



# Sustainability news

Fall 2006



# Climate

People and Parks Respond to

# CHANGE

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## Sustainability News Fall 2006

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### On the Internet

See [www.nature.nps.gov/sustainabilitynews](http://www.nature.nps.gov/sustainabilitynews) for additional information including points of contact, news briefs, and specific park updates.

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#### Climate-Friendly Parks & Climate-Friendly People

The challenge of climate change allows parks to serve as very visible models for climate-friendly actions. Seven parks that have conducted Climate Friendly Parks workshops are featured, along with seven individuals who are working to understand and interpret climate change impacts to national parks.

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#### Interview With Dr. Cynthia Rosenzweig By Kevin Leichner

A senior research scientist at Columbia University's Earth Institute, Rosenzweig has worked with the National Park Service at Gateway National Recreation Area to study the effects of climate change.



NPS PHOTO BY JULIE HANGCOCK



NPS PHOTO

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#### Outlook By Meg Weesner

Climate change may help to create conditions that favor disturbance mechanisms such as exotic plant invasion and wildland fire at Saguaro National Park.



NPS PHOTO

Cover: Glacier Bay National Park and Preserve GIS specialist Bill Eichenlaub rests during a recreational hike on the Brady Glacier. Brady Glacier has retreated 150 meters during the past 30 to 40 years. PHOTO BY BILL EICHENLAUB

Opposite top: Earth Day events at Zion National Park featured photovoltaic panels that powered the speakers and instruments for the musicians.

Opposite center: Visitors to Jamaica Bay in Gateway National Recreation Area enjoy birdwatching in a saltgrass marsh, a critical wetland habitat that may be seriously impacted by climate change.

Opposite bottom: Perennial pools are subject to rapid sedimentation events that may become more common as a shift to a warmer and drier climate occurs.

## Leadership Notes

Earth's climate is changing and our national parks, with the unique resources they protect, are beginning to experience the effects of this change. This new reality poses very important questions for the National Park Service. Specifically, how will climate change affect the natural and cultural resources entrusted to us and how do we recognize and monitor these changes? What management decisions are appropriate in response to ecosystem changes? What actions can we take to mitigate our greenhouse gas (GHG) emissions? How do we most effectively communicate this information to park visitors?

In this issue of **Sustainability News**, we look at how we are responding to these questions and how environmental leaders are making a difference in parks by conducting research and monitoring resources for climate change impacts, developing adaptive management solutions to protect ecosystems against the detrimental effects of change, and implementing model visitor outreach efforts. Seven parks are highlighted that have hosted Climate Friendly Parks workshops and have resulting action plans in place. Additional parks have developed greening plans to reduce energy and water use, to design and construct sustainable facilities, and to plan transportation innovations. Sustainable practices enable us to reduce operational and visitor-based GHG emissions; however, reducing GHG emissions in the parks alone will not stop global warming. We need the public to "Do Their Part" for Climate Friendly Parks. The challenge of climate change allows parks to serve as very visible models for climate-friendly actions that can collectively make a difference.

—Shawn Norton, Coordinator National Park Service Environmental Leadership Program

## Climate Change: From Knowledge to Action

Humans are increasingly altering the Earth's environment. From high mountain peaks to isolated deserts, dense forests, and deep ocean waters, the effects of human activities are detectable at virtually all locations on the planet. Our collective influence is now understood to extend even to the climate system, those forces that determine how much rain occurs over the course of a season and whether winters are warm enough for a cherry tree to survive in a backyard.

Humans impact climate primarily by altering atmospheric chemistry. This has been understood since the turn of the twentieth century when the Swedish physicist, Svante Arrhenius, first warned against global warming. Employing relatively simple physical laws, he recognized the accelerated rate at which carbon dioxide was being added to the atmosphere from industrial processes. If left unchecked, Arrhenius warned, Earth's atmosphere would warm.

Human influences on climate add to the natural climatic influences that have been operating throughout Earth's history. Tectonic forces, variations in Earth's orbit around the Sun, biological processes, sunspot activity, and internal dynamics of the coupled ocean-atmosphere system all contribute to what we understand as natural climate variability. But natural climate variability cannot explain the rapid warming that has occurred over the last few decades; that can only be explained by the addition of human-produced greenhouse gas (GHG) emissions to the equation. Arrhenius was right, and while understanding that adding GHGs to the atmosphere will warm the planet is not difficult, complexities exist in knowing how much warmer it will get, how fast warming will occur, and how ecosystems will be affected.

While many questions remain, we know a lot, and research conducted in national parks has added greatly to our knowledge about how natural systems are responding to climate change. We know that glacial ice is melting, high latitudes are warming faster than the tropics, oceans are

warming, and sea level is rising. Most scientists also agree that the water cycle is changing and intensifying, and that this will lead to changes in water supply, flooding, and drought patterns. We can expect warmer winters, longer growing seasons, fewer freezes, more extensive insect and pathogen outbreaks, and more intense

fire seasons. The weight of scientific evidence in support of global climate change is overwhelming—we need to take action now.

How do we develop an appropriate societal response to a problem that has been exposed by scientific investigation and what is the role of parks in that process? Science helps us understand the need for change, but people must act on that

information to find solutions. The people who have contributed to this issue of **Sustainability News** are taking action. Their examples range from providing information to managers about how climate change is impacting park resources, to raising public awareness through outreach and education, to integrating climate change issues with environmental management. Park employees and their partners are forming green teams and developing alliances with a long-term commitment to sustainable, climate-friendly operations and practices for their parks and surrounding communities.

Albert Einstein said "problems cannot be solved at the same level of awareness that created them." In the last several years I have witnessed a distinct shift in people's awareness that suggests we may be entering a solution-finding phase on climate change. We are moving into a new paradigm for problem solving which is based on the assumption that everyone can contribute something of value. This is a learning community approach where we all participate as both teachers and learners. Through this technique, innovative and sustainable lifestyle and management strategies can emerge that maintain and improve environmental health as well as our quality of life. ■

—Leigh Welling, Director Crown of the Continent Research Learning Center Glacier National Park



Leigh Welling with one of Glacier National Park's propane-powered red buses.

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**Top:** Diane Elder inspects an oil-fired furnace that operates on B20 biodiesel fuel (20% biodiesel and 80% petroleum diesel) in the maintenance shop at Whitman Mission National Historic Site. The park recently received the EPA Region 10 Champions of Environmental Leadership and Green Government Innovation Recognition award.

**Bottom:** Visitors board a biodiesel shuttle bus at Lewis and Clark National Historical Park.

**Opposite:** The annual Calabasas Pumpkin Fest at the Paramount Ranch in Santa Monica Mountains National Recreation Area provides an enjoyable venue for the SAMobile traveling exhibit.

## Park Solutions Provide Public Models

Research and monitoring activities in national parks can indicate how sensitive resources are reacting to climate disruptions. Information from these efforts helps to support management solutions in areas ranging from park maintenance to transportation systems. Steps to increase resource conservation and energy efficiency in the parks can serve as powerful examples to the public of actions to reduce greenhouse gases (GHG) and criteria air pollutant (CAP) emissions. With millions of visitors and others interested in the parks, this makes the National Park System a primary source of information for educating a large audience about GHG and CAP emissions and mitigation of these emissions.

## Whitman Blends Maintenance and Stewardship

The use of a combination of biodiesel and heating oil is being piloted at **Whitman Mission National Historic Site** to heat the park's maintenance shop and warehouse. The park blends 140 gallons of B99 biodiesel with 560 gallons of a 50-50 blend of No. 1 stove oil and No. 2 diesel fuel in a 700-gallon above-ground storage tank. Using No. 1 stove oil reduces the chance of the blend gelling at cold temperatures. Winter temperatures as low as 9° F did not cause any problems with the resulting B20 fuel mix. The park also works towards the mandated 20 percent reduction in fuel use by operating all diesel-powered equipment with B20 biodiesel.

Whitman Mission's sustainability efforts include the implementation of an Integrated Solid Waste Alternatives Plan (ISWAP) that reveals the park has been diverting more than 90 percent of its waste from the landfill. Most of this successful rate is attributed to an efficient composting operation that includes collection and on-site reuse of an estimated 46 tons of grass clippings, leaves, and wood chips annually. Another half ton of recyclables such as scrap paper, aluminum, and cardboard is collected in the park. Each year five tons of garbage is sent to the landfill, bringing the park's total annual waste to nearly 52 tons.

Converting to biobased lubricants and improving water and energy conservation add to a growing list of green practices at Whitman Mission. As a result, Chief of Maintenance Bruce Hancock was awarded the FY 2005 Regional and National Director's Award for Excellence in Natural Resource Stewardship through Maintenance.

## Bonneville Power Supports Solar Systems

In addition to significant progress with waste reduction, Whitman Mission National Historic Site has increased their solar power production by 25 percent this year. Bonneville Power Administration (BPA) helped coordinate the purchase of 12 additional photovoltaic panels and an inverter through revenue from green power credits. Installed on the maintenance shop roof, the grid-tied system increased in size from 9.1 to 11.4 kilowatts at no cost to the park. The additional energy should increase the park's renewable energy production by more than 25 percent of their total energy use.

At **John Day Fossil Beds National Monument**, visitors see the benefits of the park's photovoltaic system on an LCD monitor in the visitor center that displays instantly updated information on the system's performance. Visitors observe a photo of the system on the roof, along with a chart showing recent and current power production. The monitor is connected to a thin client, a small piece of hardware that replaces the need for a computer.

Live energy production data at these and other parks can be viewed online at the BPA federal solar meter website: [www.bpa.gov/energy/nl/tech/leemeteringdata/federal](http://www.bpa.gov/energy/nl/tech/leemeteringdata/federal). Hourly renewable energy production information is available, along with photos of park photovoltaic systems. "It's really great to see our photovoltaic systems in action," says Pacific West Region Energy Program Director Steve Butterworth. "They are producing green energy and using less grid power, creating fewer greenhouses gases."

## Park Partnership Reduces Carbon Footprint

Buses shuttling visitors at **Lewis and Clark National Historical Park** during the summer months operated on a five percent biodiesel blend as the result of a partnership between the park and Astoria Biodiesel (Astoria High School Senior Project), Sunset Empire Transportation District, and the Port of Astoria Alternative Energy Subcommittee. Of the approximately 5,525 gallons of fuel used, 276 gallons were biodiesel made from waste vegetable oil generated in the community. This apparently small amount realized a significant step in introducing biodiesel to public transportation on the north coast of Oregon and earned an American Planning Association award.

## Key Climate Change Talking Points

Working with research scientists and interpreters, the Crown of the Continent Research Learning Center has developed messages about climate change that apply beyond Glacier National Park:

### ■ Temperature and Water Cycle Changes

Earth's surface temperature has risen 1.6°F in the last 100 years; 20% of this change has occurred in the last decade. Higher elevations and northern environments are warming faster than locations at sea level and closer to the equator. Cooler temperatures are affected most, with winter and nighttime temperatures markedly higher. As a result, we are experiencing fewer cold temperatures rather than hotter summers. Precipitation in the Northwest is higher than historic levels, but snowpack is down by 30%. With less snow and warmer winters, spring runoff occurs up to 20 days earlier than normal.

### ■ Climate Change Science

The concentration of greenhouse gases (GHGs) such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) in Earth's atmosphere plays an important role in regulating the surface temperature of the planet. GHGs have increased in the atmosphere by about 35% since the late 1700s. The concentration of CO<sub>2</sub> is now higher than it has been in more than 400,000 years.

### ■ Impacts to Resources and Visitor Experience

Effects include melting glaciers, changes in temperature, changes in the timing and amount of streamflow, encroachment of forests on alpine meadows as treeline moves up in elevation, and a potential increase in flooding, fire, and avalanche frequencies. Summer recreation seasons are expected to lengthen overall.



### Learning Center Seeks Silver Certification

A strong stewardship message whispers in the woods surrounding the North Cascades Environmental Learning Center in **North Cascades National Park**. Peaked roofs and undisturbed tall trees shelter pedestrians as they walk along a curved corridor reminiscent of a meandering stream. Dappled light from the forest extends to interiors through windows that correspond with the snow-capped skyline. Naturally landscaped with plants grown from seeds and cuttings on site, the campus features a cluster of 16 buildings designed to demonstrate environmentally preferable practices and sustainable operations.

Under consideration for a silver certification from the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED™) Program, the facility maximizes efficient heating and lighting while minimizing waste. Recycled, salvaged, and low-impact materials, such as locally obtained Forest Stewardship Council (FSC)-certified wood, were integrated into every phase of the project from site restoration to construction, reducing fuel consumption for delivery to the site and helping to support the area's economy.

Next April, on Earth Day weekend, a field seminar is scheduled for participants to meet with Learning Center architects and staff to learn more about green building design and operation. Behind-the-scenes tours and group discussions will be offered, along with information about residential LEED™ programs and other strategies for green building projects at home.

### Bi-fuel Vehicle Takes NPS Message on the Road

Work to reduce greenhouse gas emissions in national parks is providing new avenues for education and interpretation. Operating on compressed natural gas or gasoline, a bi-fuel cargo van also serves as a traveling invitation to visitors throughout **Santa Monica Mountains National Recreation Area** and area communities to enjoy the park and its resources.

On the outside, high-profile graphics on adhesive vinyl create visual interest at special events or even for people passing on the freeway. Park interpreters designed the engaging imagery, which features compelling pictures of area wildlife, including a mountain lion "hanging out" in the back seat, a backdrop of beautiful blue skies, a big-eared mule deer, and two friendly rangers "HEADED your way."

Exhibit cargo inside the "SAMOBile" is portable and easily assembled at events and trailheads. Each exhibit piece reflects the captivating slogans on the vehicle. "HEADED your way!" provides orientation and sparks interest in the recreation area. "FEETS of Nature!" engages learners of all ages about park resources. "TAILgate Party" is a wheel of fortune, connecting visitors to a better future by learning about ecosystems.

To develop the traveling exhibit, park staff asked children, parents, and other visitors what might excite them about area resources and their future. Responses from the public enabled park staff to address a diversity of interests while making the SAMOBile a "TAILgate Party" that everyone can enjoy, both inside and out. ■

# CLIMATE-FRIENDLY PARKS &



NPS PHOTO



PHOTO COURTESY OF JEANNE PANEK

## CLIMATE-FRIENDLY PEOPLE

**ZION** - Innovative green architecture, aesthetically pleasing native landscaping, low-emission propane-powered shuttle buses, and energy-efficient heating, ventilation, and air conditioning systems are not enough for Zion National Park (*above*). Park employees abide by an environmental commitment statement that enables concessioners, partners, suppliers, vendors, contractors, and visitors to participate in environmental leadership practices that reach beyond protection and conservation to actually enhance park resources. “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.” Numerous objectives outlined in the system are progressing at a fast pace. Purchase of environmentally preferable materials has increased. Recycling is on the rise. Greenhouse gas emissions are being reduced. “Most important are the education and outreach efforts that reflect the passion of both the park and a model gateway community committed to stewardship,” he adds.

**JEANNE PANEK** - “Individual actions do matter,” says ecologist Jeanne Panek (*above*), who scales mountains for fun and climbs trees to measure ozone pollution. At U.C. Berkeley, Panek also works at a computer, modeling and writing to help national parks create maps of future vegetation shifts and fire frequency under different climate change scenarios. A forest ecophysiology specialist in air pollution issues, Panek’s research shows how natural ecosystems in Yosemite and Sequoia and King’s Canyon National Parks respond to human-caused, or anthropogenic, pollutants and how climate change has profound impacts on hydrology and ecology. Her work to provide resource managers with “the science behind local climate change and its ecological consequences” supports National Park Service efforts to protect limited resources and inform the public about the effects of climate change on the parks. Panek also emphasizes the most important personal actions that people can take to slow climate change. “Help make climate change part of the state and national political agenda by contacting legislators. Don’t justify poor emissions. Upgrade or don’t drive at all. Bike, walk, run, or use public transportation, and purchase clean energy,” says Panek.



NPS PHOTO

**JULIE HANCOCK** - Kids at Earth Day events in Springdale, Utah, this year loved the cookies baking in the solar oven. They repeatedly asked former Park Ranger Julie Hancock (left), “where’s it plugged in?” Solar baking was just one of many activities at the annual event near Zion National Park which promotes a message of “Locally is Globally” and demonstrates ways for people to integrate Earth-friendly behavior into everyday life.

Taking action to address climate change and other environmental challenges “doesn’t have to be all about doomsday,” Hancock explains. Three years ago, a U.S. EPA climate workshop conducted at Zion helped interest Hancock and her fellow park rangers in new ways to spread the message of sustainability. “The workshop was informative, and we saw the potential of games for kids like *Climate Change Jeopardy*.”

A strong partnership makes Earth Day possible each year. Hancock, who now works at the local community center, has acted as a liaison among area sponsors. She credits their success to Springdale Locally is Globally (SLIGO), Zion National Park, Springdale Visitor Bureau, Zion Canyon Field Institute, Blue Sky Recycling, and Xanterra—organizations that promote sustainability not only through education, but by example.

**Seven national parks have hosted workshops as part of the Climate Friendly Parks Program, a collaboration between the U.S. Environmental Protection Agency and the National Park Service. Workshops help park employees and partners identify actions to mitigate the negative environmental impacts of climate change. Working examples are provided at these two-day sessions not only by agency professionals, but also by diverse experts and practitioners representing educational and research facilities nationwide. These people and these places illustrate how individual actions work to understand and protect park resources for the future.**



**DELAWARE WATER GAP** - Visitors to the Pocono Environmental Education Center (*above*) pass through a forest and cross a wetland on their way to a sunlit gathering space for activities at Delaware Water Gap National Recreation Area. Careful siting and orientation of the building uses architecture as a teaching tool for visitors to learn the importance of sustainability and human interdependency with the environment. The exhibits will feature green design elements to support the center's education mission.

**DAN FAGRE** - Tracking glaciers and measuring climate change are not exactly a desk job. "We use a variety of modern technology tools including remote sensing, ice radar to measure glacier thickness, and digital aerial analysis," says Fagre (*right*), Global Climate Change Research Coordinator for the U.S. Geological Survey Northern Rocky Mountain Science Center. "We also collect ice and snow core samples during winter snow surveys and tramp across glaciers using GPS."

Fagre's work at Glacier National Park involves groundbreaking techniques that have helped explain, quantify, and predict what environmental changes will occur in parks and protected areas because of climate variability and change as well as other external stress factors. He and his colleagues created predictive models that show the size and extent of glaciers in the future—forecasts that indicate all glaciers in the park are likely to be gone within the next 25 years if current warming trends persist. Inclusive research on forest modeling, spatial changes in vegetation patterns, watershed studies, and atmospheric research also predict the expansion of valley cedar-hemlock forests and a rise in treeline elevation. These predictions are based on one likely 50-year climate scenario with a 30 percent increase in precipitation and a slight increase in annual temperature. Large, stand-replacing forest fires could also occur.

Recognized internationally for his education efforts as well as his scientific research, Dan Fagre has coordinated with other mountain research programs throughout the world to predict impacts on a broader landscape scale. Fagre's findings prompted Glacier to embrace the Climate Friendly Parks Program and involve him in the public outreach portion of Glacier National Park's environmental management system plan.



**GLACIER** - A 2004 photo of Grinnell Glacier (*left*) in Glacier National Park is part of a repeat photography project conducted by the NPS and the U.S. Geological Survey. Glacial recession comparison photos date back to 1940.

Dan Fagre (*right*) is known not only for his knowledge of climate change variables, but also for his skill as an innovative communicator.



USGS PHOTO BY KAREN HOLZER

USGS PHOTO

**Hands-on work ranging from collection of air quality data to using green cleaning products illustrates that climate-friendly actions in the national parks are sound targets for better environmental management overall. Steps to increase resource conservation and energy efficiency show the public what can be accomplished at the community, corporate, and household levels to reduce greenhouse gas emissions and criteria air pollutants.**



PHOTO © RUSS FINLEY/EVERETT COLLECTION

**EVERGLADES** - Prior land management decisions, coupled with rising sea level, have led to freshwater drainage, saltwater intrusion, and erosion in South Florida. Researchers with the Everglades Restoration research and monitoring program note that sea level on Florida's southern coast has risen nine inches in the past century, six times faster than the per-century rate over the previous 2,400 years. A sea level rise of five feet in parts of the Everglades is expected to accelerate as temperatures increase this century, causing greater storm surges and flooding. The effects could devastate the area, which is no higher than eight feet at any location.



PHOTO © RUSS FINLEY/EVERETT COLLECTION

**YOSEMITE** - Visitors receive a strong message about reducing greenhouse gases when they enjoy the free shuttle service on Yosemite National Park's hybrid buses. Operating since spring of 2005, the buses significantly increase fuel efficiency, and reduce particulate matter and nitrous oxide emissions. Benefits include an absence of exhaust smells and noise associated with the old diesel-only buses, along with reduced traffic in the national park. Yosemite's Climate Friendly Parks workshop in spring of 2006 resulted in a Climate Action Plan that further emphasizes reduction of greenhouse gas emissions and highlights sharing successes with visitors. Realistic environmental commitments are first approved by the park's Yosemite Environmental System (YES) team. Mitigation actions to significantly reduce greenhouse gas emissions and criteria air pollutants are directly transferable to the park's environmental management system. Earth Day visitors observed the plan in action in April 2006 when those who traveled to the park in alternative fuel vehicles received free admission for helping to reduce emissions.



NPS PHOTO

**BOB CARSON** - "Without good data, you can't build a case for air quality," says the Mammoth Cave National Park Air Quality Specialist. Totally committed to air, Bob Carson collects nitrogen oxide, sulfur dioxide, carbon monoxide, ozone, acid rain, particulate matter, and meteorological data. He also examines mercury in air, soils, water, fish, bat hair, snapping turtles, mussels, and dragonflies. "We want to see what happens as mercury moves up the food chain," he says. In 2000 he initiated an emissions inventory for the park, which established a baseline for measuring improvements. In 2004 the park became host and operator of a NOAA climate reference network station, which measures long-term climate change through temperature and precipitation. "NOAA was looking for sites that would not be subject to change or development, and Mammoth Cave fit their criteria," he adds.



NPS PHOTO



**HAROLD R. WANLESS** - An expert in sea level rise in South Florida, the Professor and Department Chair of Geological Sciences at the University of Miami has studied the recent geological history of South Florida and the Bahamas since the 1970s, documenting the effects of fine-scale sea level history and hurricanes on tropical wetland, coastal, and shallow marine environments. Wanless integrates analysis of historical aerial photography and recent satellite images with field studies to forecast changes in Florida coastal environments caused by global warming. Part of this process is attribution of changes to rising sea level, hurricanes, human development, fires, or freezes. He has also helped design the research and monitoring program associated with restoration of the Everglades and is working with an international group of scientists on a long-term solution for Mississippi Delta wetlands recovery. At the Everglades Climate Friendly Parks workshop, Wanless encouraged better planning of coastal communities and preservation of wetlands. "We must take action now. Planning for changing sea level—instead of fighting it—is the practical solution."



PHOTO COURTESY OF BRIGITTE VASWANEK

**GLACIER BAY** - A dramatic vertical rise is occurring as land is released from the weight of melting glaciers. The top image of Muir Glacier was taken in 1941. The color image below, taken from the same location in 2004, shows the extent of glacial retreat.



PHOTO BY WILLIAM O. FELD, 1941, ONLINE GLACIER PHOTOGRAPH DATABASE



PHOTO BY BRUCE F. MORNIA, 2004, ONLINE GLACIER PHOTOGRAPH DATABASE

**ARCH R. THOMPSON** - Melting ice is transforming the glacier-filled valleys of Glacier Bay National Park and Preserve into fjords. As scientists are learning how to use indicators of global change, such as glacier variation, to protect finite resources, park employees and concessioners are working hard to reduce human impacts on the sensitive Glacier Bay environment. Utilities Supervisor Arch R. Thompson (*below*) puts environmentally preferable processes in place by taking climate-conscious steps such as installing data loggers to collect peak load data at the park's power generating plant, evaluating new power generators to replace obsolete units, servicing the park's solid waste incinerator for optimum performance, and replacing old boilers with more energy efficient models. "We are evaluating biodiesel use in generators while the park remains on a list of buyers in need of a biodiesel fuel supplier," says Thompson. "Our staff communicates about the importance of reducing the park's entire waste stream. By buying smarter, buying only what we need, and making wise choices



NPS PHOTO

about what we buy, the park has improved its numbers." Thompson sends reminders to park staff about the high cost of shipping in what is often thrown away. In 2005 the park collected and handled 20 tons of solid waste (recycling 41 percent) compared to 32 tons (35 percent recycled) in 2004. ■

*U.S. EPA contributors to this feature include Leah Baker, Alan Cohn, and Karen Scott. NPS contributors include Vickie Carson, Kevin Leichner, Diane Liggett, Lynne Murdock, and Julie Thomas.*

**GATEWAY** - Green procurement, sustainability education, concessions environmental management, and incorporation of environmental management into project management are priority strategies at Gateway National Recreation Area, where rehabilitation of Jamaica Bay Visitor Contact Station (left) exemplifies the highest standards of environmentally sensitive construction and park operations.

Geothermal and passive solar heating complement natural daylighting, native plantings, and energy-saving features that will earn the facility the first LEED™ certification in the NPS Northeast Region. Park employees support Gateway conservation efforts by attending brown bag lunch sessions that focus on green topics. Some participate in greening contests where winners receive an "energy conservation hour" time off award.

**BRAD HILL** - President of Evelyn Hill, Inc., Hill (right) expects his operations at Statue of Liberty National Monument to be certified by the Green Dining Association and achieve ISO 14001 in 2007. The concessioner now recycles 75 percent of the waste generated by its own operations, by park visitors, and by the ferry concessioner that serves the Statue of Liberty and Ellis Island—more than 350,000 pounds of trash a year.



PHOTO COURTESY EVELYN HILL, INC.

# Q&A

## Cynthia Rosenzweig, Ph.D.

NASA'S GODDARD INSTITUTE FOR SPACE STUDIES



PHOTO COURTESY OF NYU

Dr. Cynthia Rosenzweig holds several key research and planning positions, which include chairing the Climate Impacts Group at NASA's Goddard Institute for Space Studies and serving as an adjunct senior research scientist at Columbia University's Earth Institute. She has worked with the National Park Service, particularly Gateway National Recreation Area, during the past eight years.

**Sustainability News:** How did your climate change research lead you to work with the parks?

**Rosenzweig:** As a young graduate student, I came to NASA's Goddard Institute for Space Studies when the first global climate models with doubled levels of carbon dioxide were being run. These yielded some of the first projections of how increasing greenhouse gases would affect the climate. The Director, Dr. James Hansen, asked me to analyze what the impacts on humans would be. I remember bringing my kids with me the first time I testified to Congress that a changing climate would affect U.S. food supply. Since then, I have testified several times on urban areas and natural ecosystems and have participated in a number of research projects regarding the natural and human impacts of climate change.

**Sustainability News:** How do the impacts to our ecosystems from climate change reflect our changing society?

**Rosenzweig:** As part of the Metro East Coast Regional Assessment Report, there is an iconic picture I often use in presentations that shows urban and natural ecosystems closely intertwined. The image looks across the Jamaica Bay marshes. A heron is taking flight and the World Trade Center is in the distance. The towers look ghostly in the picture. When we were conducting the study, we had project meetings in the World Trade Center so that we could have a vista of the region we were trying to understand.

I show this picture because, in the time since, we have had a major cultural re-visioning of the New York region as an ecosystem. Still in recovery mode, we now have a sharpened focus on Gateway and the wetlands environment. We see their importance to nurturing and rebuilding a dynamic city that is changing in so many ways, including climate.

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*We are no longer only conducting research and studying the problem. We have actively entered a new phase. For climate change, we are in a solutions mode.*

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**Sustainability News:** What improvements have you seen in coastal habitat protections?

**Rosenzweig:** Events of the past few years have underscored the critical wetlands role in recovery after major storms. Jamaica Bay's importance as a buffer to storms cannot be underestimated. We take scientific researchers from around the world to see Big Egg Marsh. In a study conducted with Ellen Hartig, formerly of the Earth Institute and now with FEMA, we documented the accelerated loss of the Jamaica Bay system. That research then led to action to try to stabilize the marshes.

Post-9/11 and post-Katrina, we see new emphasis on ecological infrastructure and its importance in the urban environment. One of my colleagues, Dr. Virginia Burkett of the U.S. Geological Survey, has been working with the City of New Orleans to incorporate climate change projections into the rebuilding of the Gulf Coast. In the same way, I have been working with the New York City Department of Environmental Protection, the Port Authority of New York and New Jersey, and Gateway National Recreation Area to prepare for the potential of more intense hurricanes.

**Sustainability News:** Sensitive park resources are serving as early indicators of the effects of climate change. What role do national parks play in understanding global climate change?

**Rosenzweig:** Dr. Richard Leakey, Visiting Professor of Anthropology, Stony Brook University, organized a global summit on climate change that included representatives from IUCN, The International Union for the Conservation of Nature and Natural Resources, and parks all over the world. There was an emphasis on the role parks are playing and can play in climate change. Parks are fantastic places for education and research because they reach huge audiences and comprise protected areas, allowing scientists to track changes as they occur.

The challenge is that parks often protect particular ecosystems, and these ecosystems are shifting. Buffer zones become critical, as do connective areas between and among parks. This is the "corridor" theory, which aims to create a route for ecosystems to move in response to climate change. Even without climate change, a need for these corridors exists to provide connectivity. Climate change adds an impetus.

**Sustainability News:** How can the National Park Service reach a rapidly changing culture with a relevant message of stewardship?

**Rosenzweig:** I participated in an NPS training session where the goal was to help interpreters deepen their responses to visitors about the impacts of climate change on the parks. At the same time, I was also working with the Jamaica Bay Institute at Gateway, speaking at brown bag lectures to park staff, with the idea that park staff would then be able to communicate critical information to park visitors. These kinds of interactions should continue and grow.

**Sustainability News:** How does a better understanding of climate change affect our actions in support of global sustainability?

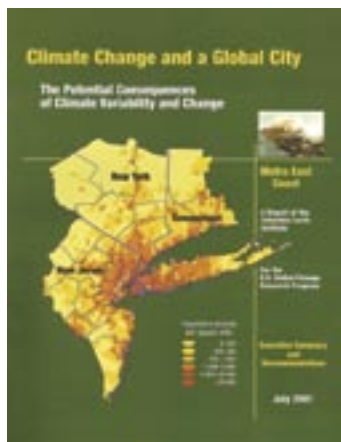
**Rosenzweig:** Columbia's Green Roof Initiative is a good example. Vegetated roofs work as an adaptation to a warmer climate and intensified storm events. Plants provide natural air conditioning by cooling building interiors. The lessened demand for air conditioning decreases heat generated by mechanical air conditioning and carbon dioxide from energy production. Vegetated roofs can also capture water and slow runoff rates. Imagine the positive impact if New York City became a sea of green roofs like the ones we are studying at Columbia University.

**Sustainability News:** What will direct our future environmental management practices?

**Rosenzweig:** The study of climate change impacts is creating a new paradigm of how scientists work together. No one field or discipline can solve this challenge alone. Now, there is truly interdisciplinary research. Projects combine multiple disciplines including climate scientists, wetland scientists, sea level rise specialists, social scientists, and public and private stakeholders. Mutual learning by both scientists and decision-makers is tremendous.

In terms of climate change, we have also experienced a major shift. We are no longer only conducting research and studying the problem. We have actively entered a new phase. For climate change, we are in a solutions mode. ■

*Interview by Kevin Leichner, Public Affairs Specialist, National Parks of New York Harbor.*



Visit <http://ccsr.columbia.edu/cig/mec> to download the Columbia Earth Institute report on the consequences of climate change on the U.S. Metropolitan East Coast.

## Climate Leadership in Parks (CLIP) Tool Provides Baseline

The U.S. Environmental Protection Agency and the National Park Service have funded development of the Climate Leadership in Parks (CLIP) tool, a labor-saving addition to the Climate Friendly Parks (CFP) Program. This tool assists national parks in developing comprehensive greenhouse gas (GHG) and criteria air pollutant (CAP) inventories, as well as identifying and quantifying potential reductions through mitigation and outreach.

CLIP helps parks develop an emissions baseline that forms the foundation of their plan to reduce emissions. Baselines include emissions from transportation, electricity use, and forestry sectors. At the end of one year, a park can evaluate how its actions have reduced baseline emissions. CLIP also helps to identify mitigation strategies and quantify potential emission reductions from these strategies. Such information assists park management in setting reduction goals and establishing budgets.

CLIP was specifically designed to be user-friendly, while still producing high-quality estimates. A variety of activity data is gathered (e.g., annual amount of electricity purchased, gallons of fuel consumed, etc.) and entered into the Excel-based tool. All calculations are automated. Once data has been gathered, a complete inventory can be produced within hours. Built-in features help identify potential mitigation options and develop action plans for reducing emissions, enabling park staff to independently complete their own inventories and reduce GHG and CAP emissions.

For more information send an e-mail to [CLIPTool@icfi.com](mailto:CLIPTool@icfi.com).



## Ford Motor Company Continues NPS Support

In its seventh year of collaborating with the National Park Foundation on climate-friendly initiatives, Ford Motor Company has renewed its support of the Transportation Interpreter and Transportation Scholar Programs. This initiative supports National Park Service strategic goals to strengthen the visitor experience by reducing congestion at national parks, further developing Alternative Transportation Programs (ATP), and educating visitors about actions they can take to mitigate their contributions to climate change.

More than 20 transportation scholars have been placed to support 25 projects. Several transportation scholars have assessed congestion at park entrances and formulated recommendations. Two former transportation scholars are now National Park Service employees, and others work for firms that consult to the National Park Service. The National Park Foundation is now preparing for recruitment for the new fiscal year.

## NASA and NPS Arrange for Change

The Earth to Sky partnership between NASA's Space and Earth Science disciplines and the National Park Service offers NASA scientists and NPS interpreters opportunities to collaborate on innovative education products.

Compelling messages about the implications of global climate change are now being crafted to respond to questions about how climate change is affecting the national parks.

To communicate these messages, a training tool is being developed for interpretive supervisors and their staff. This matrix, or "decision tree," will help interpreters prepare effectively for communicating climate change concepts to NPS audiences. The new tool will identify typical questions that are being asked and offer potential responses.



Transportation interpreters also continue to play a vital role in the visitor experience at national parks. Recruited through the Student Conservation Association, 200 interpreters have been placed at 35 national parks, serving at visitor centers and on mass transit vehicles, informing visitors about transportation choices and other park subjects. Susan Law and Anne Dunning (left) were the first transportation scholars to be placed at Glacier National Park. After serving as a transportation scholar, Law worked briefly for the park before joining the Federal Highway Administration.

Ford's green initiatives in national parks are reaffirmed by the carmaker's for-profit actions. On April 27, 2006, Ford announced the launch, with a third-party provider, of the Greener Miles™ customer carbon offset program. Customers can purchase an equivalent credit that will support the development of renewable energy resources from wind or dairy farm methane. The program relies on the concept that by replacing energy from fossil fuels with renewable energy, carbon dioxide emissions are reduced. These reductions balance greenhouse gas emissions from driving. Starting at \$29.95 for newer vehicles, the "annual pass" is priced according to model and mileage driven. At the far end of the spectrum, an annual pass for a 1985 Mercury Grand Marquis driven 15,000 miles per year would cost \$79.95. Ford reports that, so far, the 6,500 members of the program have offset 102 million pounds of carbon dioxide. ■

Conversation threads will include glaciation and snow cover changes and how these factor into sea level and ocean current changes; vegetative land cover changes and changes to ecosystems; animal migration changes and species shifts; wildland fire behavior trends and changes to timing and extent; and the implications of climate change on indigenous cultures and subsistence.

Fact sheets and materials will also be developed.

In addition, a traveling display will be developed to serve as a catalyst for informal interpretive conversations about climate change effects on the parks. A brochure, which will supplement the traveling display, will address how climate change affects the national parks. Specific parks will be highlighted where climate change is a direct threat to primary park resources.

By Shawn Norton, NPS Environmental Leadership Program



NPS PHOTO



NPS PHOTO

**Top:** Greening charrette participants at Boston National Historical Park discuss how visitors and staff can better understand the use of resources through lessons provided by history. Priority actions identified by the group included reactivation of a green team and preparing a vehicle fleet management plan for the park.

**Bottom:** Charrette participants enjoy a preliminary tour of San Francisco Maritime National Historical Park facilities before engaging in the workshop. Park staff members are working to interpret sustainability themes based on preservation of historic ships.

*With public sentiment, nothing can fail. Without it, nothing can succeed. He who molds public sentiment goes deeper than he who enacts statutes or pronounces decisions.*

—ABRAHAM LINCOLN

### Greening Charrettes—Park Vision to Visitor Values

Fifteen years ago, the National Park Service hosted its first sustainability charrette at Virgin Islands National Park. The objective was to launch a sustainability movement in the NPS and create a more environmentally responsible future. An important document emerged from that event to determine NPS building design and construction principles: *Guiding Principles of Sustainable Design*. A more profound result was a commitment to environmental leadership. The NPS sustainability movement was born.

In 2001 the National Park System Advisory Board urged the NPS to “proclaim anew the meaning and value of parks, conservation, and recreation.” By 2002 a partnership with the Environmental Protection Agency Office of Pollution Prevention directed the NPS on a new path to develop and host a series of greening charrettes for national parks. Even though parks had become more knowledgeable about green design, the broadening NPS sustainability movement still remained shallow. It was time to examine NPS operations and other opportunities to become more sustainable. It was time to evaluate procurement actions, facility management, contracts, concessions, and most importantly, to develop relevant messages for the public. It was time to deepen the NPS commitment to sustainability and to demonstrate an environmental responsibility to visitors.

Greening charrettes were conducted at 10 national parks. Charrettes provided regional venues for NPS staff, other organizations, neighbors, and partners to share information and assist in specific greening efforts. Education and outreach were emphasized to create opportunities to move from a vision of park sustainability to new visitor values. Action plans were produced to establish consistent areas of measurable green improvements. Over the next four years, greening charrettes were conducted at diverse parks: Big Cypress National Preserve, Boston National Historical Park, Bandelier National Monument, Point Reyes National Seashore, Chesapeake and Ohio Canal National Historical Park, Grand Canyon National Park,

San Francisco Maritime National Historical Park, Homestead National Monument, Rock Creek Park, and Canaveral National Seashore. Green action plans from the charrettes provided each park with short- and long-term goals in these areas: environmental leadership and planning, transportation, facilities, operations and maintenance, interpretation and education, and procurement. Green purchasing was emphasized, resulting in a widely applicable resource, *Environmental Purchasing in the National Park Service: A How-To Guide*.

Progress since the first sustainability charrette has moved beyond seeking better environmental solutions in all park operations. Agency-wide enthusiasm, momentum, and management support has developed for sustainable actions. Where single champions of sustainability once worked alone, “green teams” have formed and park employees are expected to incorporate sustainability into their routines. Partnerships have evolved to cooperate on diverse initiatives ranging from hazardous materials disposal to renovation of historic structures. Visitors now see examples of sustainability in energy-efficient buildings, photovoltaic systems, alternative fuel vehicles, green janitorial practices, and exhibits that interpret these efforts. Charrette outcomes have also become part of a larger NPS framework that includes park environmental management systems. The result is an increased knowledge base that benefits all and produces the environmental protection the NPS and the EPA are striving to achieve. With this first chapter of NPS sustainability history complete, the greening charrettes have also spawned a new idea: Climate Friendly Parks. Connecting sustainability efforts to climate change science, this program will further engage staff, partners, and the public to protect limited resources.

The words spoken by Abraham Lincoln to describe what would be needed to end the Civil War and change the course of history could not be more appropriate. The NPS has the unique potential to engage people in a “call to be green.” Lincoln’s words show what is possible when government engages citizens in a call to action. ■

## GREEN PARKS

“Environmental Purchasing in the National Park Service: A How-To Guide,” can be viewed online at [http://pfmd1.nps.gov/EMP/hazmat/EMP\\_LIB/library\\_EPP.cfm](http://pfmd1.nps.gov/EMP/hazmat/EMP_LIB/library_EPP.cfm).

By Meg Weesner, Saguaro National Park

## *Park Monitors Desert Wetland Environments*



Climate change may influence long-term vegetation trends at Saguaro National Park where increases in exotic plant species could produce ground fuel for larger and more frequent wildfires. Resulting erosion and increased sedimentation could threaten native plants and animals, especially in desert riparian areas (top) that provide essential habitat to as many as 80 percent of the animals

in Saguaro National Park. Where a fire occurred in 1999, increased erosion caused the filling of a wetland pond (bottom). Saguaro National Park is working with park neighbors on an experimental basis to clear sediment from some pools and reestablish populations of rare and sensitive lowland leopard frogs (left), the species most seriously affected by changes in the perennial pools of the park. ■

NPS PHOTOS

## November 15–17

### Greenbuild 2006

This Denver, Colorado, event presented by the nonprofit U.S. Green Building Council (USGBC) presents innovations in green building and design. Go to [www.greenbuildexpo.org](http://www.greenbuildexpo.org) for details.

## November 15–17

### International Conference on Water in Arid and Semiarid Lands

This Lubbock, Texas, event provides information about state-of-the-art dryland research, advances in technology, and new field practices with an emphasis on water resource management. Go to [www.iaff.ttu.edu/home/icasals/conference](http://www.iaff.ttu.edu/home/icasals/conference) for details.

## December 6–8

### AWEA Wind Energy Fall Symposium

Participants at this Phoenix, Arizona, event will focus on the fundamentals of utility-scale wind energy. Go to [www.awea.org/events/symposium06](http://www.awea.org/events/symposium06) for information.

## March 6–8

### POWER-GEN Renewable Energy and Fuels

The wind, solar, biomass and fuels, hydro and geothermal sectors meet in Las Vegas, Nevada. Visit <http://pgre07.events.pennnet.com/fl/index.cfm> for details.

## March 19–21

### Hydrogen Expo US

Hydrogen and fuel cell professionals meet in San Antonio, Texas, to discuss production, storage, infrastructure, fuel cell design, and vehicles. Visit [www.hydrogenexpo.com](http://www.hydrogenexpo.com) for further details.

## April 19–20

### International Global Warming and Climate Change Expo

Participants exchange information on scientific data, governmental assessments, and public policies concerning global climate change, including global warming and extreme climatic events. For further information on this Miami, Florida, event visit <http://gw18.globalwarming.net>.

## April 29–May 1

### Greening Rooftops for Sustainable Communities

Participants at this Minneapolis, Minnesota, event will discuss green roof research, design and implementation, and performance. Visit <http://greenroofs.org/minneapolis> for more.

## June 3–6

### WINDPOWER 2007

Anyone interested in renewable energy will enjoy sessions on leading wind energy topics at this Los Angeles, California, conference. Go to [www.eshow2000.com/awea](http://www.eshow2000.com/awea).

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### Internet

Sustainability News and additional NPS information about green practices appears at [www.nature.nps.gov/sustainabilitynews](http://www.nature.nps.gov/sustainabilitynews). More about climate change and national parks is located on the Internet at [www.nature.nps.gov/criticalissues/globalclimatechange.cfm](http://www.nature.nps.gov/criticalissues/globalclimatechange.cfm).

### National Park Service

The National Park Service is a bureau within the Department of the Interior. We preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations. We also cooperate with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.

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