

BY JEFF RENNICKE  
Illustrations by Land Design and  
Simulation Lab, Virginia Tech

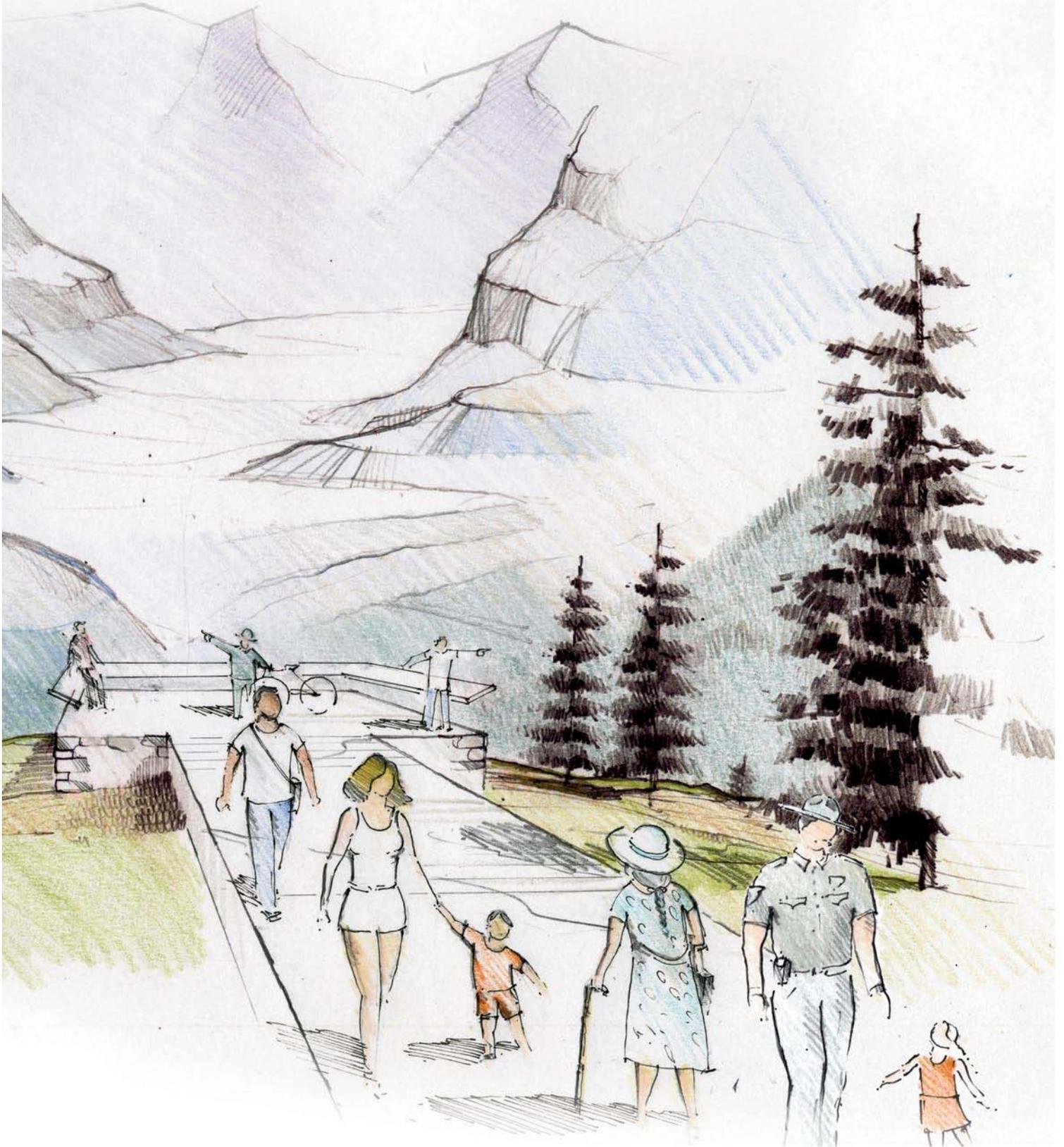
**The debate is over —  
global warming is a reality.**

How will our  
national parks  
respond to  
**what may  
well be the  
greatest  
challenge  
ever faced by  
planet Earth?**



# A CLIMATE OF Change

**AS GLACIERS RECEDE**, the Park Service's interpretive exhibits will evolve to educate the public about the impacts of global warming.



# A CLIMATE OF Change

It's in the dry clatter of rocks beneath your hiking boots. It's in the sting of the unusually warm spring sun on the back of your neck and in the roll call of dates on the string of trail signs as you hike: 1850, 1930, 1960, 1980. Yet the clearest evidence of change may lie in what you don't see anymore along most of the route to Upper Grinnell Lake in Montana's Glacier National Park: a glacier.

Over the last 150 years, Grinnell Glacier, once 500 acres, has dwindled, drop by drop, to just over a third of its original size, leaving only trail signs to mark its rapid retreat up the eastern side of the Continental Divide. Throughout the park, 73 percent of the area once covered with glacial ice is now bare rock. By 2030, scientists say, there may not be a single glacier left in the park named for its crystal-clear jewelry.

To millions of visitors over the years, these glaciers have been symbols of nature's power, beauty, and wildness. Today their melting has become an icon of global climate change, a simple and understandable symbol of the increased presence of greenhouse gases in the atmosphere—primarily carbon dioxide, nitrous oxide, and methane—and their effect on our climate. Once little more than a controversial and esoteric theory debated by scientists and politicians, the truth of global climate change now seems as clear as melting ice. According to the National Academy of Sciences, the surface temperature of the planet has risen by 1.8 degrees Fahrenheit during the past hundred years, most of that increase coming in the last two decades. The last quarter-century saw 21 of the 22 hottest years on record, and scientists expect that

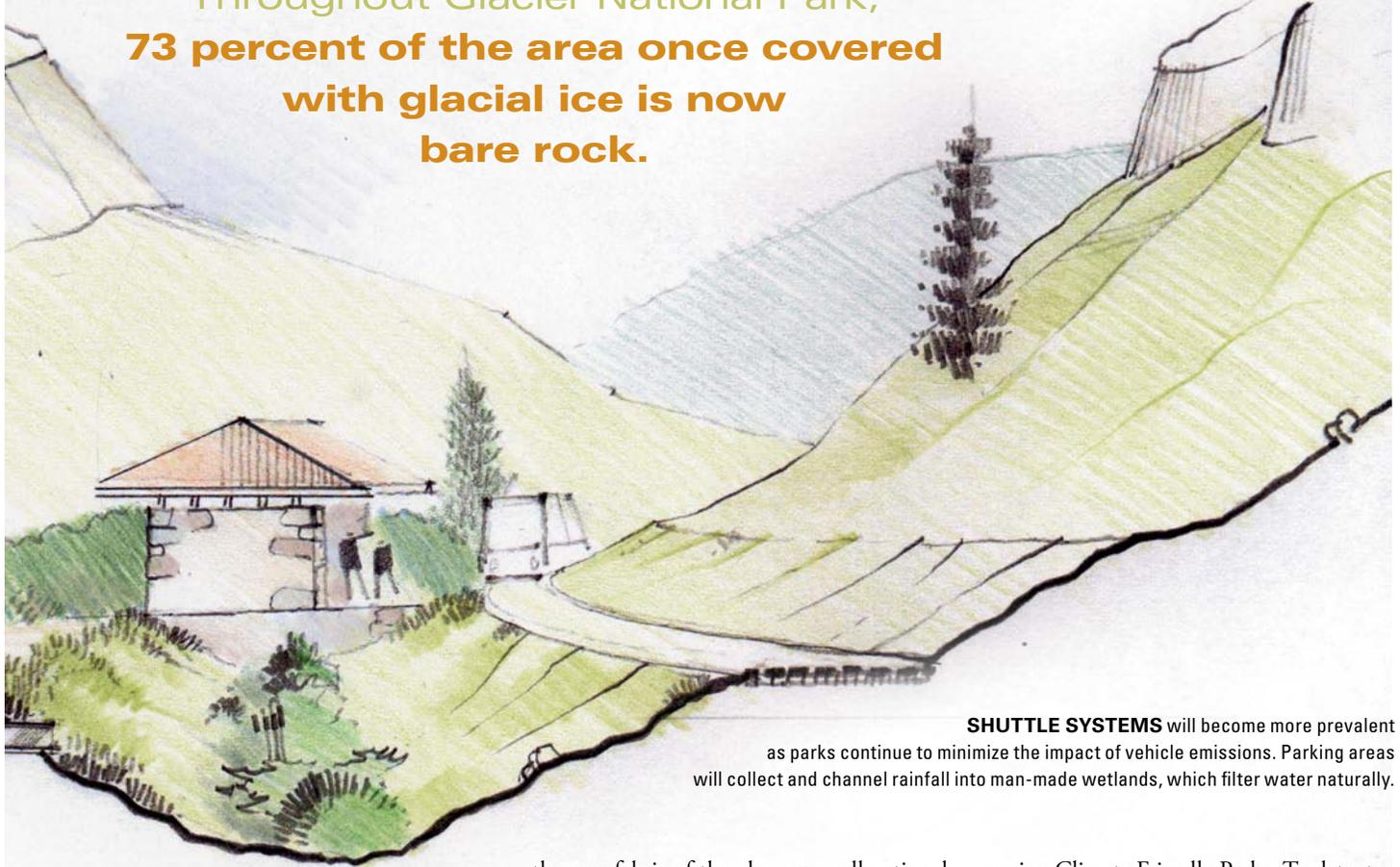
the rise of emissions could warm the earth 4.5 degrees in the next 50 years and another 10 degrees over a century—a rate of warming greater than at any time during the past 10,000 years.

The heat is on and the implications for our national parks go far beyond melting glaciers. “A climate disrupted by human activities poses such sweeping threats to the scenery, natural and cultural resources, and wildlife of the national parks that it dwarfs all previous risks to these American treasures,” says Stephen Saunders, director of the Rocky Mountain Climate Organization and principal author of a recent report on the potential effects of climate change on wild places. “There will be changes in nearly every national park unit.”

Rising sea levels in the Everglades threaten to make that park more susceptible to storm surges during hurricanes and to overwhelm the mangrove forests that buffer its freshwater and saltwater ecosystems. Those same rising seas put at risk 59 miles of beach habitat in Golden Gate National Recreation Area, threaten to flood ancient petroglyph sites along the coast of Olympic National Park, and endanger other low-lying historic sites such as Jamestown, Virginia (part of Colonial National Historical Park), and the Jean Lafitte National Historic Park near New Orleans. Warmer temperatures could result in increased fire danger and more frequent park closures in places such as Yellowstone, hasten the loss of up to 90 percent of the Joshua trees in Joshua Tree National park by 2100,



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**SHUTTLE SYSTEMS** will become more prevalent as parks continue to minimize the impact of vehicle emissions. Parking areas will collect and channel rainfall into man-made wetlands, which filter water naturally.

and render Death Valley virtually uninhabitable for long stretches of the year. Changing snow depths and ice conditions could do away with the snow-capped peaks of Rocky Mountain National Park and disrupt the predator-prey dance of wolves and moose at Michigan's Isle Royale.

From increased smog in Great Smoky Mountains to the loss of prairie pothole habitat for waterfowl breeding, no corner of the National Park System is out of reach of the hot fingers of climate change. "This is the biggest challenge we've ever faced," says Mark Wenzler, Clean Air program director for the National Parks Conservation Association, "one that threatens to change

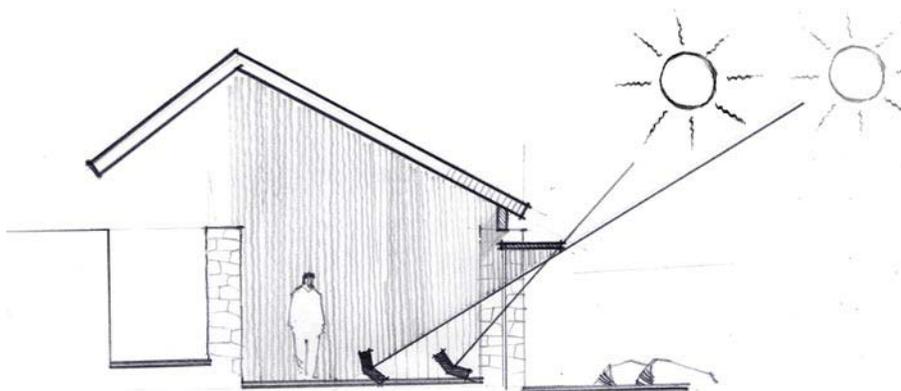
the very fabric of the places we call national parks." The reality of that challenge has created what Wenzler calls "a real sense of urgency to act."

One result of that urgency has been the creation of the Climate Friendly Parks (CFP) program, a cooperative effort of the U.S. Environmental Protection Agency and the National Park Service. Begun in 2003, CFP has a triad of goals: training park staff on the issue of climate change; helping parks to evaluate, monitor, and lessen their own environmental footprint; and showing visitors how climate change may affect the parks and illustrating ways they can get involved in the solution. Parks are asked to hold CFP workshops, develop action plans, and continually monitor and evaluate their progress on the path to be-

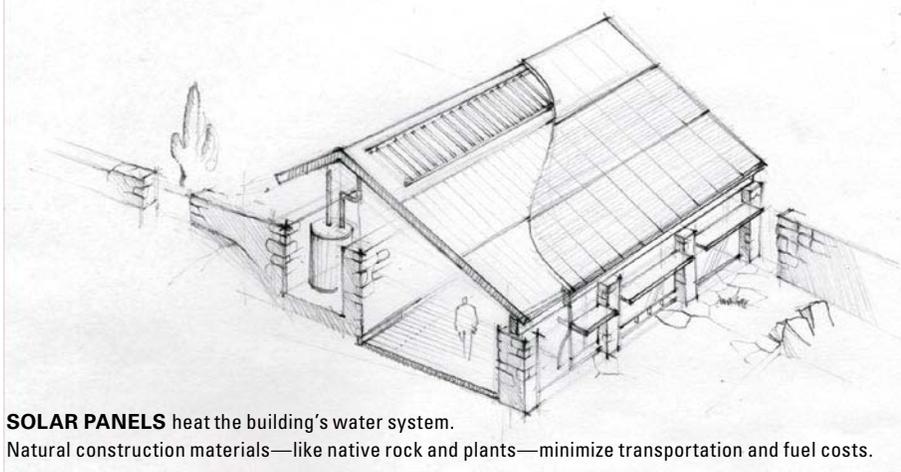
coming Climate Friendly Parks. To date, ten parks including Delaware Water Gap, Everglades, Glacier Bay, Yosemite, and Zion have held workshops, and more are in the works.

It is a new vision for our parks, says Shawn Norton, one of the program's coordinators. And when asked to describe the perfect "Climate Friendly Park," he speaks with a visionary's zeal. "A perfect Climate Friendly Park is first and foremost carbon neutral, adding no emissions to the atmosphere," Norton says. As you enter the park you are given information about sustainable practices along with a trail map and park pass. Instead of a snarl of too many private, polluting cars jostling for too few parking spots, you board an alternative energy shuttle system that takes you quickly, quietly, and cleanly anywhere you

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**SHADING PANELS** block a visitor center from a high summer sun, minimizing cooling costs; low sunlight flows in and warms the building during winter months.



**SOLAR PANELS** heat the building's water system. Natural construction materials—like native rock and plants—minimize transportation and fuel costs.

want to go in the park. The visitor center, which blends almost invisibly into the background because of its natural architecture and landscaping—including a “green roof” of native plants—is a clean energy facility that takes advantage of solar, wind, or geothermal energy, LED technology, and natural lighting. The food you purchase at the snack bar is organic and locally grown. The artwork for sale in the gift shop is made from recycled materials like glass and

aluminum. The restrooms are fitted with low-volume toilets and automatic faucet shut-offs for water savings, and they are kept clean with nontoxic cleaning products. Ranger vehicles patrolling the park emit no harmful pollutants. Remote buildings are fitted with photovoltaic panels to meet their own energy needs. And interpretive signs explain it all to park visitors, offering tips on decreasing their own ecological footprint while in the park and back at home.

This vision isn't simply a futuristic daydream, either. “We're not that far from making much of this a reality,” says Norton. “We can cut our energy use substantially. We can cut our emissions substantially. We can lower our water consumption substantially using today's technologies and, if we got aggressive about it, we could do it in just about every park within ten years. We are just getting started, but more parks are stepping up every day.”

One such park is Zion. In 2000, a park shuttle system replaced 5,000 private vehicles per day with 30 propane-powered buses, eliminating more than 13,000 tons of greenhouse gas emissions that otherwise would have filled the park's skies over the course of a year. A new “green” visitor center taps into solar power for 30 percent of its energy, takes advantage of natural light for 80 percent of its lighting needs, and features large cooling towers that provide low-energy air-conditioning in the summer and a passive solar heating system with a Trombe wall for heat retention for cooler days. Considered a model for national park construction, the new facility reduces energy use by nearly 75 percent and eliminates more than 300,000 pounds of greenhouse gas emissions every year.

Less visible are increases in the use of environmentally friendly building materials, nontoxic cleaning supplies, and a drastic rise in recycling efforts within the park. “The Climate Friendly Parks initiative allowed us to address environmental management and climate change while identifying priority areas for our environmental management system,” says Zion Superintendent Jock Whitworth. “Now we have a better idea of the impacts of climate change on the park's natural and cultural resources, and we can identify possible solutions.”

It is all part of a climate of change within the National Park System. “We are no longer asking if global climate change is going to occur,” says Bob Krumenaker, superintendent of Apostle Islands National Lakeshore. “We're acknowledging that reality and working on ways to adapt. We must all be as ecologically sound and sustainable as we

## ON THE WEB



**Want to learn more?** Visit [www.npca.org/globalwarming](http://www.npca.org/globalwarming) to read NPCA's recent report, *Unnatural Disaster*, which offers recommendations to help slow, and even halt, the damage being done to our national parks.



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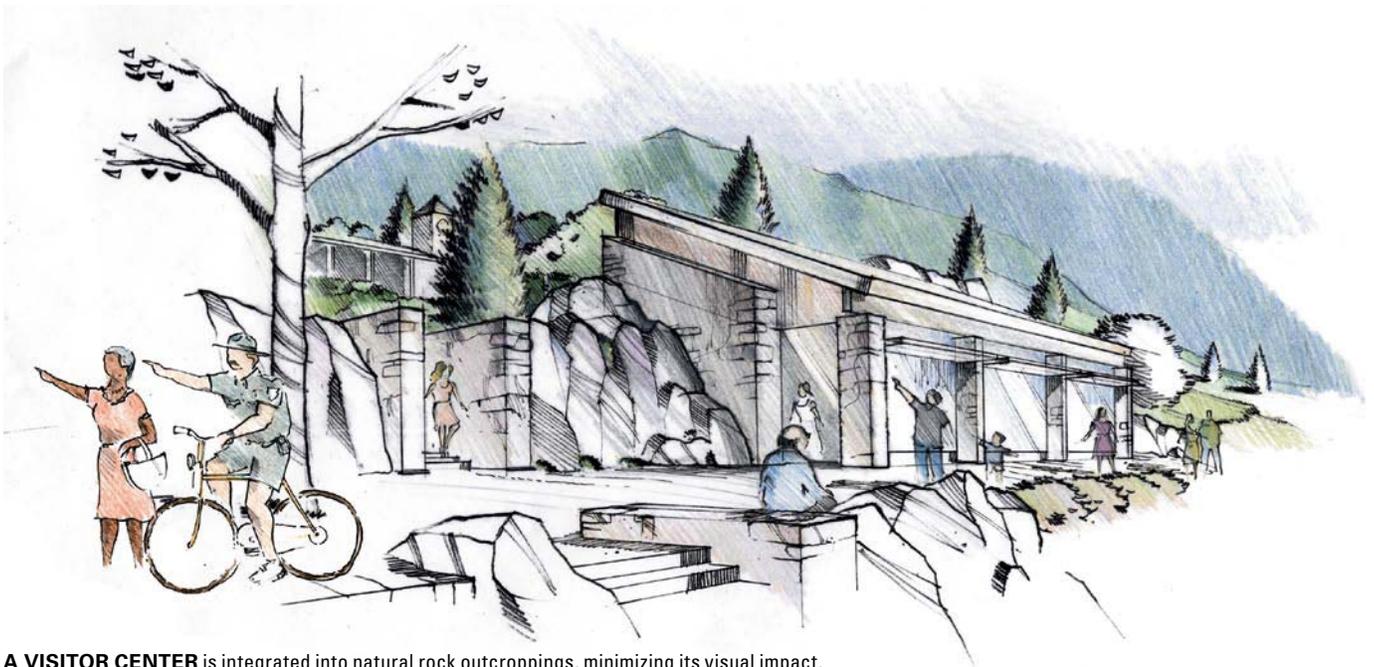
can possibly be and still get the job done.” In the Apostle Islands, that means running a new park boat, the *Nanookaasi* (Ojibway for “hummingbird”), on biodiesel and exploring the potential of geothermal energy at the visitor center. At Channel Islands National Park, it means using 76 renewable energy systems in water pumping, communications, and resource-monitoring devices to eliminate more than 28,000 gallons of diesel fuel consumption every year. At Assateague Island, asphalt roads and parking lots have been resurfaced with crushed clam shells and walkways and decks rebuilt with 100 percent reclaimed lumber. At Acadia National Park, the Island Explorer, a propane-powered shuttle bus service, has carried more than 2 million visitors, eliminating 800,000 vehicles since its inception in 1999. Solar energy powers the

Heart of the Sands Nature Center in White Sands National Monument. On Earth Day in Yosemite, where hybrid shuttles have been in operation since 2005, visitors who arrive at the park in alternative fuel vehicles receive free admission. In Gateway National Recreation Area, employees who come up with winning energy conservation ideas are granted one hour off as a reward for their ingenuity. At Glacier National Park, the historic red buses now run on alternative fuels and have inspired a program to allow employees to ride “red bicycles” between buildings. And at that trail to Upper Grinnell Lake where visitors hike in the ghostly tracks of the Grinnell Glacier, a new interpretive display will be constructed this year, illustrating the effects of climate change on national park resources.

Change is coming to our national parks, that much is clear. Exactly what that change will look like and how park staffs, park visitors, and the parks themselves will adapt to this new reality is not as clear. But, as Apostle Island’s superintendent Bob Krumenaker points out, “We in the National Park Service are in the perpetuity business. Whatever changes are coming in the climate, our parks will still be here. In the face of global climate change, our parks may take on even greater importance as some of the most pristine, untouched, and ecologically significant places left on the planet.” NP

**Jeff Rennie** is a teacher at Conserve School in Wisconsin’s North Woods.

**The Land Design and Simulation Lab** is part of the Landscape Architecture Program in the School of Architecture and Design at Virginia Tech. Staff on this project included **Hooman Koliji**, a PhD student in landscape architecture, supervised by **Patrick Miller**, FASLA, Associate Dean for Graduate Studies and Outreach, and **Robert Schubert**, Associate Dean for Research, both in the College of Architecture and Urban Studies.



A VISITOR CENTER is integrated into natural rock outcroppings, minimizing its visual impact.