

Climate Adaptation

**A Resource Guide for
Great Lakes National Parks and Communities**

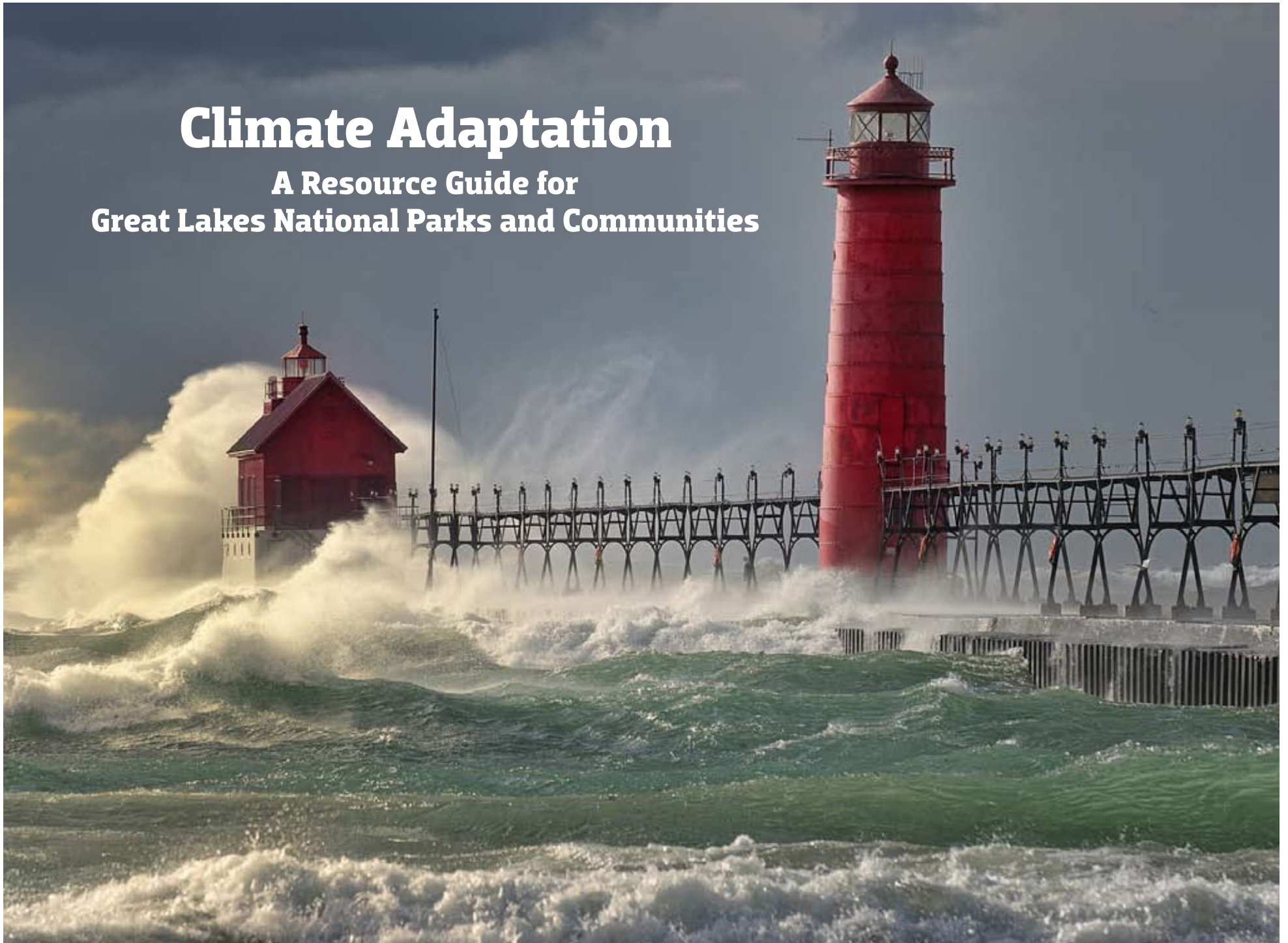


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I

Approaching Adaptation



I. Approaching Adaptation



Climate change is a global problem, but its effects are felt locally. Farmers in the Midwest have increasingly experienced severe droughts, while people living along the Great Lakes are watching their waterlines retreat. City-dwellers feel the stress of heat waves, gardeners cope with drought, and wildlife species are shifting their ranges. Such changes are altering the ways we live, work, and play at home and in the national parks.

For example, Lake Superior boaters can no longer moor safely at many of the docks they've traditionally used at Apostle Islands National Lakeshore because dropping water levels leave the platforms high above the water. At Indiana Dunes National Lakeshore,



ABOVE: Rain Garden at Indiana Dunes National Lakeshore, Headquarters ©Joy Marburger, NPS

torrential rains—which are occurring with greater frequency there as elsewhere—routinely have flooded the visitor center parking lot and made the site difficult for cars and pedestrians.

For a number of years, national parks have been involved in climate change mitigation through efforts like Climate Friendly Parks to reduce greenhouse gas emissions. Some have even worked collaboratively with their local communities. But because the effects of climate change are already being experienced, mitigation is not enough. Parks and their communities will need to adapt. Currently, adaptation efforts are just beginning and there is great opportunity for cities

and towns to partner with the local national park on co-beneficial projects. In the Great Lakes region, civic, governmental, and conservation organizations are increasingly including adaptation strategies in their response to climate change. For example, at Indiana Dunes National Lakeshore, several partners completed a parking lot redesign to include rain gardens and vegetated swales that have helped prevent polluted stormwater from degrading nearby Dunes Creek. This resource guide highlights some of those efforts in the Great Lakes region and identifies future opportunities. Hopefully, these examples will be useful not only for other parks and communities in the Great Lakes but around the country as well.

Adaptation Defined

“The National Park Service can improve the long-term health of national parks by making natural, cultural, and social systems better able to withstand and recover from climate changes through adaptation. Adaptation as defined here is an adjustment in a natural or human system that moderates harm or takes advantage of beneficial opportunities amidst the effects of climate change.”

— FROM THE NPS'S CLIMATE CHANGE RESPONSE PROGRAM

While mitigation addresses the causes of climate change, adaptation tackles its effects. Examples of adaptation include developing municipal response plans for heat waves and planting crops that are more resilient to climate change. Examples of mitigation include driving fewer miles to improving public transportation and fuel economy of all vehicles. Both approaches are needed for an integrated climate change response strategy.

II

Assessing Stakeholders' Attitudes About Climate Change



II. Assessing Stakeholders' Attitudes About Climate Change



Climate change now impacts all aspects of resource stewardship—from conservation to recreation to interpretation—yet park staff haven't always felt confident about how to engage local communities around this complex topic.

Consequently, the National Parks Conservation Association (NPCA) in collaboration with the National Park Service (NPS) initiated several workshops and surveys at Indiana Dunes National Lakeshore, Kenai Fjords National Park, and Glacier National Park, to illuminate stakeholders' values, attitudes, and interests in responding to climate change. The learning that emerged from those discussions can help direct parks and communities as they design and implement approaches to climate adaptation together.

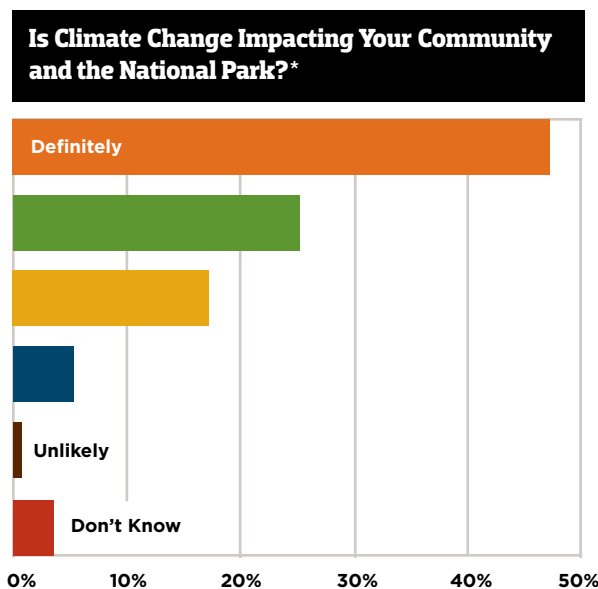
Preliminary surveys conducted in three gateway communities during the summer of 2012 indicate that stakeholders—including educators, civic leaders, conservationists, and businesses associated with the travel and tourism industry—overwhelmingly believe that climate change is happening, and that nearby parks are “definitely” or “probably” experiencing an impact.

What's more, stakeholders believe that climate change is likely to have a negative impact on both their business and their nearby parks. At Indiana Dunes, 60 percent of those polled anticipated that the negative impact of climate change on their business or organization would be “moderate” or “great.” And at Kenai Fjords and Indiana Dunes, more than 50 percent of respondents agreed or

strongly agreed that climate change threatens the future of those national parks. Many of the survey participants reported that they're already taking some actions (such as saving energy with compact fluorescent bulbs and a lower thermostat setting) in response to the threat of climate change. Many indicated a willingness to partner with their local park in adapting to the effects of climate change.

Such responses suggest that visitors and local stakeholders don't need to be convinced that climate change is happening, or that it may have undesirable consequences for themselves and the places they cherish. They're committed to climate change mitigation and have often begun such efforts themselves. However, adaptation strategies are less familiar to them.

The need for parks to lead by example was echoed in the climate change workshops that followed the surveys. Those discussions brought together a wide range of stakeholders, including land managers, park staff, local educators, civic leaders, students, conservationists, and recreation programmers, who voiced both the importance of parks as models of sustainability and leaders in adaptation as a response to climate change.



II. Assessing Stakeholders' Attitudes About Climate Change (continued)



When asked to identify the opportunities for parks and community partners in adapting to climate change, participants at these workshops highlighted the following:

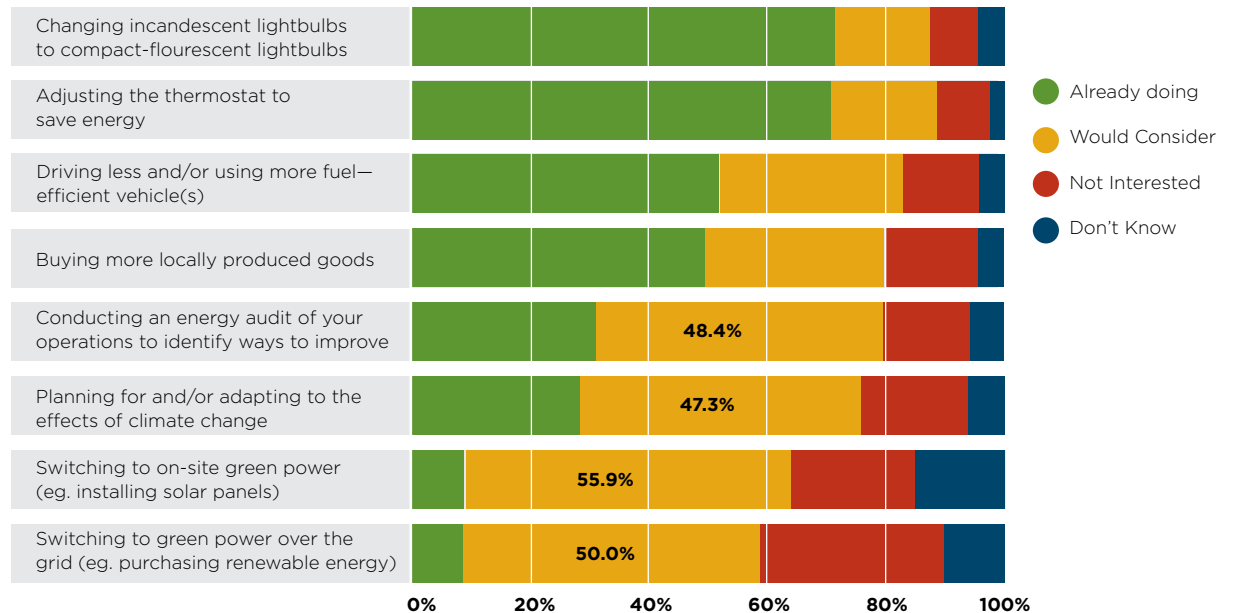
- Develop shared goals, community projects, and partnerships.
- Work collaboratively to improve quality of life and the livability of the community.
- Educate communities about large landscape adaptation.
- Develop proactive disaster plans.
- Create incentives for low-carbon transportation.
- Develop green infrastructure.
- Improve water conservation.
- Connect habitats with greenway planning.

These strategies offer meaningful benefits to the community, including stormwater management, cleaner air, new recreational opportunities, better transportation options, secure water supply, emergency preparedness, and science literacy, and can accomplish several goals with one action, subsequently engaging diverse audiences in responding to climate change.

These initial climate change surveys and workshops involving park neighbors and stakeholders indicate a strong interest in partnering with their local park in addressing climate change. National parks can become leaders in climate change adaptation by implementing projects that inspire and engage the public and by

actively seeking partnerships in their local communities. Because parks and communities share the same social and ecological systems, collaboration is essential for planning and implementing worthwhile adaptation projects.

What actions are you already taking?



III

Adaptation in Action Case Studies From the Great Lakes Region



III. Adaptation in Action: Case Studies From the Great Lakes Region



Partnerships between the National Park Service and its Great Lakes neighbors have resulted in several successful climate adaptation projects.

Best Practices for Climate Adaptation

- Expect uncertainty about the future climate.
- Be open to innovative, unconventional projects.
- Customize adaptation strategies for your community.
- Consider cultural relevancy of adaptation planning, implementation, and communication.
- Identify benefits of climate adaptation strategies.
- Identify possible collaborators and community messengers, including new community partners.
- Consider how climate change might exacerbate other stresses, such as invasive species, access to water, and pollution.
- Evaluate the effectiveness of adaptation strategies.
- Share stories of adaptation efforts, including success and failures.



ABOVE: Citizen for Conservation volunteers at native plant sale ©Donna Bolzman

Case Study One



Managing Stormwater Runoff Indiana Dunes National Lakeshore, Indiana

Torrential rainstorms have become more frequent at Indiana Dunes National Lakeshore, east of Chicago, and climate change predictions indicate storms will only intensify over time. Stormwater routinely contributed to flooding in parking lots at Park Headquarters and the Dorothy Buell Memorial Visitor Center, causing problems for staff and visitors at the park. Furthermore, the pollutant-laden runoff worsened the degradation of Dunes Creek, which flows through the visitor center site.

In response, several organizations joined forces to address the stormwater problem. Indiana Dunes enlisted the help of seasonal staff to design and install a rain garden at Park Headquarters in 2010. Ever since the garden was planted, flooding there hasn't occurred. Another rain garden was installed at the visitor center, where beds of native flowers and grasses collect and filter the roof's runoff before returning it to Dunes Creek. This larger rain garden was built as part of a demonstration project coordinated with the Save the Dunes Conservation Fund, Porter County Convention, Recreation, and Visitor Commission, the Indiana Department of Transportation, and other groups.

Other improvements to the visitor center site include unconventional drainage ditches that mimic natural streams by surrounding a narrow central channel with broad, low-sloping banks covered with plants that slow the water's movement and trap pollutants. That

“stream in a ditch” design, along with vegetated swales separating rows of parked cars, now control flooding and protect Dunes Creek from damaging runoff.

Indiana Dunes coupled this adaptation project with opportunities for educational outreach and community involvement. Teachers from area schools participated in a workshop that included a visit to the park's rain gardens; following up on this experience, students at one nearby school (Lake Hills Elementary) helped build their own rain garden. These landscapes not only handle stormwater, but are also better adapted

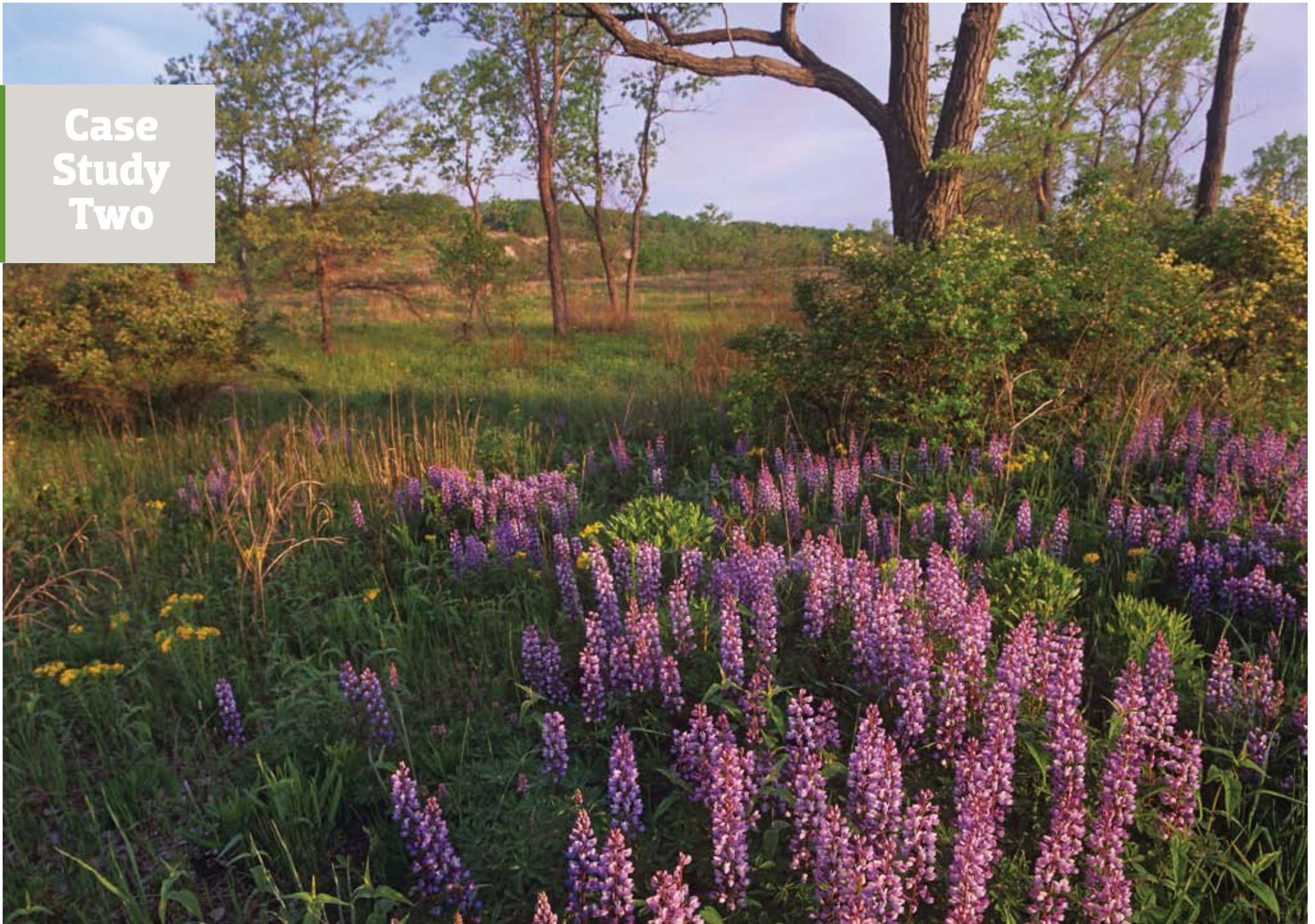
to a changing climate.

In the community, the Park Neighbors program encourages area residents to use the park's landscaping and stormwater projects as models for their own homes and businesses. By implementing sustainable landscaping practices, such as installing rain barrels or gardening with native plants in their own yards (or even by volunteering at a Stewardship Day activity), local residents are recognized as Park Neighbors who are actively involved in improving the landscape in and around the park.



ABOVE: Shoreline erosion - Red Lantern Restaurant, Lake Michigan, Indiana. NPS

Case Study Two



Planning for Climate Change Chicago Wilderness, Illinois

In one of the most developed parts of the country, some 370,000 acres of open space are protected within and around Chicago’s metropolitan area. Indiana Dunes National Lakeshore is a member of a regional alliance of more than 250 organizations called the Chicago Wilderness (CW). To improve the health of natural areas in the region and to make them more resilient to climate change, Chicago Wilderness developed the Climate Action Plan for Nature (CAPN

or “the Plan”). The Plan provides recommendations and initiatives for mitigating climate change, adapting to its inevitable implications, and spurring the public to action.

The Plan is based on a review of scientific studies on climate change and evaluates potential impacts to Chicago’s natural areas. Prior to publishing the Climate Action Plan for Nature, Chicago Wilderness had already completed a paper in 2008 titled Climate Change and Regional Biodiversity. The solid science behind the Plan helped to ensure its credibility and

to focus attention on the work to be done, rather than on arguments about the reality of climate change.

Making the process inclusive contributed to a successful outcome: All Chicago Wilderness members were invited to participate in the Plan’s development. Conservation practitioners, researchers, educators, and representatives from municipalities and federal agencies, such as the National Park Service, all helped to steer the direction of the final document, which complements municipal plans (such as the Chicago Climate Action Plan and the Evanston Climate Action Plan, which were in development as the CAPN process began).

Consequently, the Plan identifies a wealth of benefits that can result from confronting climate change; these benefits include improved stormwater management, better connectivity of greenways for habitat and recreation, and public awareness and support for ecosystem services. To implement the Plan, the Climate Change Task Force (consisting of members of the Chicago Wilderness alliance) collaborates with other working groups to pursue Plan priorities, such as promoting and maintaining larger interconnected landscapes.

The Plan has resulted in concrete work. One of the first goals was to update the Biodiversity Recovery Plan, a key document that informs regional conservation planning. In addition, several studies of species vulnerable to climate change are underway with partners in the region.



Case Study Three



Restoring Imperiled Wetlands Great Marsh at Beverly Shores, Indiana

Geese, ducks, and wading birds once flocked to the Great Marsh, a patchwork of native flowers and wet prairies located at the southern tip of Lake Michigan. Towering recent and ancient sand dunes bordered its north and south ends, and the 12-mile span in between has served as an important stopping point for many migratory birds whose various flight paths funnel together here. But a century of farming, ditching, and construction of roads and levees dried out parts of the Great Marsh and shrank its total size. Invasive plants crowded out natives and reduced the habitat's diversity, and waterfowl such as egrets and herons abandoned the degraded wetlands. Climate change is a new threat to this important habitat. Wetlands are particularly vulnerable to changes in precipitation patterns; increased drought affects water inputs and reduces storage capacity and groundwater levels.

In 1998, Indiana Dunes National Lakeshore began a wetland restoration project of Derby Ditch Watershed, a 500-acre section of the Great Marsh. In addition, the Shirley Heinze Land Trust (SHLT) had been working to acquire urbanized parcels of the marsh. Those donated and purchased parcels sat adjacent to the national lakeshore, divided from the park only by Beverly Drive (a narrow two-lane road). These lands were then donated to the park to be incorporated into its boundaries.

In 2009, SHLT received a grant from the Sustain our Great Lakes program, administered by the National Fish and Wildlife Foundation, to restore a series of interdunal wetlands throughout northwest Indiana. Under this grant, SHLT staff and volunteers began efforts to control invasive hybrid cattail on 29 acres in the Great Marsh. They planted a variety of sedges, rushes, and wildflowers—1,600 plants in all—and installed a native seed mix to reestablish the diverse wetland plant community.

To help sustain these valuable efforts, the NPS (with funding from the Great Lakes Restoration Initiative) formed a cooperative agreement with SHLT to continue restoration work through 2012. Thanks to the partnership, invasive species control was expanded to include

species such as reed canary grass, glossy buckthorn, and bush honeysuckle. Ten thousand native plants were planted by SHLT staff and volunteers to revegetate these areas.

SHLT is continuing these efforts in the Great Marsh with the recent acquisition of 14 more parcels; grant funding may soon facilitate additional restoration work in these areas. The NPS/SHLT collaboration has also cultivated community support through educational outreach. Events such as the July 2013 dragonfly hike deepen the public's appreciation for the Great Marsh and engender its support for restoration projects that help protect these valuable wetlands from the effects of climate change.



LEFT: Tree Swallow, Indiana Dunes National Lakeshore. NPS. RIGHT: Karner Blue Butterfly, an endangered species can be found in the Indiana Dunes National Lakeshore. NPS

Case Study Four



Reducing Energy Consumption Pictured Rocks National Lakeshore, Michigan

It's no secret that energy efficiency is a key mitigation strategy for dealing with climate change. But it's also an adaptation measure; reducing energy consumption allows more resources to be directed toward responding to the impacts of climate change. Additionally, using less energy can reduce water pollution, water consumption, air pollution, and land development—all things that can help our living landscapes become more resilient in the face of climate change. In Alger County, Michigan, successful teamwork between Pictured Rocks National Lakeshore, the USEPA Great Lakes Restoration Initiative, the Superior Watershed Partnership, and neighboring communities led to the Alger Energy Savers Program.

Phase 1 of the Alger Energy Savers Program included visits to residential areas of Grand Marais and Munising (gateway communities for Pictured Rocks National Lakeshore). Walk-through assessments identified energy-saving opportunities within individual homes and provided residents with a \$10 voucher for energy-efficiency products at participating local hardware stores. Over 10 months, the Energy Savers Program visited 305 homes (11 percent of Grand Marais and Munising residences), installed more than 3,100 energy-efficiency measures in Alger County homes, and inspired almost 95 percent of participants to either take, or plan to take, next steps to improve their home energy efficiency.

Phase 2 expanded the program to include area businesses. Walk-through assessments identified baseline and “next step” opportunities for energy efficiency, and provided businesses with up to \$100 worth of free energy-saving products such as compact fluorescent light bulbs, low-flow showerheads, faucet aerators, low-flow sprayers, and smart power strips. Businesses interested in pursuing “next step” opportunities received 50 percent matching funding (up to \$2,500) for product and installation costs.

Communication and outreach was critical to the program's success. A park ranger was hired to complement core program staff and to raise awareness of the program both inside and outside Pictured Rocks. And a variety of educational materials were developed in an effort to reach residents at least three times. Flyers, postcards, and table tents advertised the program, while radio and television announcements broadcast program opportunities and incentives. Postings on social media outlets and an educational website exploited the internet's reach. A park ranger cultivated the support of local groups by making presentations in uniform to Lions, Kiwanis, and Rotary Clubs and to schoolteachers and students. Question-and-answer sessions at summer fairs and Chambers of Commerce broadcast the Energy Savers opportunities to home and business owners.

Follow-up surveys indicated widespread approval of the Alger Energy Savers Program. Participants found the program to be both well implemented

(rating it 4.84 out of five) and informative (4.23 out of five). Partnerships between the NPS and other like-minded organizations created a foundation for that achievement.

By developing the project locally and working with regional organizations, the project's cultural relevancy was high. The Alger Energy Savers Program helps provide resiliency in a future made uncertain by climate change, while helping improve the quality of life for neighbors today.



ABOVE: Compact Fluorescent
©Eric Delmar/Istockphoto

Case Study Five



5. Adjusting Boat Docks for Changing Lake Levels

Apostle Islands National Lakeshore, Wisconsin

Water levels in Lake Superior sank to record lows in 2007 and compromised the boating that so many visitors to Apostle Islands expect. The park includes more than 42,000 acres of land on 12 miles of mainland shoreline and 21 islands, plus approximately 27,000 acres of surrounding Lake Superior waters. In this landscape, boats represent a critical means of transportation, yet declining lake levels (which have been linked to climate change) resulted in a 25-50 percent loss of the functional dock space that park staff and visitors rely on. Shallow water exposed the docks' structural beams and left the platforms high above the surface. The situation put boaters and their boats at risk for being trapped under the docks, and the public called for a solution. Some suggested dredging, an environmentally damaging and costly approach, and one that would not have resolved the problem for the long term.

Park staff responded instead by obtaining a \$12,000 grant from Friends of the Apostle Islands National Lakeshore. That, as well as cyclical funding available for dock maintenance, allowed the park to replace three docks and one wharf in 2010-2011. Rather than imitating the former structures, park staff developed new designs that could adapt to the future's uncertain water levels. The new dock surfaces are lower, in response to the current and likely lower future water

levels, and allow more flow-through of water close to the shore to reduce the docks' impact on sand movement. They have vertical sidewalls that are functional at a variety of water levels and keep boats from getting caught underneath. They also feature adjustable vertical rails that can be raised or lowered according to water levels and allow boats of all sizes to find the docks even if the docks are overtopped by lake water at some point in the future.

Credit for the new designs goes largely to park maintenance staff, who had experimented with adjustable rails on existing docks as a short-term remedy for the docks' dysfunction. The replacements they engineered not only lower the dock platforms, but can also adapt to unknown future fluctuations. The new structures are also better at accommodating water flow, reducing erosion along the shoreline.



ABOVE: Basswood Island dock, Apostle Islands National Lakeshore. NPS

IV

Opportunities: Potential Climate Adaptation Projects



IV: Opportunities: Potential Climate Adaptation Projects



Adaptation, by its nature, is focused on local impacts, local assets, and local communities (human and natural). This provides ample opportunities for national parks and neighboring communities to collaborate on climate adaptation work that is mutually beneficial. Climate adaptation work must rely on the practices of adaptive management: making changes as we go along and discovering what works, what's relevant, and what's necessary.

Future efforts that can engage communities and parks in collaborative adaptation projects could include:

Collaborate on new strategies

1. Participate in regional conservation and watershed alliances

National parks protect natural and cultural resources within larger landscapes that include cities, farms, industry, and other conservation land—and working across boundaries necessitates collaboration. What's more, adaptation work is often combined with traditional conservation efforts such as managing invasive species, reducing habitat loss, employing fire management, controlling insect damage, and restoring habitat. Since many parks work in partnership with regional conservation initiatives on these management issues,

these partnerships can be the foundation of additional collaboration on climate change.

Indiana Dunes National Lakeshore participates in the Chicago Wilderness alliance and the Calumet Stewardship Initiative, and also has representatives involved in the Upper Midwest and Great Lakes Landscape Conservation Collaboratives (LCC). LCCs were established by the Department of the Interior to provide regional opportunities for public-private partnerships to sustain natural and cultural resources that span the boundaries of any single parcel of land. NPS representation with the LCC facilitates sharing of research and strategies as well as funding for research and action programs.



2. Work with communities to identify shared concerns

Because climate adaptation work offers many community benefits, including stormwater management and air quality improvement, it presents opportunities for collaboration with groups and individuals who aren't usually seen as conservation partners.

Parks can look into collaborating with community leaders who are successfully addressing civic concerns such as education, literacy, and pollution. The Chicago Climate Action Toolkit provides research, tools, insights, and examples of creative climate work that could serve as models for similar initiatives connecting the parks to their communities. Although these case studies might not meet the standard definition of climate adaptation, some of the organizations and examples highlighted in the toolkit could be useful partners or models for nearby Indiana Dunes (soul food cooking in the Bronzeville Community Garden in Chicago; The Mary Zepeda Native Garden which connects the Mexican immigrant community in the Pilsen neighborhood of Chicago with migrating monarch butterflies that travel from Mexico to North America).

LEFT: Chicago Public School partner Rebecca Blazer teaches teachers to monitor plants at Sand Ridge Nature Center. Courtesy of The Field Museum

IV: Opportunities: Potential Climate Adaptation Projects (continued)



Participate in regional planning efforts

3. Participate in green infrastructure planning

Green infrastructure refers to a network of green spaces (in contrast to the gray infrastructure of the built environment that includes traditional pipes, sewers, and treatment plants). On local and regional scales, green infrastructure not only manages stormwater but also provides interconnected open space, greenways, and habitat—with benefits for homeowners, recreationists, wildlife, and communities. Establishing and conserving these greenways is an important adaptation strategy that helps localities cope with more intense storms, habitat shifts, and changing precipitation patterns associated with climate change. Green infrastructure prioritizes the same ecosystem functions that are protected in the parks, making this a natural arena for park involvement.

Green infrastructure planning and implementation is underway in collaborative programs of the Calumet Stewardship Initiative, Millennium Reserve, and Chicago Wilderness. National parks could be involved in the mapping and visioning process by

sending staff from parks or from the Rivers, Trails, and Conservation Assistance Program (RTCA) to provide resource expertise and help integrate community trail planning with recreation and resource management in the parks. The two-year

Michigan City Green Infrastructure project is another opportunity for park engagement; the lead organizations include Michigan City Sanitary District, Chicago Wilderness, Delta Institute, Alliance for the Great Lakes, and the Field Museum.



ABOVE: Lurie Garden, Chicago. ©John Roger Palmour

IV: Opportunities: Potential Climate Adaptation Projects (continued)



4. Participate in regional trail planning to facilitate migration corridors

Trails can act as migration corridors, especially north-south paths that could serve as routes for species whose habitats are shifting northward because of climate change.

Northwestern Indiana Regional Planning Commission (NIRPC), the Calumet Stewardship Initiative, Michigan City Sanitary District, the Millennium Reserve, and the RTCA program are involved with several trail-planning initiatives in the region. These projects and the park itself could benefit from park participation.

5. Collaborate with gateway communities on hazards planning

Climate change appears to be causing an increase in severe storm events, intense rainfall, flooding, extreme heat waves, and drought. These changes present real hazards for lakeshore communities and park resources. Collaborative planning and data sharing can help parks and gateway communities become more prepared to cope with extreme weather events and respond to emergencies. Improved storm warning systems would benefit the park and its neighbors.

Parks in the Great Lakes region could work with university researchers to better understand weather hazards and the changes that are related to climate change. They could also seek alliances with community response programs such as Adopt-A-Beach, sponsored by the Alliance for the Great Lakes. Program volunteers have helped collect debris from beaches after hurricanes and test for water quality.

Improve infrastructure

6. Adapt recreational infrastructure and communicate the reasons to visitors

Adapting the physical infrastructure to new conditions provides an opportunity to engage communities in park planning while helping people understand climate change and its impact on the local region. Focusing on the interests of visitors and area residents is an effective way to achieve culturally relevant community engagement.

Parks could solicit visitor input on recreational activities and how they are being affected by climate change. The Northwest Indiana Paddlers Association is interested in recreational opportunities on waterways in the region. Community involvement in watershed planning is often driven by recreational boating access; efforts to use more naturalistic erosion control structures provides habitat

improvements while also increasing access for canoes and kayaks in gateway communities.

Plant resilient landscapes

7. Encourage nearby residents to grow native plants and rain gardens

Park neighbors can be active stewards of natural resources in their own yards, while maintaining landscapes that complement the natural areas in the parks.



ABOVE: Through the Park Elementary rain garden project, this fifth grader and his peers realized how being a responsible citizen to our environment includes looking beyond themselves to find ways to help their community. Courtesy of Bill Arthur, Earth Partnership for Schools, UW-Madison Arboretum

IV: Opportunities: Potential Climate Adaptation Projects (continued)



ABOVE: Volunteers, including Jim Erdelac with the Shirley Heinze Land Trust, help students plant the Lake Hills Elementary School rain garden. Photo by Lois Tomaszewski, Michigan City News Dispatch, Michigan City, Ind. Courtesy of the Michigan City News Dispatch

Indiana Dunes could expand the Park Neighbors program and partner with institutions and programs that connect with gardeners (such as Purdue University Master Gardener program, Lawn to Lake Initiative with Illinois-Indiana Sea Grant, Save the Dunes, Shirley Heinze Land Trust, and Taltree Arboretum). The program could provide planting lists that prioritize species that are resilient to climate change.

8. Identify resilient plant species

As the climate changes and species shift beyond their traditional ranges, it would help park managers and neighboring communities to know which species are likely to be most resilient and potentially can adapt to the changes in their region. Any list of resilient native species would need to be revisited and updated as conditions change and research develops.

For example, Indiana Dunes has partnered with a local university to employ a graduate student intern to develop a list of resilient native plant species. This information should be shared with the community through the Park Neighbors program and collaborative projects that encourage native landscaping in the community.

9. Develop resilient habitats

The Little Calumet Wetlands project, undertaken by the Shirley Heinze Land Trust, is controlling invasive purple loosestrife while planting floodplain forests to mitigate damage caused by the emerald ash borer. Removing invasive species and planting native species makes habitats more resilient to change and is therefore a form of adaptation.

Indiana Dunes could extend these efforts to the Heron Rookery and Bailly Homestead areas. Other parks in the Great Lakes region with floodplain forests could undertake similar projects.



ABOVE: Students volunteering at the Indiana Dunes National Lakeshore. NPS

IV: Opportunities: Potential Climate Adaptation Projects (continued)



Share experience and knowledge

10. Share experience with other parks and conservation organizations

The National Park Service has provided tools to help individual parks evaluate their climate footprints and adopt mitigation and adaptation strategies. Smaller conservation organizations don't have access to the robust science, analysis, planning, and communication tools used by NPS, but they could learn from the parks' example.

Parks should participate in online exchanges where conservation professionals and park staff share their experiences through case studies and discussion boards. Two examples include the Adaptation Collaboratory at Notre Dame and the Climate Adaptation Knowledge Exchange (CAKE) by EcoAdapt and Island Press.

Research

11. Monitor trends in phenology and climate data

Climate adaptation will benefit from good monitoring data about species' response to the changing climate—including contributions from citizen science. For example, Indiana Dunes currently participates in the



ABOVE: Moose (*Alces americanus*) female wading through water, Isle Royale National Park. ©Jim Brandenburg/Minden Pictures

Chicago Botanic Garden's Plants of Concern NPN-affiliated efforts.

Regional parks could expand participation in regional and national citizen science and phenology programs, including the National Phenology Network and its Cloned Lilac Project. Partners for active monitoring programs could include the Dunes Learning Center, Chicago Wilderness Habitat Project, and the Chicago Botanic Garden's Plants of Concern NPN-affiliated efforts.

12. Share data for assessing the vulnerability of key species

National and regional efforts are underway to assess the climate vulnerability of plant and wildlife species. National park managers should apply any available published research to understand which of their region's species and ecosystems are most vulnerable. In addition, national park staff can share their expertise about species and habitats to inform vulnerability assessments that the National Park Service, U.S. Geological Survey, universities, and other groups may be conducting.

In the Great Lakes, for example, the NPS Climate Change Response Program and the University of Wisconsin Center for Climatic Research are currently collaborating on a project that will provide national parks with information on historical and projected climate change trends. This will provide key data to analyze the vulnerability of species, ecosystems, and other resources. Additionally, the Nature Conservancy in Illinois has conducted vulnerability assessments using the NatureServe climate vulnerability index tool for species of conservation concern in the Illinois Wildlife Action Plan and the Chicago Wilderness Climate Task Force is developing strategies and fostering collaboration for assessing vulnerability in the region. Park managers could consult other useful climate change vulnerability tools that have been developed by the USGS and USDA Forest Service.

V

The Road Ahead



V. The Road Ahead



Putting Strategies To Use

One hallmark of successful adaptation projects is cultural relevancy: creating adaptation projects that fit the region's unique cultural and environmental qualities. Cookie-cutter approaches to climate change—including adaptation—are less successful because they fail to account for local concerns and conditions. If stakeholders don't believe that projects speak directly to their needs, they won't join in and lend their participation. It follows, then, that some elements of the case studies profiled here may not be transferrable to other parks and refuges—but they can provide inspiration and examples for local adaptation projects.

Adaptation projects that succeed in engaging stakeholders share several common threads. For example, all five of these case studies involved collaboration and partnership among multiple organizations. Some partnerships (such as the Chicago Wilderness) are vast and longstanding. Others (such as the Great Marsh restoration) involved just a few entities. But across that spectrum, it's apparent that joining forces produces a sum greater than the contributing parts.

Examples of Collaborative Plans

- Calumet Stewardship Initiative
- Northwestern Indiana Regional Planning Commission policy
- Greenways and Blueways: Northwest Indiana Regional Plan
- Forest and Water Climate Adaptation: A Plan for Alger County, Michigan
- Chicago Wilderness Climate Action Plan for Nature

Collaborations also provide opportunities to identify projects that produce more than one advantage, or offer benefits to several stakeholders. For example, the Apostle Islands dock replacement appeals to a community that's strongly centered on boating, yet the docks' flow-through design also addresses conservation concerns by reducing erosion and deposition problems.

Once underway, adaptation projects should be shared so that other parks and communities can draw inspiration from these. The Apostle Islands project was summarized on the Climate Adaptation Knowledge Exchange website (cakex.org) and publicized in the park newspaper. Newspaper articles about the

Indiana Dunes improvements alerted residents to the various means available to mitigate stormwater damage. And press releases notified media outlets of the positive measures undertaken through the Alger Energy Savers Program.

Successful adaptation projects often emerge from community concerns. Energy Savers started with surveys to understand what community members valued. And at Apostle Islands, concerns from the public about the usability of docks prompted thoughtful design changes during their replacement. Both projects illustrate how pairing adaptation efforts with stakeholders' own priorities results in high levels of engagement.

By following best practices—which include customizing adaptation strategies for individual communities—projects can be designed that enlist broad public support while preparing resources to handle the coming years of climate change. By leveraging their experience, scientific knowledge, and credibility, parks can help communities adopt strategies that benefit both sides of the boundary with better recreational access, green infrastructure, improved water quality, resilient landscapes, efficient energy use, and much more.

