

SCIENCE • ADAPTATION • MITIGATION • COMMUNICATION

Inspiring Teachers at Glacier National Park

Eyes roll back. Blank stares make their way across the room. I don't blame them. I've said the same thing at our staff meetings for weeks on end. "I'm still prepping for the climate change teacher workshop. There's just A LOT to do!" I can see the hesitation in my co-workers' eyes, and the disbelief. How could a simple teacher workshop suck up so much time?

As I run around from place-to-place days before the workshop, I, too, begin to question why I am putting so much time into this. I mean, will this workshop really affect anyone? Will it make a difference? I push these thoughts out of my head and get back to the task at hand. If I learned anything from our first climate change teacher workshop in 2012, it's that the energy, creativity, and momentum of the teachers will surpass even my wildest expectations.

Two hours into the workshop, my doubts and fears begin to vanish. The teachers at our 2013 climate change teacher workshop are savvy, sharp, dedicated, and here to learn. They have come from local schools and across the nation to discover, brainstorm, and collaborate on how to teach climate change in the classroom. They are here to make a difference.

The week begins with a "standing room only" brown bag presentation from climate change

researcher and Nobel Peace Prize recipient Dr. Steve Running from the University of Montana and ends with a brainstorm session where workshop participants craft lesson plans on climate change and develop service learning projects. Along the way, our 18 participating teachers attend presentations from agency researchers and hit the trails with the park's education specialist and Crown of the Continent Research Learning Center staff. By the end of the week, the group has bonded. Just as communicating climate change is challenging, so too is teaching about it. We find that collaboration goes a long way and that sometimes the best way to get started is by being around others attempting to do the same thing.

In the months that follow, climate change lesson plans, field trip ideas, and collaborative projects from the teachers flood in. I am amazed by these teachers and what they are doing for their schools, communities, and well...all of us. Perhaps all the weeks of preparation for this workshop were worth it. As one participant said, "This workshop confirmed my belief that I don't have time for debate (about climate change), I just need to do something."

Contact: Melissa_Sladek@nps.gov

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Above: Reflecting on climate change at Glacier National Park.

Monthly Climate Change Webinar Series

2nd Thursday of every month
2:00 pm - 3:30 pm EST

Next Webinar: Feb 13th, 2014

February's presentation is titled, *The Power of Corporate Partners: Taking Notes from Innovative Industry* and will be presented by Dusty Kidd, Former Nike, Inc. Executive and Administrative Officer, Sitka NHP.

A seemingly small change in a large corporation can have multiple and lasting effects both within industry and in the world. Through the story of Nike, Inc.'s shift to become a leader in sustainable business practices, this webinar explores what the NPS can learn from the flexible and innovative minds of industry.

Register for February's webinar:

<https://www1.gotomeeting.com/register/456909144>

Upcoming Webinars

March 13th, 2014

April 10th, 2014

The March and April webinars will feature aspects of developing a truly sustainable lifestyle and workplace.

Register for March's webinar:

<https://www1.gotomeeting.com/register/238424441>

Register for April's webinar:

<https://www1.gotomeeting.com/register/436289561>

IPCC Updates

New Physical Science Report

On September 27 the Intergovernmental Panel on Climate Change (IPCC) approved *Climate Change 2013: The Physical Science Basis*, the report which assesses published research on physical science aspects of climate change in the last six years. The major findings:

- Globally averaged land and ocean surface temperature shows a warming of 0.85 °C [90% confidence interval 0.65 to 1.06°C] from 1880 to 2012 (see graphic below).
- In the Northern Hemisphere, 1983–2012 was likely the warmest 30-year period of the last 1400 years.
- The frequency or intensity of heavy precipitation events has likely (probability ≥ 0.66) increased in North America and Europe.
- The rate of sea level rise since the mid-19th century has been greater than the mean rate during the previous two millennia. Over the period 1901–2010, global mean sea level rose 19 cm [90% confidence interval 0.17 to 0.21 m].
- Atmospheric concentrations of greenhouse gases have increased to their highest levels in the last 800,000 years. Fossil fuel emissions, deforestation, and other human activities have caused a 40% increase since 1750 AD.
- Natural factors account for only a small contribution to observed warming. It is extremely likely (probability ≥ 0.95) that human influence has been the dominant cause of the observed warming since the mid-20th century.
- If humans do not reduce greenhouse gas emissions, global average temperature may increase 1.1 to 4.8°C by 2100, compared to the 1986–2005 average; extreme precipitation events

would very likely (probability ≥ 0.90) become more intense and more frequent (IPCC SPM-16); and global average sea level may increase 0.32 to 0.82 m.

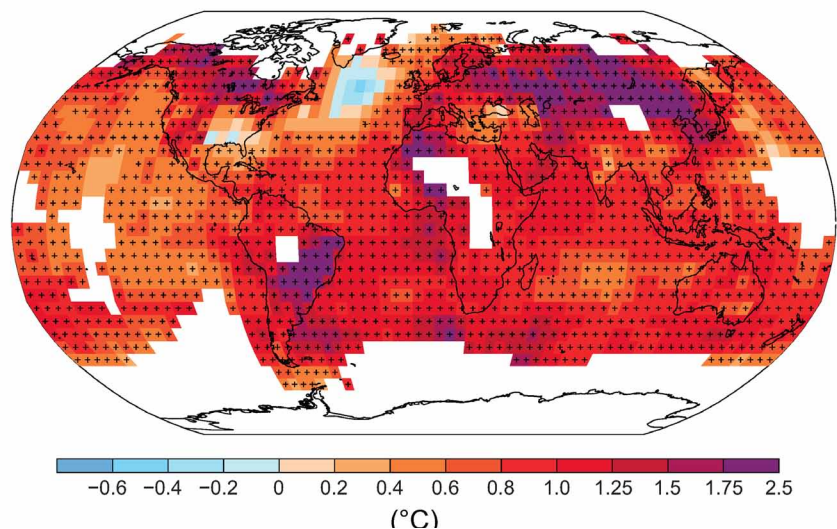
Link to the pre-publication version of the report: <http://www.ipcc.ch/report/ar5/wg1>

New Wetlands Report

Globally, wetland ecosystems are second only to forests in natural carbon density (the amount of carbon per unit area of land). Resource management actions such as forest conservation and wetland habitat restoration can reduce the amount of carbon in the atmosphere by drawing it into restored park ecosystems. On October 15, the IPCC approved *Supplement to the IPCC Guidelines on National Greenhouse Gas Inventories: Wetlands*. This report provides scientifically robust international standard methods to quantify greenhouse gas emissions and storage in wetland ecosystems and organic soils. NPS Climate Change Scientist Patrick Gonzalez served as a lead author of the report, the product of a three-year international scientific collaboration. NPS uses the IPCC Guidelines on National Greenhouse Gas Inventories as a rigorous scientific basis to quantify and reduce greenhouse gas emissions from park operations, as well as to quantify carbon storage in park ecosystems. Wetland ecosystems cover 3% of the area of the National Parks and organic soils underlie 23%. Therefore, the new IPCC guidelines for wetlands will be applicable to one-quarter of the National Park system. Link to the pre-publication version of the report: <http://www.ipcc-nggip.iges.or.jp/home/wetlands.html>

For more information on these reports, additional reports or maps, and the IPCC in general, contact: Patrick_Gonzalez@nps.gov

Observed change in surface temperature 1901–2012



Climate Change Leadership Webinar Series

From May through November 2013, NPS superintendents around the nation shared climate change learning and experience through a series of webinars.

This series featured presentations by park superintendents, NPS leaders and topical experts, and included robust discussions. The webinars illustrated climate change issues and management responses relevant to parks, showcased lessons learned, and highlighted resources available to other superintendents preparing to address climate change within their parks.

The series kicked off with a session on climate change communication and the role of Superintendents in both talking about climate change and supporting their interpretive staff to engage visitors on this critical resource issue. The next session focused on the importance of using the most up-to-date climate science in decision making. It was followed by a session on impacts to cultural parks and how to interpret this topic when it may not be as obvious how the resources are at risk due to climate change.

In the second half of the series, presentations and discussions centered around decision-making

strategies in an uncertain environment, greening operations to create more sustainable parks, and a discussion of Hurricane Sandy and emergency preparedness.

The Climate Change Leadership webinar series is a collaboration between the Climate Change Response Program and the New Superintendent Academy. This series will be offered again in 2014. Contact: Melanie_Wood@nps.gov

Superintendent Rick Kendall discussed what climate change might mean for Saint-Gaudens NHS and how his staff is engaging the public on this issue.



It's not Starfleet Academy, but it's the next best thing!

This past June, the inaugural Climate Academy completed its 10-month run, facilitated by the US-FWS, through the National Conservation Training Center. NPS played a key role in the development of the course and is currently working with the planning committee for a second year of this high-in-demand training.

The Climate Academy is a collaboration between NPS, FWS, the Association for Fish and Wildlife Agencies, the Wildlife Society and state wildlife agencies in Wisconsin and California. The 2013 course consisted of monthly webinars led by subject matter experts. Each webinar was followed by a month of online forum discussions, facilitated by volunteers, aligning the discussion with the previous month's topic.

NPS provided two of the monthly speakers, CCRP Chief Leigh Welling and Angie Richman, CCRP Communication Specialist. Both speakers were enthusiastically received, generating some of the most positive feedback from a post-course survey. The course was modeled on a similar effort in Florida, focusing on the fundamentals of climate change, impacts, adaptation options, communication strategies and planning for risk and uncertainty.

Great effort was made to make the course more than just a webinar series. Over 120 state and federal managers enrolled, participating in online forums where they discussed a specific month's climate topic. At the end of the course, students developed papers integrating what they learned in the course. There was a competition for best paper, with the winner getting to publish the work in the Wildlife Society's magazine, The Wildlife Professional. The first year winner was Elizabeth Slack, from the Florida Fish and Wildlife Conservation Commission, whose paper was entitled, "Something Wicked This Way Comes: A Literature Review of the Use of Climate Change Tipping Points in Resource Management."

Plans are underway for year two of the popular course, which will run over five months, beginning in February 2014. Contact:

Douglas_Parsons@nps.gov



Tools and Training

Climate Change Adaptation in the Crown of the Continent 14th Annual Forum March 17-19, 2014

The annual CMP Forum is an opportunity for participants to share information and explore opportunities for improved interagency cooperation.

<http://crownmanagers.org/>

Crown of the Continent Newsletter

Check out the Fall 2013 edition of this newsletter to learn how climate change may be affecting mountain goats and amphibians, innovative methods teachers are taking to teach climate change, and perspectives from students and staff.

<http://www.crownsience.org/newsletters>



South Florida Climate Change News and Notes

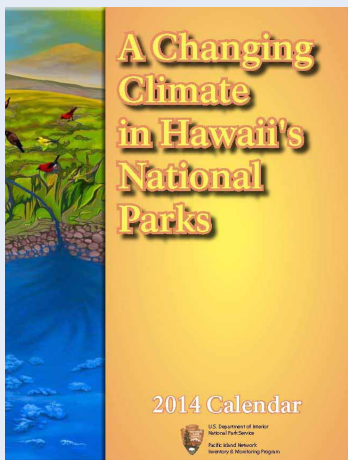
This e-newsletter provides a timely and engaging update on climate change communication and science initiatives underway in South Florida. To subscribe to the mailing list, contact:

Larry_Perez@nps.gov



Climate Change Communication products developed for the Pacific Islands

The Pacific Islands Inventory and Monitoring network has developed a climate change in Hawaii poster and calendar for 2014. They have sent them to all the parks in Hawaii and many local schools. The idea of both products is to incorporate a climate change themed painting from a local artist into a discussion about the very real impacts of climate change in Hawaii parks and society. For copies or more information, Contact: Corbett_Nash@nps.gov



Climate Change and Forests of the Acadia NP Region

Novel climatic conditions are likely to result in changes to the character, mix and distribution of forests; this means that the species currently present within parks may decline or disappear while more southerly or warm-adapted species may gain substantial habitat.

Stewarding forests for continuous change is a challenge for park managers; however, understanding projected rates and directions of forest change can inform monitoring and management of park lands.

To support such efforts for Acadia NP, we analyzed projected changes in tree habitat suitability for 83 tree species for three future periods (2040, 2070, and 2100). We postulated models from two scenarios — 'least change' and 'most change' — that represent the rough bounds of plausible future conditions. The model output is meant to inform managers of potential changes in the suitability of habitat for tree species given both the current and future environmental conditions as the climate changes.

At Acadia NP, the results indicate some startling potential future changes. General trends in the data suggest strongly decreasing future habitat suitability for 13 species (16%), minor change for 18 species (22%), but large increases or new habitat for 52 species (62%) (see figure below).

Boreal tree species, including fir, spruce, aspen, and paper birch, have strong decreases in suitable habitat under both future scenarios but most temperate species currently present in the park retain suitable habitat.

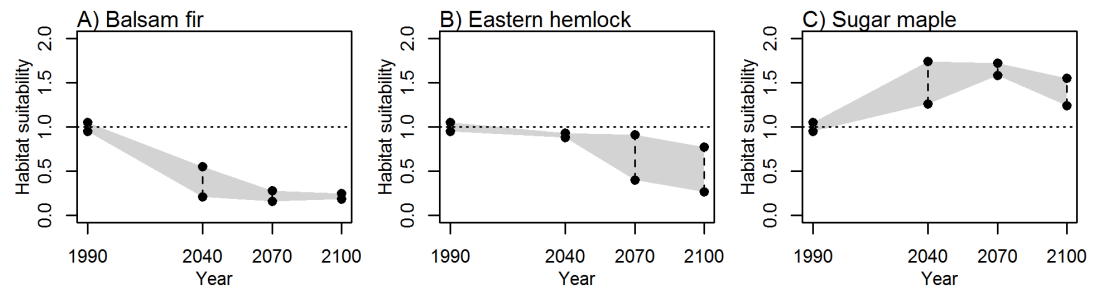
Under the warmest scenario, several oak, hickory, and pine species common in the southeast and

south central U.S. are likely to have suitable habitat in the Acadia region by the end of the 21st century. Forest change may be accelerated by more frequent or intense disturbances such as wind and ice storms, which open growing space for new species.

Results from studies such as this should be helpful for guiding focused on-the-ground monitoring efforts to detect early signs of forest change and inform the development of park strategies to achieve desired conditions in a continuously changing world.

The full report is available at: <https://irma.nps.gov/App/Reference/Profile/2204495>
Or contact: Nicholas_Fisichelli@nps.gov

Forest blowdown near Bass Harbor in Acadia NP. Increased storm frequency or intensity associated with climate change may accelerate forest compositional shifts by felling the current overstory and allowing new species to capture growing space.
Photo by Kathryn Miller, NPS.



Ratio of future to baseline (1961-1990) habitat suitability for three common tree species at Acadia. Ratios > 1 indicate increases in potential suitable habitat and ratios < 1 decreases in suitable habitat (e.g. ratio = 2.0 indicates a doubling of habitat and ratio of 0.5 is a 50% reduction). Projections for each time period come from two climate scenarios representing least and most change futures. Discrepancies between climate scenario models are due in large part to differences in levels of greenhouse gas emissions.

South Atlantic LCC update

The South Atlantic Landscape Conservation Cooperative (SALCC) is crafting a shared Blueprint, for actions needed to sustain natural and cultural resources in the face of future change. The Blueprint will be an adaptation plan that will look fifty years into the future. This Blueprint will fulfill the National Fish, Wildlife and Plant Climate Adaptation Strategy Goal to *identify areas for an ecologically-connected network of terrestrial, freshwater, coastal, and marine conservation areas that are likely to be resilient to climate change and to support a broad range of fish, wildlife, and plants under changed conditions.*

In terms of temperature and precipitation, climate change is a difficult scenario on which to base planning. Among the greatest challenges are questions such as how temperature and precipitation will lead to changes in ecosystems and how that might change risk to resources. How could this change the future of the forest? What could this mean for a popular beach? How might an iconic species be impacted? Questions like these drive LCC and Climate Science Center (CSC) planning to sustain the function and critical resources of the landscape.

The SALCC is a consensus-based forum that includes fifteen federal, state and private member organizations, including the National Park Service. The mission to create a shared conservation blueprint was determined through a broadly-informed strategic planning process. A key goal is to facilitate implementation of the Blueprint. The SALCC will complete version 1.0 of the Blueprint in March 2014 and is identifying potential imple-

mentation projects to demonstrate relevance to on-the-ground conservation decisions.

The Blueprint development process included four workshops with almost 200 participants, including several NPS staff. Participants worked with GIS layers of predicted change imposed over important resources, so that it would be possible to identify where and what actions were needed for landscape sustainability. The landscape change GIS data layers made available to participants were: (a) risk to stream flow; (b) future coastal beach and marsh; (c) predicted urbanization; (d) wind energy capacity; (e) and future year land use and land cover. Participants explored 17 different GIS layers showing locations of important natural and cultural resources of the landscape. These included, for example, national parks and other protected areas, National Register of Historic Places, National Wetlands Inventory, Tidal and non-tidal freshwater marsh, current land use and land cover and other categories.

A team will draw upon workshop results to finalize a mapped plan that will go before the SALCC Steering Committee for adoption consideration.

There are 25 National Parks within the SALCC, but the parks only cover 2% of the landscape, making it even more imperative that the NPS collaborate with partners so parks can operate within a functional landscape. Results from the workshops can be found at: <http://www.southatlanticlcc.org/profiles/blogs/reviewing-the-results-from-blueprint-workshops>

Contact: Janet_Cakir@nps.gov

New climate stations provide key information on Brooks Range weather patterns in Gates of the Arctic NP & P

Sixteen climate stations have been installed as part of the Arctic Inventory and Monitoring program in the last 3 years. The stations are providing unique and critical data from high elevation locations in the Arctic and help characterize the climate gradients and patterns of the central Brooks Range. The stations record air temperature, relative humidity, wind speed and direction, solar radiation, snow depth, rainfall, and soil temperatures at 10, 20, and 50 cm depths. Real-time and archived data are publicly available through the Western Regional Climate Center at: <http://www.raws.dril.edu/wraws/akF.html>

The Howard Pass site, on the north side of the Brooks Range in Noatak National Preserve, recorded some remarkable data during the 2012-2013 winter season. Winter temperatures were as low as -48° F in February and wind gusts as high as 84 mph in January. Cold temperatures combined with strong arctic winds from the north resulted in frigid wind chill factors throughout the winter; average wind chill in February was -39.5° F and the maximum was -101° F!

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Left: Monitoring station at Howard Pass, Noatak National Preserve.

Piecing Together a Changing Planet at Biscayne NP

Studio Art Quilt Associates (SAQA) Florida and Biscayne National Park will collaborate on an exhibit interpreting climate change in textiles for a show that will travel to some of the very places depicted in the artwork.

Stories of how artists have played a crucial role in the environmental movement are legion. The arts convey beauty, fragility, and urgency in ways that touch the heart and soul, thus opening the mind as well. Twenty-six pieces, united in an arresting vertical format, will be selected to be “catalysts for conversation” on one of the biggest – and most overwhelming – challenges our planet has ever faced.

The collaboration between Biscayne NP and SAQA, a national non-profit organization that promotes the fiber arts, will be professionally juried and will highlight national park connections to climate change. The show will premiere at Biscayne’s Dante Fascell Visitor Center Gallery in December, 2014, and will then begin a tour of national parks and museums in gateway communities beginning in March 2015. Confirmed venues include the Hockaday Museum of Art in Kalispell, Montana (just outside Glacier NP), Cape Cod NS, and the Arrowmont School of Arts and Crafts in Gatlinburg, Tennessee, a partner of Great Smoky Mountains NP. Additional venues still in negotiation include Lowell NHP and parks and museums in the San Francisco Bay Area, Cleveland and New York City areas.

An additional potential collaboration involves Miami Beach classical composer Carson Kievmann’s

newly-completed fourth symphony on climate change themes which could involve anything from a simple “soundtrack” to accompany the exhibit to full orchestral performances, either at the parks or in nearby venues.

The exhibition has been nominated as a Signature Project for the NPS Centennial, serving as a means to demonstrate national parks as a unified system on this critical issue. It has also been endorsed by the NPS/FWS/NASA Earth-to-Sky collaboration, and the “Arts Afire” champion for the “Call to Action” Centennial Initiative. A small amount of funding for shipping and perhaps other aspects of the program is also expected from the Climate Change Response Program, to minimize costs for hosting venues.

The first completed quilt is pictured to the right and was created by Maya Schonenberger. This quilt is described as follows. The diversity of the National Parks is vast: high and low, wet and dry, cold and hot. Yet climate change is an oddly unifying concept. Warmer temperatures melt ice, but also cause tiny colorful plants that live inside coral animals to abandon their hosts, a phenomenon known as “bleaching.” By including Glacier NP’s high peaks and Biscayne NP’s brain corals into a single piece, the artist acknowledges both the differences and the commonalities evident in America’s national parks. “Melting glaciers and bleached corals are both very visible realities to me, whether hiking and skiing in mountains or snorkeling the waters of a coral reef” stated Maya. Contact: Gary_Bremen@nps.gov



Seasonal Park Ranger Makes Visitor Awareness Go Beyond the “Obvious” Resource at Jewel Cave

Most visitors to Jewel Cave National Monument experience a guided cave tour and perhaps take part in some outdoor recreation while visiting the Black Hills of western South Dakota. Yet, most of them do not realize that they are visiting a Climate Friendly Park. Nor are visitors aware of what actions have been taken in order to implement sustainable practices in park operations. For this reason, seasonal park ranger Beth Ann Herman worked with an assortment of staff to design and create a climate change site bulletin for enhanced

visitor education. The one-page brochure offers visitors an easy reference guide for quick awareness of mitigation efforts on site and how the efforts relate specifically to the surface and sub-surface resources. Honoring the Go Green initiative within the Call to Action, the Monument plans to offer the brochure in digital form through its website and partner links. For a copy of the brochure or more information, contact:

Bradley_Block@nps.gov

More Information

This newsletter is a quarterly forum to share the latest actions relating to NPS efforts to manage our parks in a changing climate.

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