Resources

Finding: Natural systems in America's national parks are molded by processes that include critical species interactions, fires, and floods. Human activities have disrupted these natural processes, causing large-scale changes and management challenges. Sustainable protection of park resources requires the recognition and use of natural processes in planning and resource management.

Recommendations:

- Following the successful reintroduction of wolves in Yellowstone National Park and elk in Great Smoky Mountains National Park, the National Park Service should reintroduce key species of native wildlife into additional park ecosystems to reestablish their essential role in natural processes.
- National Park Service fire management teams should continue prescribed burns where they are effective in park resource restoration and support staff of other national parks where resources have been degraded by fire suppression.
- Where artificial dams and diversions have altered natural processes in national parks, the National Park Service should guide other agencies in experimental water releases and controlled flooding. Based on their success at Olympic National Park, where the Elwha Dam is scheduled for removal in fall 2011, the Park Service should guide the removal of nonfunctional dams and operational dams that harm park resources.

Finding: Across the National Park System, invasive species threaten native plant and animal populations and their habitats. Invasive plants are a management concern in all but a few of the parks NPCA assessed. Invasive animals, diseases, and insects were documented less frequently, but they are damaging park resources in more than 25 percent of the parks examined. The ecological and economic consequences of delaying action can be enormous.

Recommendations:

- The administration should use its existing authority to control the entry of non-native plants, animals, and diseases into the United States and provide the Park Service with the resources needed to eliminate or limit the impact of existing non-native invasive species on the national parks.
- The National Park Service should expand its collaboration and education programs with neighbors and stakeholders to prevent the spread of invasive species into national parks.

Finding: Natural resources in many national parks have been damaged by water diversion, mining, logging, livestock grazing, and agriculture that occurred before the parks were established.

Recommendation:

- Congress must provide sufficient funding to the National Park Service for projects that restore ecosystem processes and critical habitats degraded by past human activities.

Finding: Most air pollution affecting national parks comes from external sources. Improving air quality and protecting visitor health will require multiagency cooperation and strong leadership by the National Park Service and Department of the Interior.

Recommendations:

- State regulators, the U.S. Environmental Protection Agency, and the National Park Service should work together to ensure that all national parks meet the standards mandated by the Clean Air Act, the National Park Service Organic Act, and Park Service management policies.

- The Department of the Interior should use its authority under the Clean Air Act to certify instances of park air quality impairment by power plants and major pollution sources and ensure that federal and state regulators clean up these sources of park pollution.

Finding: Although impaired water quality in national parks is sometimes a legacy of land use before the park was established, it more frequently results from activities taking place on adjacent lands. Recognizing impacts is hindered by lack of data.

Recommendation:

- The National Park Service should collect comprehensive baseline data on national park water quality, water flows, and aquatic communities to monitor and defend against the impacts of development and extraction activities taking place on adjacent lands.

Top left: Parks should reintroduce native wildlife whenever possible. ©Len Tillim/istockphoto
Top center: Removal of the Elwha Dam in Olympic National Park will benefit the Elwha River, salmon, and other associated park resources. ©Dave Logan/istockphoto
Top right: Cooperation is needed to ensure air quality is protected in parks such as Shenandoah National Park in Virginia. ©John Keith/Bigstock

Findings and Recommendations

Finding: Climate change poses a long-term threat to park resources by exacerbating landscape fragmentation and complicating traditional approaches to resource management.

Recommendations:

- The National Park Service should increase data collection and analysis on the impacts of climate change, use the parks as observatories to advance understanding of the consequences of climate change for natural and cultural resources, and take action to mitigate the damages that climate change can produce.
- To build ecosystem resilience to climate change impacts, Congress should increase funding for land and water restoration initiatives, targeting lands and waters in and around national parks.
- To improve National Park Service responses to climate change impacts, Congress should provide funding for the Department of the Interior Climate Science Centers and Landscape Conservation Cooperatives.

Cultural Resources

Finding: Cultural resources suffer from a systemic lack of prioritization and emphasis within the National Park Service. Two-thirds of America's national park units were designated to preserve nationally significant cultural resources, but at more than 90 percent of the parks NPCA assessed, cultural resources were in "fair" or "poor" condition. More than 60 percent of the 27,000 historic buildings in the National Park System are in need of repair. More than half of the 80 million museum artifacts in the National Park System are uncataloged, and 53 percent of parks surveyed rated "fair," "poor," or "critical" in annual monitoring of cultural resources.

Recommendations:

- The National Park Service should develop a multiyear strategic initiative to improve the condition of cultural resources throughout the park system. This initiative should include strategies for addressing the currently inadequate level of protection for historic buildings and historic artifacts.
- It is critical that the National Park Service expand its efforts to monitor the condition of cultural resources and give cultural resource protection the same level of priority it does for natural resources.
- The National Park Service should ensure that parks, centers, and regional offices have adequate professional staffing to meet cultural resource management needs. The National Park Service should increase efforts to catalogue and monitor cultural resources and use them as primary sources for interpretation.

Landscape Conservation

Finding: America's national parks form parts of greater natural and cultural landscapes, and the health of park resources is inextricably linked to the health of adjacent landscapes. The most serious threats to national park resources emanate from activities on adjacent lands.

Recommendations:

- The administration should enforce existing laws to reduce threats from adjacent lands, including resource extraction, air and water pollution, and development that impair ecological functions, fragment wildlife habitat, and degrade natural or cultural landscapes.

- The president should issue an executive order requiring federal agencies to manage their lands and waters cooperatively with surrounding landscapes to conserve and restore natural ecosystems and watershed health. The order should direct federal agencies to partner with state, local, and tribal governments, private landholders, nonprofit organizations, and each other to conserve and restore large landscapes identified as ecologically significant by the National Park Service.

- Congress, the Department of the Interior, the National Park Service, the Department of Transportation, and state governments should give national park wildlife "freedom to roam" by protecting and creating wildlife corridors between national parks and nearby terrestrial and aquatic ecosystems. Specific steps include constructing wildlife crossings over or under roadways and removing human-made obstacles to fish and wildlife migrations.

- The administration and Congress should protect natural and cultural resources associated with national parks by providing incentives for willing landowners to manage their lands in ways compatible with landscape connectivity.

- By 2012, the National Park Service should prepare a new park system plan that identifies key park wildlife habitat, lands required to implement climate change adaptation and mitigation, and under-represented themes of American history and cultural diversity. The president and Congress should establish new parks and expand existing parks to make the National Park System truly representative of the nation's remarkable natural and cultural heritage.

Top left: Cumberland Island National Seashore's Plum Orchard Mansion is one of its premier cultural resources. ©Brandon Laufenberg/istockphoto
Top center: Wildlife such as pronghorn need accessible, protected migration corridors. ©Angela Cable/istockphoto
Top right: Activities on adjacent lands can harm park resources. This logging, which occurred near Redwood National and State Parks, can increase sedimentation in rivers that are important for salmon. ©Michael Nichols/National Geographic Stock

Findings and Recommendations

National Park Service Management

Finding: National Park Service resource protection and management are hindered at the individual park level by a lack of funding and staff training. This hindrance, in turn, limits data collection on natural and cultural resources and the integration of those data into interpretation programs.

Recommendations:

- Building on the successful National Park Service Inventory and Monitoring Program, Congress should continue to fund National Park Service efforts to inventory resources and monitor resource trends over time.
- The National Park Service should expand the practice of employing centralized technical teams and networks that serve multiple parks and provide specialized assistance on resource issues.
- The National Park Service should ensure that interpretive programs integrate up-to-date research and analysis into exhibits, publications, and presentations on park resources.

Park Funding

Finding: Staff throughout the National Park Service are unable to meet resource protection and management responsibilities because budgets are insufficient. A long-term commitment to increased funding is vital for the improvement of park resource conditions and resource management.

Recommendations:

- Congress and the administration should provide sufficient funding and staffing for National Park Service operations, maintenance, construction, and land acquisition necessary to achieve the high level of natural and cultural resource protection mandated by the 1916 National Park Service Organic Act. In particular, restored operations funding to address an annual shortfall of more than $600 million would be central to addressing the staff shortages highlighted throughout this report.
- During the next decade, to prevent park resource degradation, Congress should allocate funds from the Land and Water Conservation Fund to acquire the two million acres of high-priority private lands identified within park boundaries by the National Park Service.
- Congress and the National Park Service should allocate sufficient funds to expand park staff training opportunities in key resource protection and management areas, such as ecosystem restoration, invasive species control, preservation maintenance, and artifact conservation.
- To provide additional personnel and funds to assist with resource management challenges, the National Park Service should expand community programs such as the Cooperative Ecosystem Studies Unit network that establish long-term partnerships with universities and nonprofit groups.

Above: The Washington Monument can be viewed from the steps of the Thomas Jefferson Memorial; both are part of the National Mall & Memorial Parks in Washington, D.C. ©Ben Klaus/istockphoto

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