

# Climate Change Response Program Newsletter

Q1 | 2016



SCIENCE • ADAPTATION • MITIGATION • COMMUNICATION

## Great Smoky Mountains Among the First to Install Electric Vehicle Charging Stations

Great Smoky Mountains National Park staff conducted an energy audit in 2006 to guide the development of their *Climate Friendly Parks* plan. During the audit, park management identified the need to both reduce their operational carbon footprint, and assist the visiting public in reducing their greenhouse gas emissions.

As a means of advancing these goals, the park recently invested in a series of alternative fuel projects. In September 2015, the park unveiled several improvements made possible through funding from the Department of Energy's *Clean Cities National Park Initiative*, including:

- the installation of electric vehicle (EV) charging stations at the Sugarlands and Oconaluftee visitor centers,
- the conversion of five gasoline lawn mowers to run on cleaner propane autogas,
- the replacement of three gasoline cars with three low-speed electric vehicles.

Various cooperating partners supported these efforts. The Nissan Corporation donated two of the new EV charging stations. The Great Smoky Mountains Association agreed to manage the administration of the

stations, including the Internet connection necessary for processing payments. And East Tennessee Clean Fuels and the Land-of-Sky Clean Vehicle Coalition provided the necessary connections to put all of the pieces together. All equipment is maintained by park staff.

As the most-visited national park in the nation, Great Smoky Mountains is excited to be among the first national parks to install EV charging stations for the public. During the recent unveiling, Superintendent Cassius Cash said, "Putting this equipment in use will help us meet our goal of reducing our greenhouse gas emissions from 2006 levels by 20% by 2020, and you will hear more from us in 2016—the 100th anniversary of the National Park system—on our continued efforts toward this goal."

For more information on any of these initiatives, please contact Brian Bergsma at [brian\\_bergsma@nps.gov](mailto:brian_bergsma@nps.gov).

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**Donal O'Leary**

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## Snowmelt controls Plant Lifecycles in Crater Lake National Park

Crater Lake National Park is world-renowned for the depth, clarity, and purity of its saffire-blue waters. The same snow that contributes to this gorgeous lake also dominates the landscape outside of the caldera, playing a role in the timing and duration of plant life cycles. As a George Melendez Wright Initiative for Young Leaders in Climate Change Fellow, I spent the summer of 2015 researching the interactions between snowmelt timing and plant phenology throughout Crater Lake. In collaboration with GIS Specialist Chris Wayne and Dr. Jherime Kellermann, I analyzed weekly satellite imagery, applying “big data” analytical techniques to environmental problems.

Climate change is projected to bring less snow to this region, with an earlier spring melt expected over the next century. The team found that when snowmelt occurs earlier in the year, plants have an earlier “green-up” and a longer growing season. This may lead to an invasion of exotic plants that can take advantage of an earlier spring and improved growing conditions, which can have major implications for the alpine and montane ecosystems of Crater Lake.

Climate change may also contribute to larger wildfires as early snowmelt leaves midsummer fuels drier than normal. Coincidentally, Crater Lake experienced both the earliest snowmelt and the largest wildfire on record during 2015. With these new findings park managers will be better prepared to protect their lands with innovative adaptation strategies that will help mitigate climate change’s impacts on our natural resources.

I am a Masters Candidate at Western Washington University in Bellingham, Washington. I am passionate about remote sensing, climate change research, and outdoor recreation. I find it energizing to see the Earth from new perspectives.



The timing of snowfall and subsequent melting relates directly to the timing of plant life cycles at Crater Lake National Park. Image by WolfmanSF used with permission under the [Creative Commons](#) license.





**Adam Griffith**

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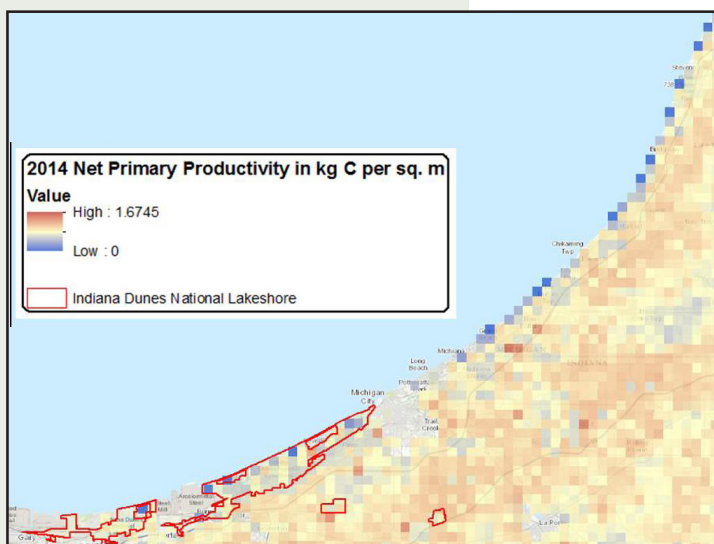
## Low Productivity Doesn't Mean Low Resilience of Plant Communities in Great Lake National Parks

Great Lakes national parks occupy unique geological positions on the landscape, yielding a wide variety in plant diversity. Indiana Dunes National Lakeshore has the highest species diversity in the region while Sleeping Bear Dunes National Lakeshore has populations of rare plants such as Pitcher's Thistle (*Cirsium pitcheri*). Climate change can threaten rare plants and species richness by shifting suitable growing conditions beyond species' current range limits. During my 2015 YLCC internship, I analyzed climate and remote sensed data in five Great Lakes national parks to help develop measures of ecosystem stability for plant communities potentially vulnerable to climate change.

Under the supervision of Joy Marburger (NPS) and with support from Noel Pavlovich, Ralph Grundel, and Jean Adams of the United States Geological Survey, I analyzed annual net primary productivity (NPP) data collected from MODIS satellites between 2000 and 2015. Using these data, we identified cool summers, mild winters, and rain during the growing season as significant predictors for NPP over the period of study. Pixel analyses of the remote sensed data were used to identify areas in the parks where NPP deviated significantly from the mean.

This information can be useful to land managers making decisions about which species or areas might be candidates for invasive species removal or restoration. In some areas, the results can also serve as an evaluation tool for past management decisions. Expansion of this work can help quantify measures of ecosystem stability such as resilience or resistance.

The code I wrote for this project can be applied to MODIS satellite data of other resolutions, and to other productivity indicators such as the Normalized Difference Vegetation Index and the Enhanced Vegetation Index. Furthermore, the code can be applied to any national park or area of interest in the contiguous U.S. This research was presented at The Association of American Geographers Conference in San Francisco in March and at the Indiana Dunes Science Conference in April.



Net primary productivity near Lake Michigan is highly variable. Note the low productivity vegetation closest to the lake, indicating poor sandy soils. Some of the low productivity sites, however, exhibited high resilience to changes in temperature and precipitation. NPS Image



Adam D. Griffith poses with Pitcher's Thistle (*Cirsium pitcheri*) at Sleeping Bear Dunes National Lakeshore while inspecting plants for a boring weevil. NPS Image

## Understanding Species Adaptive Capacity

A new paper (Beever et al. 2015) addresses the importance of including adaptive capacity of species as a fundamental component when assessing vulnerability to climate change.

Vulnerability to climate change depends on the amount of climate change a species will experience (exposure), its responsiveness to direct and indirect climate impacts (sensitivity), and—the focus of this study—its ability to accommodate those changes through adaptive capacity. Adaptive capacity consists of coping mechanisms such as changes in behavior or growth form, movements including shifts in geographical range and distribution, as well as genetic evolution to adjust to environmental or ecological stressors.

A nationwide survey of hundreds of climate change vulnerability assessments found that among the three components of vulnerability, adaptive capacity is evaluated least frequently, is often omitted entirely, and is often confused with sensitivity. To address these limitations, a broad team of experts from federal and state agencies,

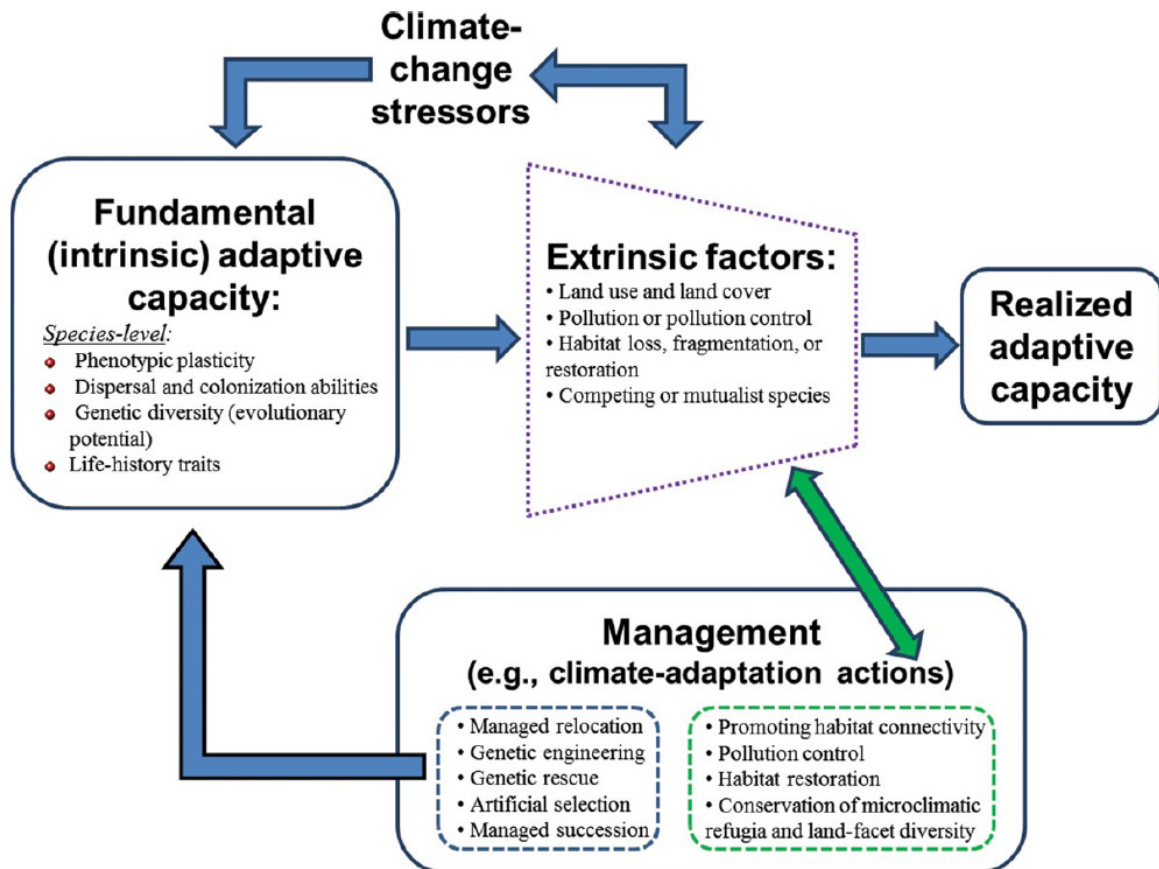
academic institutions, and non-governmental organizations identify ecological features that contribute to adaptive capacity, highlight the potential role for management and conservation to enhance species' adaptive capacity, outline research needed to better understand adaptive capacity, and provide case studies illustrating how the inclusion of adaptive capacity can enhance models of species response to climate change.

The authors argue that consistent inclusion of adaptive capacity would improve existing vulnerability assessments, the efficacy of climate change adaptation efforts, natural resource management, conservation, decision-making, and related policies. A park or region, for example, may be concerned about a suite of migratory bird species that are similarly sensitive and exposed to climate change, but pressed to prioritize among species and ensure that limited resources produce results. Accordingly, an understanding of the species' adaptive capacity might, for example, help managers discern which species are able to shift their

arrival dates on breeding grounds to keep up with earlier spring onset and which are not, and also help them understand how to most effectively reduce the vulnerability of low-adaptive-capacity species.

By not fully accounting for species' inherent abilities to adapt to environmental and ecological change, projections of vulnerability to climate change may overestimate extinction potential of some species; however, the authors assert that existence of adaptive capacity does not indicate species can handle unlimited amounts of contemporary climate change. In sum, variability in adaptive capacity among populations and species will have profound implications for which species are most rapidly and markedly affected by climate change.

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This new conceptual model of fundamental (intrinsic) and realized (extrinsically constrained) adaptive capacity of a species is analogous to the fundamental and realized ecological niches of a species (sensu Hutchinson 1957). Figure reprinted with permission from Beever et al. "Improving conservation outcomes with a new paradigm for understanding species' fundamental and realized adaptive capacity." *Conservation Letters* (2015).



## A Changing Landscape: Glacier's Warming Climate

There is rarely a day at work that I don't talk about climate change. I didn't plan it that way, but as a science communication specialist in a park known for its climate change research, it is almost inevitable. Over the years, I have tried many ways to become successful at it—trying new techniques, taking trainings, and looking for new and innovative ways to communicate this rather difficult topic. It isn't always easy. That's why, when a young park employee and graduate student walked into my office and told me she wanted to create videos on climate change, I listened.

Sarah Moody, a graduate student of the University of Montana's Environmental Studies program and employee of Glacier National Park, desired to make a difference. Armed with creative writing skills and fueled with passion for the park, she believed several short videos on climate change might reach new audiences and spread an understanding of climate change impacts currently happening in Glacier.

Walking into my office that day, she pitched her idea to me and asked if the Crown of the Continent Research Learning Center had any interest in working with her. My obvious first question to Sarah, "Do you have any experience making videos?" The answer?

"No." I suggested she take a film-making class at the university before attempting such a project and sent her on her way.

Months later, my phone rang. It was Sarah. Passionate as ever about her idea, Sarah had followed my advice and had taken a journalism class on video production. She was ready to go to work. After meeting with her and setting up a plan, I agreed. And this time, sent Sarah on her way with an outline in-hand and a commitment to help Sarah and her co-producer Stephanie Oster tell the story of Glacier's changing climate.

And, that's just what they did. Over the course of the next year, Sarah and Stephanie filmed, interviewed, and edited content for two short videos on climate change. The first, *A Changing Landscape: Glacier's Warming Climate*, gives an overview of how Glacier's landscape is changing and how climate change is affecting the park. The second video focuses on water and how changes in hydrology may affect numerous species and humans in the future.

*A Changing Landscape* went live this fall and generated public comment, spurred featured articles in local and regional newspapers, and hit over 1,800 online viewers. It also helped

earn Sarah her graduate degree. The second video is due to go live June 2016. Partial funding for both videos was provided by the Jerry O'Neal National Park Service Student Fellowship, awarded to Moody in March 2014.

*A Changing Landscape* is available on both the *CCRRC's YouTube channel* and the *Glacier National Park website* and includes an audio described version. To learn more about how climate change is affecting Glacier and the surrounding area, visit <http://www.crownsience.org/topics/climate> or check out the United States Geological Survey's *Climate Change in Mountain Ecosystem's website*.

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NPS Image



# Regional Updates

## Earth to Sky Alaska Regional Course



NPS Image

More than 50 scientists and science communicators gathered in Anchorage in October to talk and learn about changing climate in Alaska. This was the pilot course for a new, regionally-focused training model that we hope to take to other regions of the country over the coming years.

Participants gathered for three days at the Campbell Creek Science Center to hear from scientists and presenters from 11 different organizations, including NASA, the University of Alaska, federal and state agencies, native organizations, and non-profit groups. Presenters and students discussed the latest news about climate impacts and their implications to our state. Course participants came from all over Alaska (from Kotzebue to Glacier Bay, from Dillingham to the Arctic Refuge), representing numerous governmental, non-government, and community organizations—the most diverse audience ever assembled to date for Earth to Sky.

Earth to Sky (ETS) is expanding its efforts through this course with new emphasis on partnering, and sharing new research specifically within a locally-based and engaged community of communicators and scientists. We are delighted with its successful launch, and look forward to the many future opportunities and new products that will surely result about changing climate in Alaska.

The course was also sponsored by NASA's Arctic Boreal Vulnerability Experiment (ABOVE) research campaign, which will be taking place for the next 9 years in the arctic.

For more information and to access the presentations and materials on-line; watch for updates on [www.earthtosky.org](http://www.earthtosky.org). (You'll need to register - for free - on the site to access all the many references - click on Professional Development and look for "ETS @ AK 2015.")

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### Pikas In Peril - Update

Scientists from the National Park Service (NPS) and three western universities predict a complex future for populations of the diminutive and charismatic pika. The hamster-sized member of the rabbit family lives in rocky, icy patches in the western United States.

Funded principally by the NPS Climate Change Response Program, researchers from the NPS, Oregon State University, University of Colorado-Boulder and University of Idaho completed a five-year study on pika population vulnerability to climate change in eight national parks. The predictions through the end of this century vary by park because of local conditions such as elevation, weather patterns, and genetic diversity.

For example, in cold and wet Grand Teton National Park in Wyoming, scientists expect pika populations to survive. However, the researchers predict local extinctions of the species by the year 2100 in other parks, including Rocky Mountain National Park in Colorado. Study findings will help guide park strategies to mitigate the effects of climate change.

The elusive pika is an important indicator of the overall health of mountain ecosystems. As climate changes, higher areas in some parks may warm to the point that pika populations can no longer survive in them.

The paper, Habitat Availability and Gene Flow Influence Diverging Local Population Trajectories Under Scenarios of Climate Change: A Place-Based Approach, is available [online](#).

More detailed results for each park, including a full reprint of the paper, is available on the [Pikas in Peril website](#). For more information about this and other studies being conducted by the NPS Inventory and Monitoring Program, Contact Tom Rodhouse, [tom\\_rodhouse@nps.gov](mailto:tom_rodhouse@nps.gov).





## Climate Change Response Program

Natural Resource Stewardship and Science

This quarterly newsletter celebrates the latest initiatives and accomplishments by National Park Service sites and programs in response to climate change.

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## Climate Fundamentals Academy Workshops

The *Climate Fundamentals Academy* is a 3-part series of 2-day training workshops hosted by the Association of Climate Change Officers (ACCO). The Academy provides participants with a foundation for understanding greenhouse gas emissions and related reporting and disclosure frameworks, strategies for engaging stakeholders and leading organizational change, assessing the legal and policy landscape, and examining the economic implications of climate change.

Regional offerings of the Climate Fundamentals Academy are scheduled for Boston, Fort Lauderdale, San Diego, San Francisco, and Washington DC during spring and summer of 2016.

Under an agreement with the ACCO, NPS employees are welcome to participate for free in upcoming 2016 offerings.

Interested participants must first register through *DOI Learn* for scheduled workshops. All available workshops can be found by searching the course catalog for "Climate Fundamentals Academy".

Though tuition is free, travel to and from the training location is to be paid by the benefitting account.

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## New Online Introduction to Climate Change Class

A new online class focusing on the effects of climate change in national parks is available in *DOI Learn*. The free course was developed by the Natural Resource Stewardship Training Program at the Stephen T. Mather Training Center and subject matter experts from the Climate Change Response Program.

*Introduction to Climate Change in National Parks* provides foundational knowledge about the science of climate change; introduces the policies, programs and partnerships that guide and support NPS climate change response and science; and explores case studies highlighting ways that the changing climate is impacting park resources. The course also introduces the principles park managers use to assess, adapt to, and plan for changing conditions. It provides learners with sources for more in-depth information, expertise, and assistance in dealing with specific problems.

The course is part of the Career Academy for Natural Resources' Foundational Module

Orientation and Development: Natural Resources and Science. It is designed for natural resource employees at the entry/developmental level, and for employees at all levels in any career field who would like to learn more about climate change and natural resources.

*Introduction to Climate Change in National Parks* is the second of a planned series of on-line learning opportunities designed to provide NPS employees with an introduction to specific natural resources and natural resource issues. The first course in the series, *Air Resources in National Parks*, launched last spring.

For more information about these classes, and about the Career Academy for Natural Resources, go to the Natural Resource Stewardship Training website: <http://www.nps.gov/training/nrs/> or contact Jeri Hall, Training Manager for Natural Resources; [jeri\\_hall@nps.gov](mailto:jeri_hall@nps.gov).

## Monthly Webinar Series

Join CCRP for presentations by leading climate change scientists and communicators on the second Tuesday of every month from 2:00 to 3:30 PM EST.

**April 14** | No-analog Climates and Communities: Mapping, Metrics, and Modeling. Jack Williams, Professor of Geography, Director of Nelson Center for Climatic Research, University of Wisconsin-Madison.

[Register for the webinar here](#)

**May 12** | Historical and Projected Climate Change Trends in the 408 US National Parks; featuring Patrick Gonzalez, Principal Climate Change Scientist, National Park Service.

[Register for the webinar here](#)

