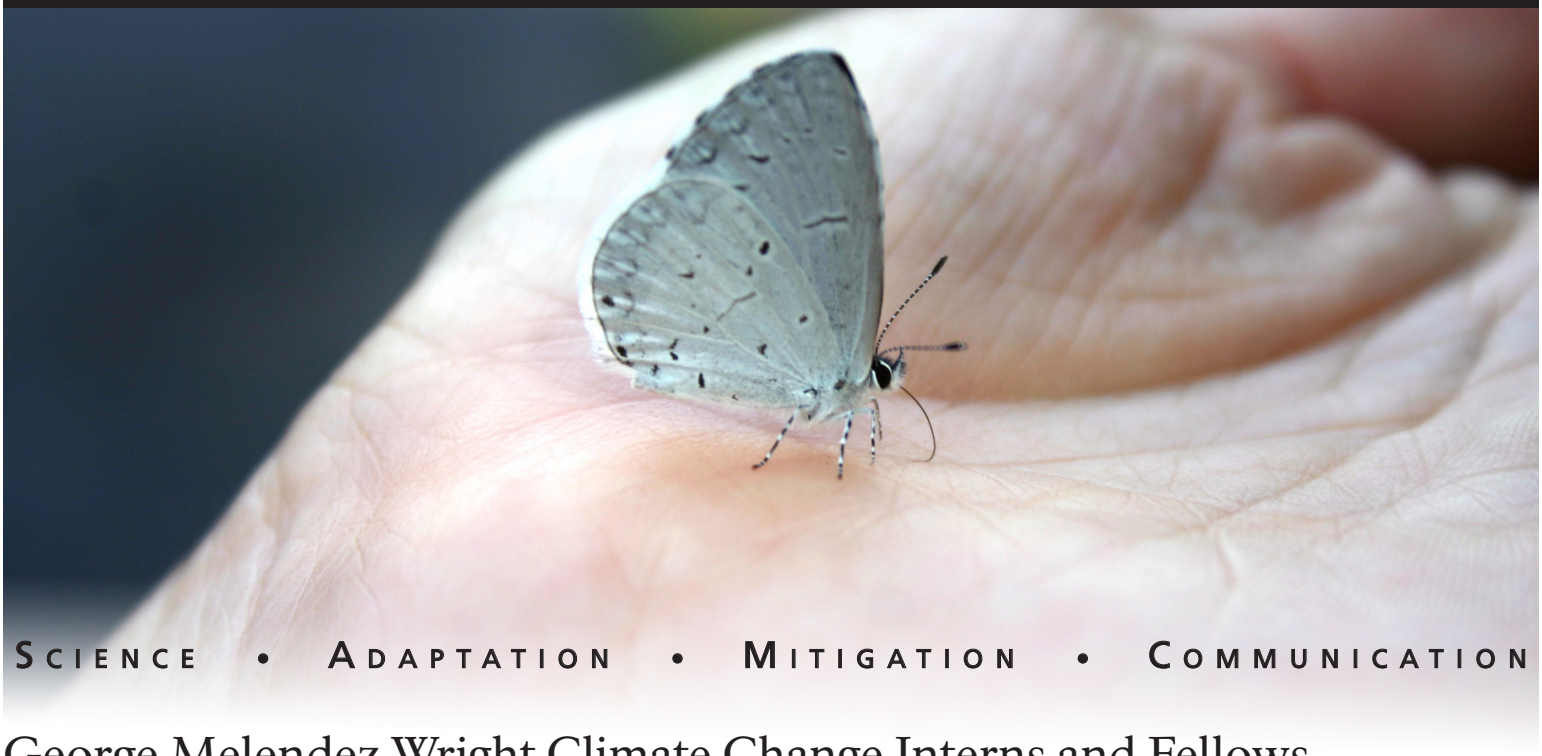
Climate Change Response Program *News*
September / October 2011

National Park Service
U.S. Department of the Interior

Climate Change Response Program



George Melendez Wright Climate Change Interns and Fellows

This issue of *Climate Change Response Program News* highlights the great work of a talented group of young people who are passionate about our National Parks and about understanding, and acting on, the effects of climate change. This year's George Melendez Wright (GMW) Climate Change Interns and Fellows have brought their deep commitment, creative ideas, and hard work to dozens of parks and programs. We are delighted to present some of their stories from the field.

Through the GMW Internship program, the CCRP funds university students for 12 weeks to help parks and programs understand and respond to climate change in many different ways. The projects are developed in advance by parks and programs and submitted for consideration via a competitive proposal process. Some interns, like Gina DiCicco at North Cascades NP, focused on sustainable operations as a route to decreasing greenhouse gas production in the park. Others, like Christine Harris at Cape Cod NS, developed interpretive products and programs to educate park visitors about climate change and its effects. Others conducted field research and connected it to staff and public education, or assisted with multidisciplinary program development.

The GMW Fellowship program supports Masters and Ph.D. students for one year conducting park-based research with the potential to inform innovative solutions to resource management problems related to climate change. Proposals are submitted by students, with the endorsement of resource management leaders in each park, and evaluated by a diverse panel of internal and external scientists. Among this year's fellows are Lauren Oakes from Stanford University, who spent a field season collecting data on the ecological and cultural consequences of Yellow Cedar decline in Glacier Bay NPP; and Lukas Bell-Dereske from Rice University, who braved the blowing sand at Sleeping Bear Dunes NL to examine how an ecologically important plant-fungus symbiosis responds to climate change, with attendant effects on dune plant community structure.

As *A Call to Action* reminds us, the NPS has an exemplary record of ensuring the stewardship and public enjoyment of the national parks, and an obligation to make parks more relevant to broader, and younger, audiences. The George Melendez Wright Climate Change Internship and Fellowship program aims to meet that obligation. Science and service are great ways to connect people to parks and simultaneously foster the next generation of park stewards and NPS professionals.

The following stories and profiles reveal young people connecting with national parks as they work on research, education, communication, and management projects related to the greatest ongoing threat the national parks have ever faced. These projects reflect the energy, creativity, and commitment that students and NPS staff bring to a thoughtful and effective response to climate change. It is a pleasure to share and celebrate them with you.

In this Issue

This is a special issue of the Climate Change Response Program newsletter featuring the work of our 2011 George Melendez Wright Climate Change Interns and Fellows. For more information on this program or any of the projects highlighted here, contact: Tim_Watkins@nps.gov

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Above: A blue azure butterfly lands on the hand of climate change intern Keith Hoffman at Great Smoky Mountains National Park; NPS photo.

Monthly Climate Change Webinar Series

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

Next Webinar: Oct 13th, 2011

October's presentation will feature Benjamin Rasmussen of the Volpe Institute. He will be joined by NPS planners in sharing their collaborative efforts on an innovative planning approach to regional transportation and land use in the context of climate change.

This Cape Cod NS planning project engaged numerous regional stakeholders and incorporated scenario planning to develop a collaborative process that considers climate impacts and opportunities for building resilience through planning.

Follow this link to register for October's webinar:
https://www1.gotomeeting.com/register/870164424

Upcoming Webinar

Nov 10th, 2011
Julia Cole with the University of Arizona will discuss the role that the oceans play in moderating climate, and how climate change will impact this dynamic system.

Follow this link to register for November's webinar:
https://www1.gotomeeting.com/register/390990792

Studying Greenhouse Gas Production in Alpine Soils

Climate change intern, Becky Brice, spent her summer working to quantify nitrogen and carbon dioxide flux in the alpine soils of Rocky Mountain National Park. Soils that are typically frozen during the winter season, when thawed by a warming climate, have the potential to contribute significantly to the production of greenhouse gases. Higher nitrogen levels in soil may result as the frozen alpine soils thaw. This additional nitrogen in the alpine system can cause decreased species diversity. Precipitation and moisture availability in the alpine zone is expected to increase with climate change which should also increase carbon dioxide release from the soils.

Becky and her project lead, Dr. Jason Janke, performed seasonal analysis of greenhouse gas production from high elevation soils bi-weekly and evaluated the effects of soil type, soil temperature and physical site characteristics. The study took place at three sites along Trail Ridge Road. Carbon Dioxide measurements were taken using a specialized sensor designed to measure CO_2 in soil respiration. Soil samples were collected at each of the three sites and nitrogen concentrations in the form of nitrite, nitrate, and ammonia were determined from each of these samples.

Becky earned her bachelor degree in Land Use/ Geology at Metropolitan State College in Denver in 2011. She will continue her studies toward a graduate degree in climate change and earth physical processes at the University of Denver this fall. Becky's home is in Golden, Colorado where rock climbing, cycling, mountaineering, and photography are among her favorite pastimes.

Interpreting Climate Change at Cape Cod

Christine Harris' GMW internship opportunity took her to Cape Cod National Seashore, where she worked out of the Salt Pond Visitor Center. As the "Climate Change Interpreter" her duties involved everything from planning Junior Ranger Day, which had a theme of "Wacky Weather and Crazy Climate," to writing press releases and setting up media visits with park scientists about ongoing park research pertinent to climate change. She also had the responsibility of creating and organizing resources for interpreters to encourage them to include more information about climate change in their existing programs.

Christine created a climate change kit for interpreters that was a compilation of documents, presentations, images, and references. She created a presentation for the general public about how climate change has affected Cape Cod National Seashore and what the park is doing about it. She had the opportunity to present this summer during one of the weekly Science in the Seashore programs. Additionally, she created an exhibit titled "Climate Change at Cape Cod National Seashore: What Our Resources Are Telling Us" that is displayed in the main lobby of the Salt Pond Visitor Center.

Christine states, "the internship was a rewarding experience that allowed me to further develop my knowledge of climate change and educate others about what an important issue it is."

Race Point Light, near Provincetown at Cape Cod National Seashore. NPS Photo.

Exploring Phenology with Young Students

During her internship at Santa Monica Mountain National Recreation Area in Thousand Oaks, California, Heather Martin worked with the National Park Service and the Fish & Wildlife Service to create elementary and middle school phenology field trip programs to be conducted at the park.

To create an opportunity for students to see native plants in their native environment, the Fish & Wildlife Service has helped to establish native schoolyard habitats in several area schools. Heather created programs that helped students learn more about native plant phenology in national parks, and how phenology data are used to understand the effect that changing climate has on the natural cycles of plants and animals. Students will continue to participate through a national effort to collect phenology data with the National Phenology Network (**http://usanpn.org**).

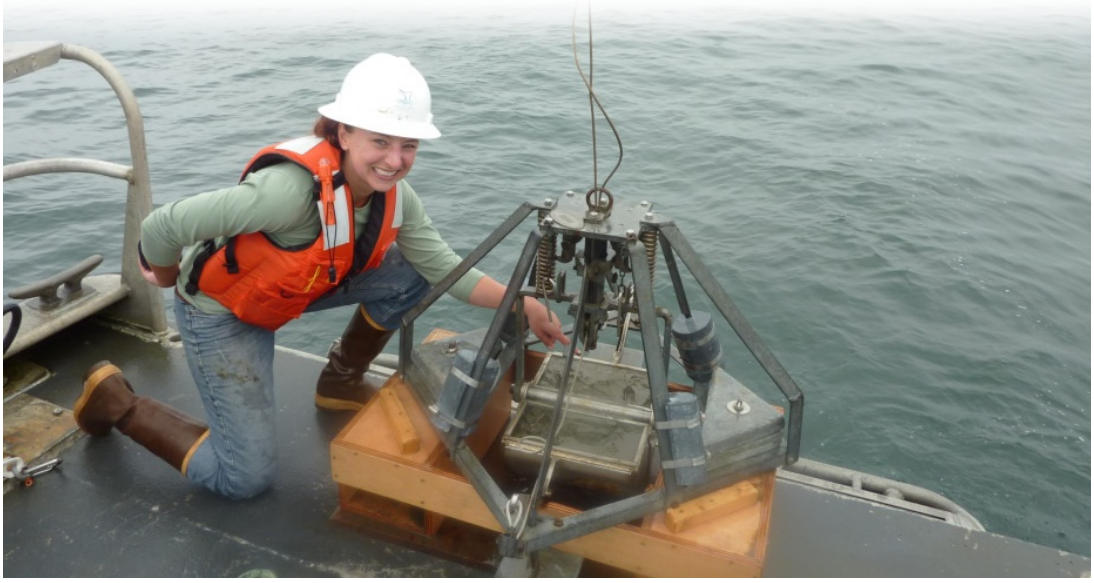
The National Park Service will be working with outside organizations such as the local university, California State University Channel Islands, Fish & Wildlife Service and local high schools to help conduct these programs.

Red Tides May Be a Canary in a Climate Coal Mine

Kristen Feifel is a PhD student at the University of Washington in the School of Oceanography. Her research focuses on harmful algal blooms (HABs), more commonly referred to as "red tide." HABs are caused by a variety of toxin producing marine algae that can negatively affect ecosystems and human health when present at sufficiently high concentrations in the environment. As a GMW Climate Change Fellow, Feifel is conducting research off the coastline of Olympic National Park. The park's jurisdiction extends to the extreme low tide line of the coastal strip and abuts the Olympic Coast National Marine Sanctuary. Multiple HAB-forming species have been detected along the Olympic coast including *Pseudo-nitzschia* spp., *Heterosigma akashiwo*, *Alexandrium catenella*, *Akashiwo sanguinea*, and *Chaetoceros* spp. Within Olympic NP, HABs have caused shellfish toxicity, massive bird kills and sea otter mortalities.

The natural and economic resources of Olympic NP are threatened by periodic HABs; it has been hypothesized that recent changes in climate may be a contributor to increases in HAB outbreaks. HAB populations may serve as a bioindicator of large-scale marine ecological disturbances such as changes in climate. As such, HABs may be the quintessential "canary in the coal mine" for coastal ecosystems. Understanding the effects that large-scale climate variability and local environmental conditions have on HAB populations could help predict impending changes in coastal ecosystems and those resources that depend upon them.

Some HAB forming species in the Pacific Northwest can form a dormant cyst after a bloom that becomes entrained in the sedimentary record; changes in cyst abundances in sediments reflect changes in planktonic HAB populations. To better assess the influence climate has on some HAB forming species, Kristen plans to locate and identify cyst beds along the Olympic coast and then construct historical records based upon the dormant cyst stage. Using sediment records to identify bloom sources, cyst beds, and reconstruct historical HABs will help managers to understand past environmental drivers of blooms and elucidate the potential effects that climate change may pose to natural resources.



Kristen uses a Smith-Mac sediment grab to extract sediments while aboard the NOAA R/V Tatoosh in August, 2011.

GMW Climate Change Fellow: Lukas Bell-Dereske

As a GMW Climate Change Fellow, Lukas has been working in Sleeping Bear Dunes National Lakeshore. He is examining the possible effects of climate change on vulnerable Great Lakes dune plant communities, and how a fungal symbiont found in the dominant plant species, ecosystem engineer American beachgrass, might affect this community's response. In 2011, he surveyed the dune community to analyze how the abundance of the fungal mutualist may affect the diversity of the plant community. In 2012, he will set up an experiment to manipulate plant community composition, precipitation regime, and presence of the fungal symbiont to investigate how these factors interact to affect the growth of the plant community. The results will help inform management decisions in the future. As a native son of western Michigan, he is thrilled to be assisting in efforts to understand, and possibly mitigate, the effects of climate change on the fragile dune plant community of Sleeping Bear Dunes.

The Flora of Acadia

The flora around Acadia National Park has attracted botanists and flower lovers to Maine for over a century. However, the earlier botanists observed and collected a different flora than what Fellow Caitlin McDonough found on Mount Desert Island this summer – the past 117 years have seen some native species decline and disappear, while new ones have appeared. Tracing floristic changes with a look at phenology, Caitlin time-travelled in Acadia with the help of archives, herbarium specimens, and old records to sort out how the flora had changed and try to understand why.

In 1894 two botanists published *The Flora of Mount Desert Island, Maine*. With the help of local botanists Caitlin compared 1894's flora to present day. The losses and declines in abundance she found on Mount Desert Island matched extinction rates published in studies on the towns of Worcester and Concord, MA over the same time period. But Acadia is a national park, not a township of fields, forests, and urban/suburban development.

Calculating changes in abundances required some historical sleuthing – scientific names have changed, old variations have become their own species, the poetics of Victorian era abundance descriptions needed calibration. Specimens collected in the late 19th Century and their flowering dates may provide a clue into the forces driving the changes in Acadia's flora. While results have concluded that habitat alone does not determine changes in abundance, it is still unclear why Acadia's flora is as susceptible to loss as the wildflowers in urban/suburban Massachusetts.

Effects of Fire on Mercury Fate and Transport

Mesa Verde National Park has some of the highest rainwater mercury concentrations recorded in the United States, a result of regional coal-fired power generation. It is believed that wildland fire may play a role in mercury mobilization, speciation, methylation, and bioaccumulation in streams, lakes, and reservoirs. Forest fires are increasing in frequency and magnitude in the United States. Climate change predictions for much of the western U.S., including southwestern Colorado, suggest hotter and drier conditions, favoring a continuation of this trend. Furthermore, fuel management practices critical to preserving forests and minimizing wildfire intensity may indirectly influence the fate of mercury species in forest soils. Jackson Webster's fellowship project approaches the issue of mercury transport with the hypothesis that forest fire will decrease the abundance of reduced sulfur containing functional groups capable of strong mercury binding in forest soil.

Considering the accumulation of fuels associated with predicted climate change vegetation mortality, future fire management strategies at Mesa Verde will not necessarily be employed to restore the natural fire regime, but more pragmatically, reduce fuel loading and thereby protect and preserve invaluable archeological resources. This research will help elucidate the role of wild fire and fire management in the biogeochemical cycling of mercury species in Mesa Verde National Park.

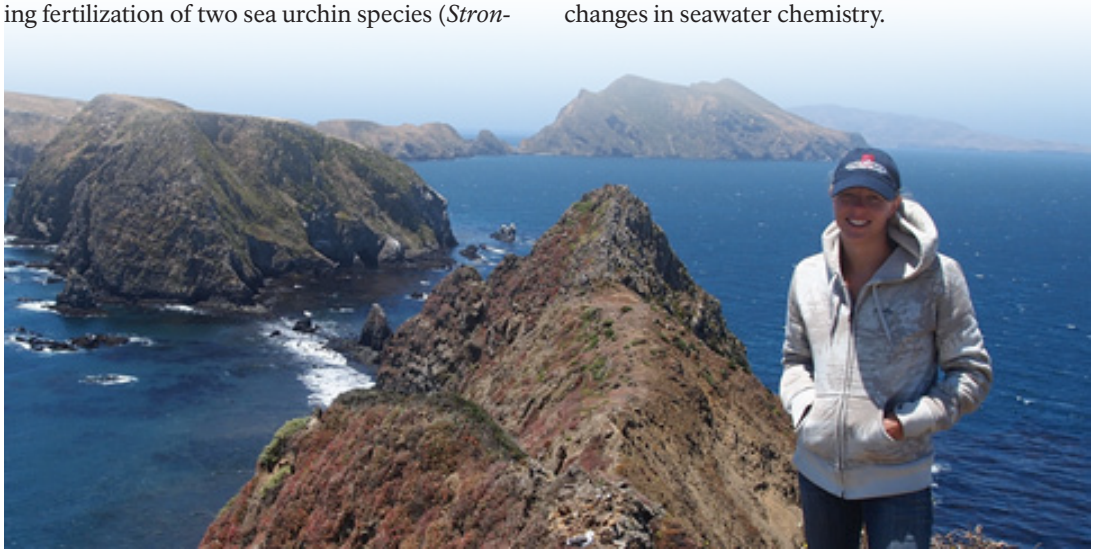
Jackson Webster is currently a Ph.D. student in the Civil, Environmental, and Architectural Engineering department at University of Colorado, Boulder. His interest is contaminant transport in aquatic environments.

Ocean Acidification in the Channel Islands

Lydia Kapsenberger is a second year Ph.D. student at the University of California Santa Barbara. Funded by the GMW Climate Change Fellowship program, she is conducting research on ocean acidification in the Channel Islands National Park (CHIS).

The objectives of this project are two-fold: (1) to deploy two autonomous pH SeaFET sensors to characterize near-shore pH on Anacapa Island and Santa Cruz Island and to estimate pCO_2 in the field in order to inform laboratory studies, and (2) to conduct laboratory based experiments testing fertilization of two sea urchin species (*Strongylocentrotus purpuratus* and *S. franciscanus*) from two locations spanning an upwelling gradient in the CHIS.

With this project she plans to contribute to the overall understanding of climate change effects on marine organisms as well as emphasize the coupling of environmental monitoring and experimental design. It is Lydia's hope that the baseline knowledge of near-shore pH and pCO_2 levels generated from this project will encourage the park to initiate a long-term ocean acidification monitoring program in order to track future changes in seawater chemistry.



Horse Fossils Help Answer Climate Change Questions

With current climate change projections, scientists are unsure how plant and animal species will react to their shifting environments on a long time scale. Will species adapt to the changes around them? Will they have enough time to do so before it is too late? The paleontological record can help answer some of these questions. By studying how species have reacted to previous climate changes over long periods of time, we can set a baseline for what is "normal."

One such park with the paleontological resources to study and examine these questions is John Day Fossil Beds National Monument where Kaitlin Maguire, a Ph.D. student at the University of California, Berkeley, is conducting research on how animals in the past responded to climate changes. In particular, she is looking at how species of horses responded to a large spike in temperatures 15-20 million years ago, called the Mid-Miocene Climatic Optimum. During this period, temperatures rose about 3°– 4° C, similar to the worst case scenarios predicted for today's climate change. Kaitlin's research aims to determine if horse species tracked their preferred environment during this increase in temperature, or if they stayed put and adapted to the changes. To find the answer, she is studying the rocks in which horse fossils have been found in order to recreate the environment they lived in. The period of time she is examining is when horses evolved from small woodland browsers to larger grassland grazers.

The use of paleobiology in modern climate change research is just beginning, but will hopefully add valuable information to our understanding of the future of species in National Parks.

Tick Populations Responding to Climate Change

As the Earth's temperature and rainfall patterns are altered with climate change, many species face the threat of extinction. Ticks, however, are likely to benefit from milder winter temperatures and extended spring and fall seasons. Their geographic ranges are expanding, and changing climatic conditions have been shown to correlate with reported changes in tick density and occurrence.

This summer, Victoria Shelus researched ticks and tick-borne pathogens along the Appalachian Trail, laying the groundwork for the development of a model to predict tick distribution using environmental and climatic variables. This was done through collaboration with the NPS Office of Public Health and the Center for Disease Control (CDC) Division of Vector Borne Infectious Diseases.

Along the Appalachian Trail there are three primary ticks of public health importance, *Ixodes scapularis*, the Black-legged tick or Deer tick, *Amblyomma americanum*, the Lone star tick, and *Dermacentor variabilis*, the American dog tick or Wood tick. These ticks transmit the pathogens for seven different diseases; Lyme Disease, Anaplasmosis, Babesiosis, Ehrlichiosis, Tularemia, Southern Tick-Associated Rash Illness (STARI), and Rocky Mountain Spotted Fever.

Extending 2,175 miles along the Eastern United States from Maine to Georgia, great variation exists along the trail with regard to tick species, and their density, infection rates, and seasonal activity. Victoria cataloged these differences from data in published scientific literature, and sought to understand this variation through the relationship between ticks and environmental factors such as precipitation, humidity, temperature, elevation, host density and diversity, land cover, soil type, and habitat fragmentation.

As she continues with this project in conjunction with her graduate studies at the Nicholas School of the Environment at Duke University, she will develop a geospatial risk model using Geographic Information Systems (GIS) to predict areas of high risk of exposure to ticks and tick-borne pathogens. This model can be used for targeted interventions and prevention messages within the National Park units along the Appalachian Trail, and serve as a baseline for monitoring changes in tick density and distribution due to climate change.

For more information on ticks and tick-borne pathogens please visit the CDC's information page at: **http://cdc.gov/ticks/**

Information about the NPS Office of Public Health can be found at:
http://www.nps.gov/public_health/index.htm

Adult deer tick; photo courtesy CDC.

Mark Your Calendars

October 31 - November 2, 2011
The second annual GreenGov Symposium will be held in Washington, DC. This is hosted by the White House Council on Environmental Quality, and will bring in experts to explore how to green the federal government.
http://www.whitehouse.gov/greengov/symposium

November 7-12, 2011
Climate Change and Disaster Risk Management Online. This online conference will touch on the latest findings on social, economic and political aspects of climate change.
http://www.climate2011.net/

November 14-17, 2011
Climate Change Vulnerability Assessment Training in Anchorage, AK. This course is designed to guide conservation and resource management practitioners in two essential elements in the design of climate adaptation plans. Registration is open to all applicants through the FWS's National Conservation Training Center. Future trainings will be held in 2012 in Florida, Washington, Colorado, and West Virginia.
https://gm2.geolearning.com/geonext/doi/login.geo

Nov 28 - Dec 9, 2011
COP 17 United Nations Climate Change Conference in Durban, South Africa. The United Nations Climate Change Conference will bring together representatives of the world's governments, international organizations and civil society to continue to build from conversations of past meetings.
http://unfccc.int/meetings/cop_17/items/6070.php

Sarah Bisbing surveying stands of *Pinus contorta* in the high Sierra of California.

Adaptive Response to Climate Change in Lodegepole Pine

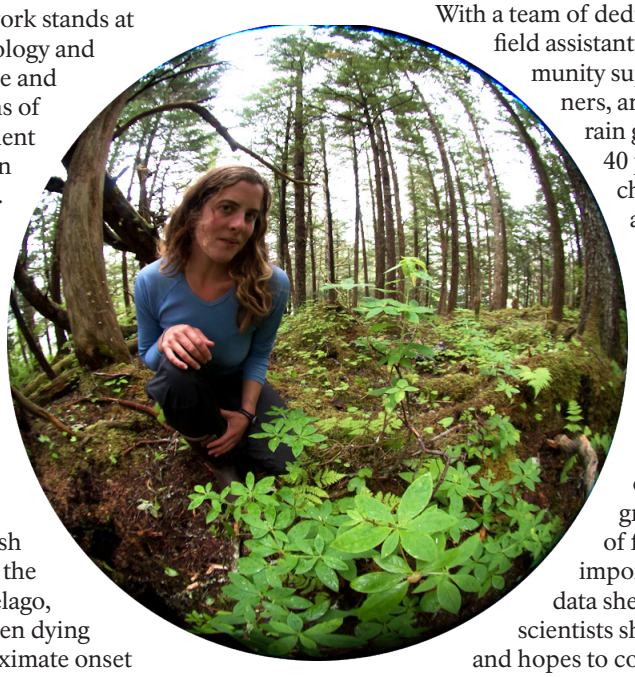
Increasing concerns over the consequences of global climate change make it imperative that we attain a better understanding of the drivers of distributions, the role of genetic differentiation, and phenotypic plasticity in the adaptive response of widespread species. As changes in climate affect conditions at the local and regional scale, some species will be forced to adapt or migrate to accommodate their environmental requirements. The subspecies of lodgeppole pine (*Pinus contorta)* already grow at the extremes of site conditions, subsisting in nutrient-poor sand dunes and ombrotrophic bogs in the northwest; podzolized soils in coastal California; exposed areas at treeline in the Sierras; and dry, fire-prone sites in the Rocky Mountains.

Knowledge of how this species performs across a range of environmental conditions and the manner in which genetic variation is organized across the landscape will not only advance general understanding of distribution and adaptation but may also be crucial for land managers working to maintain species and communities in the face of a rapidly changing climate, providing them with a better understanding of the adaptive abilities of the lodgepole pine and aiding in predictions of species' performance in novel environments. Moreover, information on population structure will enable managers to preserve unique populations across the landscape, providing species with the opportunity to persist through the maintenance of high levels of variation.

Sarah Bisbing, a GMW Fellow and Ph.D. student at Colorado State University, is conducting climate change research to determine the extent of genetic variation within and among the four distinct subspecies of lodgepole pine and uncover how specific ecological site characteristics may elicit adaptive changes in morphological characteristics. Ultimately, seedlings from all four subspecies will be planted across the range of the species, testing the response of each subspecies to the environmental conditions found across the landscape. This research will be the first range-wide landscape genetics study of lodgepole and only the second *Pinus* spp. study to utilize both molecular techniques and a reciprocal transplant experiment.

Land-use and Conservation in the Alaskan Rainforest

Lauren Oakes recently returned to Stanford University with a backpack full of tree cores and a ream of tattered Write-In-The-Rain paper after a long field season on the outer coast of Southeast Alaska. Lauren's work stands at the interface of ecology and land change science and addresses questions of resource management and conservation in a changing climate.



Yellow-cedar (*Callitropsis nootkatensis*), a species of high cultural, economic, and ecological value, ranges from California to Alaska, populating mixed forests. From British Columbia through the Alexander Archipelago, these trees have been dying off since the approximate onset of the industrial revolution. Scientists now understand that reduced snow-pack, associated with climate change, makes yellow-cedars susceptible to sudden freeze-thaw events. In her interdisciplinary doctorate research, Lauren is studying what happens next in these forests and what changes in these forest communities mean for long-term management and conservation.

With a team of dedicated and determined field assistants, a strong base of community support and regional partners, and a wardrobe of rubber rain gear, Lauren established 40 plots in the West Chichagof Yakobi Wilderness and initiated study in Glacier Bay National Park this summer. As a documentarian and artist, captivated by the power of narrative and visual media to document land use changes, Lauren will consider archival photographs and oral accounts of forest uses equally important to the biophysical data she collects. She believes scientists should share their stories and hopes to communicate her science to a broader audience in the road ahead.

You can read more about her summer on the field blog: **http://www.forest-frolic.blogspot.com**

Interpreting Climate Change in North Cascades NP

Through the National Council for Science and the Environment's Campus 2 Careers program and the George Melendez Wright Climate Change Internship Program, Gina DiCicco was able to spend her summer working in North Cascades National Park. Her work at North Cascades fell into three categories: climate change documentation, media projects and public outreach, and communicating with youth.

Gina documented the effects of climate change in the park, as well as the park's responses to them, by following glacial monitoring and aquatic monitoring teams into the field to document their work. She also photographed the park's worm bins, flex fuel vehicles, water treatment facility, and recycling system, for use in park brochures, web pages or ranger talks.

One of her most rewarding responsibilities was to meet with youth groups that visit the park, with whom she discussed weather and climate, the greenhouse effect, and some general impacts we can expect to see. To make the contacts more personal, she asked the kids what their favorite part of the North Cascades was and then brainstormed ways that it might be affected by climate change, followed by a discussion of ways we can all make climate-friendly decisions in our daily lives. Gina stressed that they have ownership over the government and this park and implored them to use their voices.

Participating in the GMW Climate Change Intern program in North Cascades National Park was a great experience for Gina. While learning about climate change, communication, media software, and the National Park System she was able to develop skills and knowledge she says will surely be useful in her future academic and professional pursuits.

Backfilling and Hydrology at Jean Laffite

As an Intern at Jean Laffite National Historical Park and Preserve, Cheiko Hunter looked at how a recent canal backfilling project will act to restore the natural hydrology of the marsh at the Park's Barataria Preserve unit and combat the effects of climate change that threaten it. While working on her thesis at Tulane, Cheiko developed an affinity for the bottomland hardwood forests and marshes of Louisiana, and an interest in the all-encompassing problem of global climate change, inspiring her to apply for the internship program.

Backfilling involves removing the spoilbanks that border canals and placing that material into the canal, making it shallower. Canals dug in the past half-century, primarily for oil exploration, increase the rate of erosion and of soil shrinkage, and alter water chemistry and flow. This is especially problematic in the Gulf Coast region, where subsidence of the land works with the rising sea levels associated with climate change to threaten low-lying wetland habitats, which are crucial as buffers against storms and as filters of human waste. She is also working to inform the park about the specific effects that climate change is expected to have at Barataria, and how best to meet these challenges.

Willow Decline in Rocky Mountain NP

The focus of Kristen Kaczynski's fellowship at Rocky Mountain NP is two-fold. First, she performed controlled greenhouse experiments to test the strengths of the interacting stressors leading to willow stem dieback, including drought and temperature stresses. She built warming shelters, manipulated water levels and inoculated willow stems with fungi to assess the stem's photosynthetic capacity and growth under various treatments.

Secondly, Kristen is interested in the temporal dynamics of the willow decline in the Kawuneeche Valley at the headwaters of the Colorado River and is investigating connections between the onset of the decline and landscape scale climate drivers, such as drought or increased/decreased maximum or minimum ambient temperatures. Results will inform park managers on the timing and causes of this decline and should form the foundation for riparian recovery and restoration efforts within the park and throughout the West.

Phenology Monitoring at Lewis and Clark National Historic Trail

Since June, David Sempek has been helping with the development of a phenology monitoring program for the Lewis and Clark National Historic Trail in Omaha, NE. The goal of his internship is to identify a suite of plant and animal species along the Lewis and Clark Trail that can be used to determine the effects of climate change. Legacy data from the journals of Lewis and Clark and literature reviews have been used to aid in the selection of candidate species, along with species lists from NPS units along the Trail representing the five ecoregions through which the Trail passes. Other NPS phenology projects have been consulted regarding methods used for species selection.

The phenology program is being developed in collaboration with the USA-National Phenology Network, a national organization that provides both peer-reviewed phenological observation protocols and an internet-based data entry portal. The park hopes to coordinate training and observers along the trail with the help of existing trail partners, such as national wildlife refuges, national forests, state and local park agencies, and nonprofit affiliates. Observers along the Lewis and Clark NHT will be able to enter their phenology data into the USA-National Phenology Network's website, to be viewed and used by members of the scientific community.

Melting Glaciers and Alpine Lake Habitat

Krista Slemmons, a Ph.D. student in the Ecology and Environmental Sciences program and the Climate Change Institute at the University of Maine, is investigating how climate-induced changes in alpine glaciers alter lake habitats in Glacier National Park. She is examining aerial photos of glaciers to identify the degree of glacial loss within six watersheds and relate this to changes in lake communities. Slemmons is also extracting lake sediment cores and identifying if changes in algal communities through time are related to the loss of glaciers. The results will help park managers predict what will happen to biological resources as glaciers continue to recede, and ultimately disappear.

Slemmons' doctoral research involves evaluating the response of algae within arctic lakes of East Greenland and alpine lakes of the Rocky Mountains to changing glacial ice. Slemmons examines how aquatic biodiversity and lake clarity have not only changed through time but how both of these features are affected by modern human activity. Her research aims to provide an imperative step toward understanding the fate of lakes as glaciers recede and show how these glacier-lake linkages are models of profound hydrological and biogeochemical change in high latitude and high altitude regions.

Rising Sea Level and Coastal Forests in the Everglades

Southern coastal rare plant communities in Everglades National Park are threatened by sea level rise (SLR). Kristie Wendelberger is helping the Park develop a monitoring program for these communities by creating a map using high resolution satellite images of the rare plant communities found in the study area. This will give the Park baseline data on plant community distribution and abundance, allowing for future community change assessment and more efficient rare plant inventories. As below ground salinity levels increase with SLR, park staff expect to find a shift in species composition from non-salt loving (glycophyte) to salt loving (halophyte) species. Halophyte species have been hypothesized to increase the rate of this shift by drawing up salty ground water, thereby increasing the soil salinity and allowing them to out-compete surrounding glycophytes. Kristie will be testing this hypothesis using shade-house competition experiments with varying glycophyte/halophyte combinations grown under different water-stress scenarios. Additionally, to help park managers predict what changes will happen, and thus to monitor them, she is assessing the effects of varying salinity levels (0ppt, 5ppt, 15ppt, 30ppt, and 45ppt) on seedling germination and establishment in 6 species found in coastal Buttonwood forests. How seedlings grow in response to salinity will determine what plants may become more or less abundant with changing salinity levels. The target species include representatives from the canopy, subcanopy, and herbaceous layers of the forest. With this information, Park managers will be able to monitor community shifts and have a better understanding of when it is important to perform conservation actions for their most threatened species.

Kristie is a Ph.D. student in the Department of Biology at Florida International University. She received an MS in Ecology at the University of North Carolina, Chapel Hill in 2010 and a BS in Environmental and Plant Biology at Ohio University in 1998. She has been studying rare plant conservation issues for over 8 years which she finds to be both challenging and rewarding.

Coastal forests in Everglades National Park are threatened by sea level rise. Increased salinity could cause shifts in species compositions in these fragile woodlands. NPS photo.

More Information

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

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The Climate Change Response Program can be found on the web at: http://www.nps.gov/climatechange