

# **PROCEEDINGS OF THE ACADIA NATIONAL PARK SCIENCE SYMPOSIUM**

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# Summary

The 2015 Acadia National Park Science Symposium, held at the Schoodic Education and Research Center (SERC), brought together over 100 researchers, students, and park staff to discuss science taking place in and beyond park boundaries, and will highlight science to plan for the future, the theme of this year's meeting. The symposium featured four invited speakers and 43 posters describing results and plans for research in a range of disciplines, including natural sciences, social sciences, and humanities.

The speakers at the event were:

Beck Cole-Will - Overview and Wild Acadia and Science for Acadia - National Park Service, Acadia National Park

Nick Fisichelli - Climate, trees, birds, and visitors: Understanding and preparing for potential changes in national parks - National Park Service, Climate Change Response Program

Bill Labich - What should regional conservation partnerships (RCPs) be doing about climate change? - Regional conservationist, Highstead

Speed presentations:

Jane Disney - Frenchman Bay Partners

Anica Miller-Rushing - Down East Research and Education Network

Christine Tillburg - Ecosystem Indicators Partnership

Abe miller-Rushing - Citizen Science Association

Sandra De Urioste-Stone - Nature-based tourism and climate change risk: Assessing visitor perceptions at Acadia National Park, Maine - Assistant professor, University of Maine

For more information on Schoodic Institute and research in Acadia National Park and surrounding areas, please see:

<http://www.schoodicinstitute.org/>

Emma Albee, Science Information and Communications Manager, Schoodic Institute

Abraham Miller-Rushing, Science Coordinator, Acadia National Park

# Speaker Abstracts

## Overview and Wild Acadia and Science for Acadia

Rebecca Cole-Will

National Park Service, Acadia National Park

We are facing many challenges to preserve natural resources in Acadia National Park. Climate change, invasive species, pollution, and many other threats are changing the environment in unprecedented ways. And so we must adjust our approach to resource management. At Acadia, we are adjusting to take a more proactive and systematic approach, setting measurable goals and aligning science and management activities to improve ecological integrity, historical authenticity, and resilience of the park's natural and cultural resources.

# **Climate, trees, birds, and visitors: understanding and preparing for potential changes in national parks**

Nicholas Fisichelli

National Park Service, Climate Change Response Program

Climate change adaptation is an iterative process of knowledge co-production and application. Crucial steps in adaptation include understanding the range of plausible future changes and using this information to develop achievable goals and appropriate adaptation responses. In this presentation, I will highlight ongoing and potential changes in climate, forests, bird assemblages, and visitor use across the national park system and at Acadia National Park and briefly show how this type of information is being used to plan for and manage change.

# **What should regional conservation partnerships (RCPs) be doing about climate change?**

William G. Labich

Regional Conservationist, Highstead

Forty-three Regional Conservation Partnerships (RCPs), covering 60% of New England, are advancing the pace and practice of large landscape conservation through coordination, strategic planning, engaging stakeholders, and raising funds and conserving land together. Hosted by Highstead Foundation, the RCP Network provides networking, information on best practices, and targeted technical and financial assistance. The RCP Network partners with groups like the North Atlantic Landscape Conservation Cooperative and Open Space Institute to provide RCPs with hands-on training in how to access and use science-based datasets to consider impacts of climate and land-use change. Is this what we should be doing?

# **Nature-based tourism and climate change risk: Assessing visitor perceptions at Acadia National Park, Maine**

Sandra De Urioste-Stone

Assistant Professor, University of Maine

Climate change poses many risks and opportunities for nature-based tourism. Understanding visitor perceptions of climate change risk and potential impacts on travel is an essential element to develop sound destination adaptation strategies. I will share results from visitor surveys at Acadia National Park (2014-2015) that measured perceptions of climate change impacts.

# Poster Abstracts

## Dark citizen science: Reviving old, lost, and overlooked citizen science records

Emma Albee<sup>1</sup>, Seth Benz<sup>1</sup>, Mark Berry<sup>1</sup>, Rebecca Cole-Will<sup>2</sup>, Caitlin McDonough MacKenzie<sup>3</sup>, Abe Miller-Rushing<sup>2</sup>, Glen Mittelhauser<sup>4</sup>, Hannah Webber<sup>1</sup>

1 Schoodic Institute at Acadia National Park, Winter Harbor, Maine

2 National Park Service, Acadia National Park, Bar Harbor, Maine

3 Boston University

4 Maine Natural History Observatory

For years humans have made valuable observations about the world around them. Records of these observations, what we call “dark citizen science”, are often overlooked, but are invaluable resources in the study of how species, landscapes, and environmental conditions have changed over the past century or more.

Acadia’s museum collection contains over one million items, including plant and animal specimens, photographs, reports, field notebooks, and maps. Libraries, historical societies, and colleges in the surrounding communities contain millions more. We have begun an ambitious project to digitize these specimens and records and make them freely available in an online database. To do so we are engaging volunteers to pull key data — species occurrences, abundance, and phenology — transcribing information into databases. One of the first projects has shown that the park lost nearly 20% of its flora over the past 100 years. We are working with researchers to use historical records and new field observations to understand why losses occurred and to identify species that are likely vulnerable to future environmental changes. Dark citizen science records provide critical data to protect our environment and also provide compelling personal stories that can engage the public in science and conservation.

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## How to submit an application for a Research Permit in Acadia

Emma Albee<sup>1</sup> and Abe Miller-Rushing<sup>2</sup>

1 Schoodic Institute at Acadia National Park, Winter Harbor, Maine

2 National Park Service, Acadia National Park, Bar Harbor, Maine

## **Increasing the accessibility of research conducted in Acadia through digitization**

Emma Albee<sup>1</sup>, Abe Miller-Rushing<sup>2</sup>, Marie Yarborough<sup>2</sup>, Rebecca Cole-Will<sup>2</sup>, and Katherine Pontbriand<sup>2</sup>

1 Schoodic Institute at Acadia National Park, Winter Harbor, Maine

2 National Park Service, Acadia National Park, Bar Harbor, Maine

For the past few summers, Acadia National Park has been working to digitize their bibliography of all research that has been done in the park. These documents include journal articles, letters, and park reports about research that was conducted in and around Acadia National Park since the park was formed. Information, such as title and author, and a digital copy of the documents were then uploaded to a database called the Integrated Resource Management Application, or IRMA ([irma.nps.gov](http://irma.nps.gov)), so they could be accessed by scientists in the future.

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## **Enhancing synergy across citizen science projects to engage diverse audiences and address grand science challenges at a single location: Acadia National Park**

Seth Benz<sup>1</sup>, Emma Albee<sup>1</sup>, Mark Berry<sup>1</sup>, Abe Miller-Rushing<sup>2</sup>, Rebecca Cole-Will<sup>2</sup>, Hannah Webber<sup>1</sup>, Bill Zoellick<sup>1</sup>

1 Schoodic Institute at Acadia National Park, Winter Harbor, Maine

2 National Park Service, Acadia National Park, Bar Harbor, Maine

The scientific and educational benefits of citizen science projects are often limited because they attract relatively narrow audiences or are narrowly focused. For example, a project might engage a small set of people very deeply in many aspects of an ecological restoration experiment or another project. Participants might be limited to those people who have a lot of time and energy to invest. Alternatively, a project might engage a large number of people collecting certain types of narrowly-defined observations, such as wildlife sightings or water samples. These relatively narrowly focused projects can limit the educational and experiential opportunities for volunteers, or the amount and type of data or other scientific outputs generated! At the Schoodic Institute and in Acadia National Park, we are integrating a number

of related citizen science projects that engage different audiences—e.g., one-day visitors, year-round volunteers, and week-long intensive volunteer experiences. The projects are intertwined and synergistic, and are all aimed at helping the park understand and respond to rapid environmental changes. This diversity of citizen science volunteer opportunities provides many points of entry for new volunteers, options for volunteers to apply skills learned in one project to a related but different project, and opportunities to learn new topics and skills. The diversity of projects also provides concrete scientific, education, and management benefits to the national park. Here we describe the rationale and initial lessons learned as we begin undertaking this strategy!

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## **Update on the revision the bedrock and surficial deposit maps of MDI**

Duane Braun

Maine Geologic Survey, Mapping volunteer, Mount Desert, Maine

From 2012 through 2014 field mapping of MDI was done. In 2015 map production is underway with both the bedrock map and the surficial deposit map planned to be completed in 2016. Tentatively each MDI map will be produced at 1:30,000 scale from the nine 1:24,000 scale maps that were used in the actual field mapping. All maps will be available as free downloads in PDF or ArcGIS format on the Maine Geologic Survey website. Presently the surficial deposit map is essentially complete and is undergoing final editing, a copy of which will be shown at the symposium. The surficial deposit map has about four times the detail as compared to the existing map. The bedrock map is about one-half complete with the remainder to be drawn up this fall. The portion of the bedrock map completed will also be shown at the symposium. The recent field mapping has led to significant changes in rock unit patterns in the southwestern and western parts of MDI. The geologic history sequence of events has also been changed somewhat with the recognition of two shatter zones adjacent to each other in the southwestern part of MDI.

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## **Species composition and diversity of maritime ledge ecosystems**

Amanda Butak<sup>1</sup>, Michael Day<sup>1</sup>, Kathryn Miller<sup>2</sup> and Abe Miller-Rushing<sup>2</sup>

<sup>1</sup> School of Forest Resources, University of Maine, Orono, Maine

Ledge and rocky outcrops are common geomorphologic features along the eastern coastline of the Gulf of Maine. Plant communities consisting of pines, spruce and ericaceous shrubs typically dominate these localities. However, coastal currents that regulate local climates create a sharp distinction between communities lying to the east of Frenchman's Bay and those from Mount Desert Island Westward. These maritime climates provide for contrasting vegetation assemblages dominated by two pine species. Pitch pine (*Pinus rigida*) is the dominant tree in ecosystems at more southwestern sites and jack pine (*Pinus banksiana*) at more eastern localities. Within each ecosystem two co-occurring vegetation communities are present, one developing under the direct influence of pines and the other lacking pines. Pines appear to have keystone roles, meaning they are necessary for the survival of their associated vegetation. Our continuing study is focused on species composition and diversity differences between ecosystems and community-types (pine-dominated and non-pine), and how the role of temperature and atmospheric humidity (vapor pressure deficit) affect species distributional patterns. The ability for plants to be successful in these high-stress coastal environments is related to strategies to avoid or compensate for moisture stress, with response to vapor pressure deficit being a major factor. We have found that individual species differ in their ability to respond to vapor pressure deficit, which correlates with species distributional patterns. Higher trends in species richness and diversity were found in Schoodic (jack pine ecosystem), which tends to experience lower temperatures and increased atmospheric humidity than Wonderland (pitch pine). This results in lower transpirational demand for plant species in Schoodic, making it a more suitable environment for species that lack the ability to respond to high moisture-stress environments. Higher temperatures and moisture-stress in Wonderland result in higher dominance and more stress-adapted plants, which contributes to the lower richness and diversity. Pines appear to play powerful roles in these ecosystems, as both ecosystem engineers and keystone species. Pines provide a more suitable microclimate for plant communities by decreasing high-light and temperature extremes and increasing atmospheric humidity beneath the canopy. In addition, pines qualify as keystone species as their ecophysiological characteristics make them adapted to establish plant communities in environments prohibitive to other tree species. We have found that plants growing in pine-dominated community-types experience less seasonal water stress ( $\delta^{13}C$ ) and exhibit greater productivity compared to their non-pine counterparts. Pine-dominated communities also have greater soil depths, contributing to a higher availability of water and nutrients for understory plants. Significantly higher concentrations of nutrients associated with marine aerosols were found in plants associated with pines, suggesting that pines may efficiently capture fog and marine aerosols, providing additional water and nutrients to surrounding plant communities. In addition, pines have significantly higher concentrations of elements that correlate with bedrock weathering, suggesting pines tap a deep source of water. Understanding the physiological differences between species and how this relates to species distributional patterns can be valuable for resource managers to protect the pines and special species within these communities in a warming climate.

# **Charting the second century of resource stewardship at Acadia National Park**

Judith H. Connery<sup>1</sup>, Rebecca Cole-Will<sup>1</sup>, Brian Henkel<sup>2</sup>, Abraham Miller-Rushing<sup>1</sup>, Cristy Garris<sup>3</sup>, and Caroline Stem<sup>3</sup>

1 National Park Service, Acadia National Park, Bar Harbor, Maine

2 Friends of Acadia, Bar Harbor, Maine

3 Foundations of Success, Bethesda, Maryland

As Acadia National Park prepares to enter its second century, park resource staff and partners are working together on an adaptive management plan to identify key targets for conservation, the most important threats and their drivers, develop a vision of desired future conditions, and chart strategies and actions for conservation. In this planning process we are identifying critical research needs, developing action plans, and considering needed monitoring for tracking measurable components of resource condition to determine the effectiveness of our actions so that we can adapt our plan as needed. Our goal is to develop a challenging but realistic stewardship plan for the next decade so that, with partners, neighbors, and visitors we can preserve the park's continuously changing ecological integrity, cultural history, scientific values, and scenic beauty, while offering visitors a broad range of transformative experiences, and participating in regional and national conservation efforts.

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## **Approaches for improving efficacy and participant engagement in citizen science initiatives**

Jane Disney, PhD and Duncan Bailey

MDI Biological Laboratory, Bar Harbor, Maine

Citizen science initiatives often encounter a number of "pain points" which can limit project success, such as issues with project discoverability, data management, and ongoing participant engagement. Drawing inspiration from techniques used by social media platforms to maintain user engagement, we have developed new tools for our online citizen science platform, Anecdota.org, that can help projects avoid these issues. By giving project managers a unified venue for engaging, re-engaging, and collecting data from the public, and by presenting data in an easily-searchable online context that encourages data exploration and analysis and helps identify new research questions, we believe we can not only help existing projects collect more

data but also inspire more members of the public to start their own citizen science projects.

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## **Frenchman Bay Partners: Working toward a healthy and sustainable future for Frenchman Bay**

Jane E. Disney<sup>1</sup>, Anna Farrell<sup>1</sup>, Bridie McGreavy<sup>2</sup>, Chris Petersen<sup>3</sup>, Bob de Forrest<sup>4</sup>, Fiona de Koning<sup>5</sup>

1 MDI Biological Laboratory

2 Mitchell Center for Sustainability Solutions University of Maine

3 College of the Atlantic

4 Maine Coast Heritage Trust

5 Acadia Aqua Farms

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## **An examination of potential predation threats to the Common Eider (*Somateria mollissima*) at a mixed offshore seabird colony**

Nina A. Duggan

College of the Atlantic, Bar Harbor, Maine

Populations of Common Eiders (*Somateria mollissima*) are believed to be currently in decline in Maine, although the causes for these changes are not clear. Some studies in literature have suggested that predation by gulls may play a major role in chick mortality, while others indicate that gulls may actually ward off predators. The role of human disturbance in estimates of predation is always difficult to observe. In this study, potential threats to *S. mollissima* during their breeding season were observed. Observations of *S. mollissima* chicks were recorded at varying times of day, tide levels, tidal pool conditions, weather conditions, and stages of growth of the chicks. No examples of predation from the nesting gull species (*Larus marinus*, *L. smithsonianus*) were observed. It was found that there are multiple potential threats to *S. mollissima*, Maine's only hunted sea duck, in the form of Bald Eagle (*Haliaeetus leucocephalus*), Atlantic Harbor Seal (*Phoca vitulina vitulina*), Grey Seal (*Halichoerus grypus*), and human disturbance.

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## **Whenology: Science of the seasons**

Richard Feldman<sup>1</sup>, Alyssa Caddle<sup>2</sup>, John Cardente<sup>2</sup>, Mark Chandler<sup>3</sup>, Abe Miller-Rushing<sup>1,4</sup>

1 Schoodic Institute at Acadia National Park, Winter Harbor, Maine

2 EMC Corporation, Hopkinton, MA

3 Earthwatch Institute, Boston, MA

4 National Park Service, Acadia National Park, Bar Harbor, Maine

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## **Compliance surveys for *Myotis septentrionalis* increases opportunity for long term bat monitoring at Acadia National Park**

Christopher Heilakka<sup>1</sup>, Bruce Connery<sup>1</sup>, Bik Wheeler<sup>1</sup>, and Erickson Smith<sup>1</sup>

1 National Park Service, Acadia National Park

The recent listing of the northern long-eared bat, *Myotis septentrionalis*, requires Acadia National Park to assess how our cyclical trail and facility maintenance could be affecting the habitat and the incidental taking of this listed species. Ultrasound Detectors were placed at three long-term monitoring sites throughout the summer to assess when bat species were beginning to emerge and arrive on Mount Desert Island. A series of ultrasound detectors were then used during the maternity period to chart presence and absence of species at specific locations. Before trail work, building, and road maintenance projects this summer, wildlife technicians screened project sites using visual and ultrasonic acoustic data to ensure the absence of bats before work started, or consult with project managers if bats were present. From this data the park hopes to create a better understanding of how bats are using the landscape of Acadia National Park and how we can mitigate any negative effects on this listed species.

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## **Carbon stocks in eelgrass areas around Mt. Desert Island: Implications for eelgrass protection in Maine**

Megan L. Hooper<sup>1</sup>, Ming Feng E. Schnorr<sup>1</sup>, Beverly Johnson<sup>2</sup>, Jane E. Disney<sup>3</sup>

1 University of Maine, Orono, Maine

2 Bates College, Lewiston, ME 04240

3 MDI Biological Laboratory Salisbury Cove, ME 04672

*Zostera marina*, which is commonly known as eelgrass, is an important part of marine ecosystems around the world. This plant is able to store carbon in a process known as carbon sequestration, resulting in the removal of carbon from the atmosphere and storage of it in sediments. This plant has experienced a significant worldwide decline, including the area around Mt. Desert Island, ME. We have determined the percent total carbon and dry bulk density in the above ground biomass, below ground biomass, and sediments in five remaining eelgrass areas. This involved sampling shoots, rhizomes, and ocean sediment with a coring device at each sample site. In addition we mapped the extent of the eelgrass beds in these areas. We calculated the total carbon stock with these data, comparing sites with and without recent declines. With this information, we are able to build a compelling case for protecting eelgrass in Maine.

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## **HISTORY: Are we owners or stewards?**

Bill Horner, MD

Founder, Friends of Island History President, Mount Desert Island Historical Society

Next year marks the centennials of Acadia National Park and the National Park System. We will celebrate a century of land stewardship from both national and regional perspectives. What will be our legacy one hundred years from now? We can ask the same question of history. Will we as public historians be as successful in historic stewardship as have been our land-oriented colleagues? Would a History Trust, embodying many of the principles of land preservation trusts, provide an effective means of unifying the highly varied history resource holder landscape into a collaborative and mutually beneficial whole? How would the public benefit?

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## **Visitor-created trails in Acadia National Park**

Charles Jacobi<sup>1</sup>, Abigail Seymour<sup>2</sup>, Karen Anderson<sup>1</sup>

1 National Park Service, Acadia National Park, Bar Harbor, Maine

2 Friends of Acadia

With 2.5 million visits annually Acadia National Park is one of the most intensively used national

parks. Visitor-created trails are emblematic of the human urge to explore and discover, in this case, within Acadia National Park. Wherever visitors concentrate in large numbers (Cadillac Mountain) and sometimes small numbers (Little Moose Island) vegetation is eventually lost as visitors follow the same path of least resistance in the landscape and a primitive trail is created. Soil erosion often follows. We mapped many of these trails to illustrate their extent throughout the park. We then collaborated with the park trail crew and other staff to manage them with the goal of protecting resources and reducing their "footprint," closing some while still allowing access along other designated routes that are then informally maintained.

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## **Response of deciduous trees spring phenology to recent and projected climate change in central Lithuania**

Romualdas Juknys, Arvydas Kanapickas, Irma Šveikauskait, Gintar Sujetovien

Vytautas Magnus University, Lithuania

The most noticeable warming in the investigated area is characteristic of winter and early spring. The changes in monthly precipitation are less expressed and the decrease in the amount of precipitation is a specific feature of almost the entire vegetation period. In our geographical location the increase in available chilling with the annual rate of 3.6 hours is specific of the last 90 years, indicating that the nearest decades do not pose any threat of shortage of chilling in our geographical location. The timing of leaf unfolding for all the investigated species is the most responsive to temperatures in March and April, i.e. the months which are warming the most. According to the 'optimistic' (RCP 2.6) scenario, and the 'pessimistic' (RCP 8.5) one, the mean annual temperature is projected to increase by 1.29°C and 3.98°C respectively to the end of this century. Species specific advancement in leaf unfolding is expected in the future. According to RCP 8.5 scenario for the far future (2071-2100), an almost two-week (13.8 days) advancement in leaf unfolding is projected for early season birch species. A less expressed advancement is projected for late season species – 9.7 days for maple, 8.8 days for lime and 8.7 days for oak. According to RCP 2.6 scenario, the advancement in leaf unfolding falls in the range from 7 days for birch to 4.9 days for oak as the least responsive species.

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## **Avian spatial trends and habitat selection on Mount Desert Island and Acadia National Park**

Emily Kaplan<sup>1</sup> and Michael J. Good, MS<sup>2</sup>

1 College of the Atlantic, Bar Harbor, Maine

2 Down East Nature Tours, Bar Harbor, Maine

Avian spatial trends and habitat selection on Mount Desert Island and Acadia National Park are analyzed using geographic information system (GIS) allowing us to visualize, question, analyze, and interpret phonological data to understand relationships, patterns, and current trends using eBird data.

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## **Use of game cameras in monitoring Leach's Storm Petrel**

Rachel Karesh

Island Research Center College of the Atlantic 105 Eden St Bar Harbor ME 04609

Leach's Storm Petrel (*Oceanodroma leucorhoa*) is a common but elusive seabird that nests on islands in the North Atlantic. Traditional monitoring techniques of nesting populations range from highly invasive nest grubbing, audio playbacks, and opportunistic encounters. I examined the feasibility of using conventional game cameras placed in immediate proximity to nesting burrows as a less invasive technique for determining burrow occupancy and associated behaviors. Camera placement proved crucial, as units placed too close to the nest produced poor quality pictures in which the flash unit washed out details of the image. Cameras placed too far from the nest either failed to capture a flying bird or prevented association of particular birds to their nesting burrow. Burrow occupancy and nesting was confirmed using conventional methodologies, with the cameras providing good information about patterns of nest entry and nest departure. I examined the relationship between arrival and departure times to weather factors including cloud cover, rain, and phase of moon. I believe this method is a useful addition to our overall techniques for monitoring burrow nesting seabirds.

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## **Capacity for recovery from defoliation in spruce-fir forests and the influence of commercial thinning**

CJ Langley and Michael E. Day

University of Maine, Orono, Maine

A tree's capacity for recovery after a defoliation event is linked to the pool of non-structural carbohydrates (NSC) available to stimulate growth of latent buds to recover leaf area. Three

locations were established throughout Maine in order to test and compare the NSC concentration of spruce and fir from thinned and unthinned stands. In order to determine how the whole tree responds to the treatment and allocation of storage reserves, samples were collected from four organ systems. Spruce and fir were found to differ in their concentration of available NSC, with fir having greater available reserves. Additionally, it was found that spruce stores a higher portion of NSC within the roots where fir stores them within large branches, closer to the site of production. Both species had lower NSC available in the large branches following the thinning treatment.

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## **Habitat quality and distributional changes of the Guillemot (*Cephus grylle*) in response to Gull movements**

Meaghan S. Lyon

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I examined the natural history and breeding biology of the Black Guillemot (*Cephus grylle*) on Great Duck Island, Hancock Co. Maine. Approximately 400 pairs of Black Guillemots nest along the rocky berm in significantly clumped distributions, many in close proximity to Herring gulls and Great Black-backed Gulls. Nest sites have been mapped periodically since 1999 and entered into a GIS. I analyzed changes in distributions of nesting sites and habitat usage over the past 15 years using these GIS data, placing particular emphasis on areas that also showed shifts in nesting gull populations. I monitored nest sites for hatching, chick provisioning, and adult nest attendance. I recorded feeding rates and interspecies interactions including incidences of klepto-parasitism by gulls. Guillemot numbers declined in areas exhibiting the greatest increase in nesting gulls, and appear to have increased in areas with a declining gull population, however gulls and guillemots continue to overlap in nesting habitat along much of the island's shoreline. Further analysis of Black Guillemot breeding biology and behaviors are important in determining appropriate strategies for management and conservation of the species.

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## **Breeding by the sea: Coastal bluff vernal pools as breeding habitat for Spotted Salamanders (*Ambystoma maculatum*)**

Matthew Messina and Stephen Ressel

College of the Atlantic, Bar Harbor, Maine

Woodland vernal pools are important breeding habitat for Spotted Salamanders (*Ambystoma maculatum*) throughout their range. In Acadia National Park, Maine, USA, a population of *A. maculatum* breeds in pools which form in granitic depressions located on coastal bluffs located approximately 46 meters from the high tide zone. Use of these pools by *A. maculatum* piqued our curiosity because, while fed by groundwater from surrounding woodlands, salinity levels may be elevated due to salt spray. In April 2015, we collected preliminary baseline data on: 1) size of breeding population, 2) salinity levels of pools containing breeding adults and egg masses. We visited pools on alternate nights from the onset of spring migration until breeding ceased (20 days). A maximum of 129 adults were observed in eight different pools four days after observations began. Seven of these pools subsequently contained egg masses. Salinity levels varied from 0.1 ppt to 30 ppt among pools. In high saline pools, salamanders were either dead, in apparent osmotic distress (thrashing), or confined to surface water layers with salinities of 0.3-3.5 ppt. Egg masses are being monitored to assess hatching success among pools with different salinities.

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## **Using the Forest Service Climate Change Tree Atlas and National Land Cover Data to predict changes in forest composition in Acadia National Park**

Miller, Kathryn M.<sup>1,2</sup>, Brian R. Mitchell<sup>3</sup>, and Brian J. McGill<sup>2</sup>

1 National Park Service – Northeast Temperate Network, Bar Harbor, ME

2 University of Maine School of Biology and Ecology, Orono, ME

3 National Park Service – Southeast Region Inventory and Monitoring, Atlanta, GA

**Background and Methods** Forests are a critical resource in Acadia National Park (ACAD), and their long-term health is of great concern to park managers and the public. Knowing how forest composition is expected to change with climate change is essential for making informed decisions. Using the US Forest Service's Climate Change Tree Atlas species maps that were summarized for eastern national parks by the NPS Climate Change Adaptation Program, we compared predicted changes in species importance values with current tree species abundances in ACAD. For new species predicted to gain suitable habitat in parks, we simulated dispersal over 100 years using a species' current modeled importance values and predicted suitable habitat, along with species-specific dispersal rates and life history characteristics to simulate realistic dispersal from the northern edge of a species' range. Lands classified as non-forest in the 2011 National Land Cover Database were treated as a barrier in the dispersal simulation. Results Many of the most abundant tree species currently in ACAD are expected to experience a large decrease or complete loss in suitable habitat in ACAD by 2100 under the

high emissions scenario. Dispersal of new species that are predicted to gain suitable habitat in ACAD will be severely dispersal-limited due to habitat fragmentation and life history constraints. A number of diffusely present species, which are species that are present in the same county as a park, are predicted to keep or gain suitable habitat by 2100. Diffusely present species, such as black oak (*Quercus velutina*) and white oak (*Quercus alba*), that predicted to keep or gain suitable habitat may be important for restoration or planting efforts in ACAD to increase the chances of forests to persist and/or adapt to climate change.

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## **Documenting disturbance pressures on the Thrumcap Double-Crested Cormorant nesting colony using remote cameras for a second field season**

Kevin Miller, Erickson Smith, Bik Wheeler, Chris Heilakka, Bruce Connery

National Park Service, Acadia National Park, Bar Harbor, ME, 04609

From 1972-1989, a successful breeding colony of at least 200 nesting pairs of double-crested cormorants (*Phalacrocorax auritus*) were regularly documented on The Thrumcap in Frenchman Bay, Maine. Three consecutive years, 2011-2013, the colony failed to rear a single chick despite pairs remaining on territory throughout the nesting season. Acadia National Park, which manages The Thrumcap, hypothesized that disturbance from other species may have led to the reproductive failure of the colony. In 2013 the wildlife division of the park deployed 3 remotely triggered game cameras on the island to monitor animal activity on the island. Based on the recommendations of that study, more cameras (6) were deployed in May of 2015 to double the effort and increase the camera coverage of the island in an attempt to document disturbances to the colony. The cameras took 1 photo every half hour between May 18th and August 31st, 2015, resulting in 40,153 photos. This year, chicks were successfully reared on the island, for the first time since 2010. Based on the photographic evidence gathered during the 2015 field season, we identified and characterized potential disturbance to the colony and made recommendations for future work to further refine the monitoring methods.

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## **Connecting citizen science with natural resource management: A case study in Acadia National Park, Maine**

Abe Miller-Rushing<sup>1</sup>, Emma Albee<sup>2</sup>, Christie Anastasia<sup>1</sup>, Seth Benz<sup>2</sup>, Mark Berry<sup>2</sup>, Rebecca Cole-Will<sup>1</sup>, Hannah Webber<sup>2</sup>

1 National Park Service, Acadia National Park, Bar Harbor, Maine

2 Schoodic Institute at Acadia National Park, Winter Harbor, Maine

Connecting citizen science with the management of protected areas and natural resources can be difficult. Even without the management component, citizen science is a difficult, interdisciplinary endeavor if done well. Connecting science—whether conventional or citizen science—with management action is also difficult all on its own. Management agencies and conservation organizations have long struggled with this problem. In this poster we describe our work to connect citizen science with natural resource management in Acadia National Park in Maine. The park is revisioning its approach to resource management to be more deliberate, holistic, and adaptive, and to focus on restoring natural resilience to rapid environmental changes. In this revisioned approach, citizen science can help meet key monitoring, management, and education objectives.

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## **The Citizen Science Association: A new organization to support citizen science researchers, educators, and practitioners**

Greg Newman<sup>1</sup>, Mary Ford<sup>2</sup>, Kris Stepenuck<sup>3</sup>, Rick Bonney<sup>4</sup>, Darlene Cavalier<sup>5</sup>, Nolan Doesken<sup>1</sup>, Muki Haklay<sup>6</sup>, Eric Jolly<sup>7</sup>, Rebecca Jordan<sup>8</sup>, Martin Storksdieck<sup>10</sup>, Jennifer Shirk<sup>4</sup>, Abe Miller-Rushing<sup>11</sup>, and Mark Berry<sup>12</sup>

1 Colorado State University, Fort Collins, Colorado

2 National Geographic, Washington, DC

3 University of Vermont, Burlington, Vermont

4 Cornell Lab of Ornithology, Ithaca, New York

5 Arizona State University, Tempe, Arizona

6 University College London, London, United Kingdom

8 Rutgers University, New Brunswick, New Jersey

9 American Geophysical Union, Boulder, Colorado

10 Oregon State University, Corvallis, Oregon

11 National Park Service, Acadia National Park, Bar Harbor, Maine

12 Schoodic Institute at Acadia National Park, Winter Harbor, Maine

The mission of the Citizen Science Association is to advance citizen science through communication, coordination, and education. The vision is a world where people understand, value, and participate in science. The goals are to establish a global community of practice for citizen science, advance the field of citizen science through innovation and collaboration, promote the value and impact of citizen science, provide access to tools and resources that

further best practice, support communication and professional development services, and to foster diversity and inclusion within the field.

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## **Down East Research and Education Network**

Anica Miller Rushing, MEd.

DEREN Coordinator

The mission of the Down East Research and Education Network (DEREN) is to provide research collaboration and networking opportunities among researchers, educators, landowners, municipalities, conservation organizations, managers, and academic institutions in Hancock and Washington Counties, Maine. The goal of the network is to enhance local scientific and cultural knowledge, land and resource conservation and management, youth participation, and the local economy and governance in the two-county region.

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## **Herring Gull (*Larus smithsonianus*) and Greater Black Backed Gull (*Larus marinus*) chick growth on Great Duck Island, Frenchboro, Maine**

Audra Novine McTague

Island Research Center College of the Atlantic 105 Eden St. Bar Harbor Maine

In contrast to the current trend of the species in the western Atlantic including the Gulf of Maine, the populations of Herring gulls (*Larus smithsonianus*) and Great black backed gulls (*Larus marinus*) on Great Duck Island immediately south of Acadia National Park, have gradually increased. As part of an on-going seventeen year study of gull breeding biology on the island, data were collected on chick growth in both species throughout the station's field season (June to August). The data collected included daily information on chick weight and head to bill length. Additional nests were monitored from the lighthouse tower to estimate overall fledging success. We concluded that there was an average fledging success of 1.8 chicks per nest (0.92 S.D.  $N = 10$ ), and that there is a strong positive correlation between age, weight and bill length. This will allow us to determine critical periods of mortality in chicks even when we can only recover a partially decomposed set of remains. Growth patterns within members of this year's population were consistent with that of past years.

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## **The effects of American Mountain Ash (*Sorbus americana*) berries on insect abundance**

Elizabeth A. Orcutt

Phenology is the study of the timing of recurring and seasonal events, biotic and abiotic factors that cause the timing of those events, and the relationship between events of the same or different species (NETN 2015). Project BEST, Birds Eating Stuff, is a second year phenology study on the Schoodic Peninsula in Maine. This study focuses on the phenological stages of nine American Mountain Ash trees (*Sorbus americana*) and how those trees interact with birds and insects. In the 2014 season the nine study trees were laden with berries. In the 2015 season the trees were barren. The focus of this poster is to examine how the presence of berries affects the abundance of insects found on the leaves, fruit and trunks of the trees. It is hypothesized that the presence of berries would attract a higher abundance of insects and absence of berries would attract a lower abundance.

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## **Climatic trends at the Bear Brook Watershed in Maine – Biogeochemistry of the vernal transition**

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The northeastern region of the United States has experienced significant changes in climate over the past 2 decades. In a case study at the Bear Brook Watershed in Maine, we examined the trends in various environmental and climatic conditions focusing on the vernal transition. Of particular interest is the rate of change in the biotic and abiotic ecosystem processes following the loss of the snowpack. Air and soil temperature data collected over a 10 year period (2002-2011) showed a progressive increase in daily temperatures (1.2°C increase in air temperature and 1.5°C increase for soil under hardwood forest, over 10 years). Soils under the hardwood forest type responded more strongly than those under the softwood forest type. We are using this recent pattern of warming to study changes in the biogeochemistry of the watershed during the vernal transition, where insolation results in rapid soil temperature increases following snowmelt. Here we report on a pilot project to (a) evaluate multi-year monitoring data to determine the linkages among forest, soil and stream dynamics, and (b) measure the characteristics of soil extractable NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup> and DOC to the loss of snowpack.

We expect to use the increasing interconnectivity and continuity between the compartments to help us understand the response of the ecosystem as a whole, with a view to understanding and predicting how these responses may change as a function of the changing climate over time.

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## **The influence of abiotic factors on rough periwinkle behavior and dispersal**

Julianne E. Pekny

Schoodic Institute at Acadia National Park, Winter Harbor, Maine

With accelerating global climate change, direct and cascading effects on different ecosystems are becoming clearer. Changes associated with climate have affected a wide range of behaviors in organisms such as reproductive strategy and dispersal. Organisms in the intertidal zone are subjected to changing conditions in both the terrestrial and aquatic zones of their habitat. Here, we investigate the influence of abiotic factors associated with climate change on the behavior of an intertidal invertebrate, the rough periwinkle (*Littorina saxatilis*), on the Schoodic Peninsula. Which factors govern where snails are and what they are doing? This examination uses field observations in conjunction with experimental trials and will provide pilot data as a foundation for a long-term study on the changing phenology and behavior of rough periwinkles in the future.

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## **The potential for spatiotemporal mismatches of the abundance of fruit, insects, and fall migratory birds on the Schoodic Peninsula**

Megan Roselli<sup>1</sup>, Richard Feldman<sup>1,2</sup>

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2 University of Massachusetts Amherst

Climate change alters phenology, the timing of biological events, differently for each species in an ecosystem. As a result, mismatches may form between when a species is most in demand of a resource and the availability of that resource. However, it is not known whether mismatches are occurring between fall migratory birds and their main food resource: fruit and insects. Here, we report on the degree to which the spatiotemporal variation in the abundance of migratory fall birds matches spatiotemporal variation in fruit and insect availability on the Schoodic Peninsula

## **Phenological responses to climate change in Acadia National Park**

Ella Samuel<sup>1</sup>, Caitlin McDonough Mackenzie<sup>2</sup>, Abe Miller-Rushing<sup>3</sup>, Richard Primack<sup>2</sup>

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To take a pulse on the ecological effects of climate change, this research records phenology patterns for thirty-six plant species on the ridges of Cadillac, Pemetic, and Sargent mountains in Acadia National Park. Phenology is a key plant trait included in many climate vulnerability assessments. Warmer spring temperatures tend to lead to earlier leaf-out and flowering events. As a field assistant for Caitlin McDonough Mackenzie, I monitored plant phenology in Acadia from late April through June, building on two years of previous data. Two species of personal interest—*Vaccinium angustifolium* (Lowbush Blueberry) and *Minuartia groenlandica* (Mountain Sandwort)—provide a snapshot into the project proceedings and offer insight into local phenology patterns as they relate to fluctuations in temperature. To understand the effect of changing temperatures on diverse plant communities in Acadia, our data collection will continue and future citizen science opportunities will help build networks of important phenology observations.

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## **The future of destination selection in a changing seasonal climate: Implications for visitation to Acadia National Park and Mount Desert Island, Maine**

Matt D. Scaccia, Sandra De Urioste-Stone, Emily Wilkins

University of Maine

Climate change is expected to have significant implications for Maine's tourism seasons. The state is predicted to have wetter summers, milder winters, and other effects that will influence Maine's outdoor recreation and tourism industry. Given these changes, it is also expected that visitors will modify their travel behavior and adapt to the effects of climate change which may lead to changes in the travel destination selection as well as the recreational activities they

participate in. For this study, visitors to Acadia National Park and Mount Desert Island, ME were asked to participate in brief travel interviews, during their visit, asking if they believe that climate change will affect outdoor recreation and tourism on Mount Desert Island (n=744). These participants were then asked to provide their email address to participate in a second “at home” survey (n=161). The results of this second survey reveal that the majority of visitors feel that climate change will affect outdoor recreation and tourism in the region and that Maine’s climate was an important factor in their choosing to visit the state. It was also found that the majority of visitors believe it is highly likely that the region would see climate change impacts such as sea-level rise, more frequent extreme weather events, wildlife migrations, increased presence of tick and mosquitoes, etc. within the next ten years. They also believe that these (among several other potential impacts) will significantly affect recreation and tourism in the region over the same time period. Finally, the survey showed that if weather conditions became unsuitable for pursuing their preferred recreational activities, a large portion of participants would not continue visiting the region while the majority would select to visit another place either in Maine, the Northeastern U.S., or another place in the U.S. A majority of respondents also reported that they would choose to visit the region during another time of the year and would choose to participate in other recreational activities. This study demonstrates that climate change will very likely have a significant influence on the future visitation patterns at Acadia National Park and Mount Desert Island, ME.

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## **Illegal trails in Acadia National Park, Mount Desert Island, Maine**

Abby Seymour<sup>1</sup>, Charlie Jacobi<sup>2</sup>, Karen Anderson<sup>2</sup>

1 Friends of Acadia, Bar Harbor, Maine

2 National Park Service, Acadia National Park, Bar Harbor, Maine

Acadia National Park offers more than 140 miles of hiking trails to park visitors. Sometimes that is not enough for park neighbors or other trail enthusiasts. Over the past 20 years, park staff have found and mapped most of these illegal trails. Usually they are cut, cairned, flagged, or lined with logs and branches. Occasionally they are even signed. Typically they connect to existing park trails, lakes, streams, or other attraction sites, but some extensive networks have been found completely within park boundaries and are far from any adjacent lands. After mapping, park staff obliterate these routes and talk with private landowners whenever it is appropriate. This poster shows the extent and location of these illegal trails in the park.

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## **Assessing the presence of monarch butterflies and milkweed**

## **habitat in Acadia National Park and on Mount Desert Island, Maine**

Erickson Smith, Bruce Connery

National Park Service, Acadia National Park, Bar Harbor, Maine

Monarch butterflies have experienced a drastic reduction in parts of their population across North America. As part of a national initiative to respond to threats to pollinators, wildlife technicians at Acadia National Park assessed the presence of monarch butterflies within the park and in surrounding communities, which lie in the northeastern part of the monarch's range. The abundance and spatial distribution of habitat was documented: 32+ milkweed stands were located and measured outside park boundaries, while only 13 stands were located within the park. Stands ranged in size from 1 plant to thousands of plants. Surveys were conducted to count eggs, caterpillars, and adults at milkweed stands to begin to accumulate baseline data about the monarch's presence on MDI, as historical data is non-existent. While some have hypothesized habitat loss is the main driver for the monarch's decline, habitat seemed abundant on MDI and in the surrounding mainland communities. Monarchs were observed in all life stages within and outside of the park, though without historical data, it is difficult to assess if their numbers are down.

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## **Signs of the Seasons: A New England phenology program**

Esperanza Stancioff<sup>1,2</sup>, Beth Bisson<sup>2</sup>, and Elissa Koskela<sup>1</sup>

1 University of Maine Cooperative Extension, Orono, Maine

2 Sea Grant, Orono, Maine

Changes in temperature or precipitation can affect the timing of plant and animal life cycle events, such as flowering or animal migration. The study of the timing of these events is known as phenology. Climate scientists from institutions throughout New England are using Signs of the Seasons data to advance research in both terrestrial and marine ecosystems. Collaborating researchers work with Signs of the Seasons staff to engage citizens in making observations of key indicator species associated with their research questions, and help to analyze and communicate the resulting data. As a citizen science program, Signs of the Seasons is a way for anyone, regardless of their science background, to learn more about climate change and make a local contribution to addressing this global challenge.

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# **Invasive Exotic Plant Management, Mount Desert Island, Maine**

Tony Tocci, and Joe Kelley

National Park Service, Acadia National Park, Bar Harbor, Maine

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## **Tools for data literacy: Engaging citizen scientists in analysis of mercury data from national parks across the U.S.**

H. Webber<sup>1</sup>, C. Flanagan Pritz<sup>2</sup>, M. Schauffler<sup>3</sup>, B. Zoellick<sup>1</sup>, S.J. Nelson<sup>4</sup>, C. Eagles-Smith<sup>5</sup>, D. Krabbenhoff<sup>6</sup>

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The educational goals for many citizen science programs include improved science literacy, yet the analysis of scientific data is most often left to professional researchers. Working with data—evaluating the quality of scientific information and the capacity to pose and evaluate arguments based on evidence—is foundational to the process of science and science literacy. The Maine Data Literacy Project was created to help non-scientists—specifically school teachers and students in citizen science-based Scientist-Teacher-Student Partnerships—develop tools and skills to use data they collect to productively answer their own questions. We identified challenges that non-scientists face when working with raw or messy data and developed a framework for teaching data literacy. Over the past year we have expanded our focus on citizen science and data beyond teachers and students to the Dragonfly Mercury project, which is a National Park Service-wide initiative engaging citizen scientists in ~50 national parks in the collection of dragonfly larvae from park waterbodies. The project brings together National Park Service staff, school groups and teachers, and older citizen scientists—many of whom ask for the project data and all of whom can benefit from an opportunity to develop skill in making sense of data they collect. Here we will present a set of data literacy tools developed by the Maine Data Literacy Project for an original audience of teachers and students together with versions of those tools adapted for the more diverse citizen

scientist audience of the Dragonfly Mercury project. The set of three tools deal with key concepts of data sense-making: showing and describing variability; displaying, describing, and interpreting data in the context of a question; and explaining how the interpretation is supported by the evidence.

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## **Rockweed phenology: Establishing an intertidal monitoring program with citizen scientists and re- evaluating a historical model for gamete release**

Hannah Webber<sup>1</sup>, Ariel Powers<sup>1</sup>, Joellyn Colangelo<sup>1</sup>, Elissa Koskela<sup>2</sup>, Esperanza Stancioff<sup>2,3</sup>, Beth Bisson<sup>3</sup>, Sarah Brochu<sup>4</sup> and Jessica Muhlin<sup>4</sup>

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4 Maine Maritime Academy, Castine, Maine

One changing climate metric affecting marine biota is sea surface temperature. Relationships between sea surface temperature and reproductive phenology, or the timing of life cycle events, are known for many species of algae. *Ascophyllum nodosum* is a dioecious, long-lived, foundational species found on sheltered, rocky intertidal shores in the north Atlantic. Release of *Ascophyllum* eggs and sperm begins when sea surface temperatures are 6°C and peaks when water temperatures reach 10°C. Little is known on how increases in sea surface temperature may alter *Ascophyllum* reproductive phenology, or what cascading effects shifts in reproductive timing will have within the nearshore marine environment. Signs of the Seasons (SOS) is a citizen science-driven phenology monitoring program in northern New England (USA) developed by the University of Maine's Cooperative Extension, Maine Sea Grant, and partnering research scientists. The coastal SOS program has developed protocols to monitor *Ascophyllum*, collecting phenological data to document changes in the timing and duration of reproduction accompanied by water temperature and salinity data. We present data from two seasons of *Ascophyllum* phenology monitoring at Schoodic Point, Acadia National Park and at the other locations along the coast of Maine and New Hampshire. In addition, we re-evaluate a model of temperature-mediated gamete release.

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## **Revisiting MacArthur's classic study of niche partitioning of Spruce Wood Warblers**

Bik D. R. Wheeler

Acadia National Park, Bar Harbor, ME College of the Atlantic, Bar Harbor, ME

In 1956 and 1957, Robert H. MacArthur studied the ecology of five species of the genus *Setophaga* (wood warbler), resulting in contributions to the theory of niche partitioning. MacArthur asserted that the five *Setophaga* are sympatric species that evolved to occupy separate behavioral niches. His observations were conducted in Acadia National Park, Maine, USA. In the breeding seasons of 2014 and 2015, I repeated MacArthur's study in the same location, to reassess warbler niche partitioning and observe possible changes over time. To conduct a direct comparison, I have used the same forest structure measurements, and observational methods. In the past 60 years, the forest structure, warbler species assemblage, and taxonomic classification have shifted. Using technological advancements such as video recording of foraging behavior and more precise measurements, I hope to give a more accurate depiction of interspecific comparisons. In addition to a direct comparison with MacArthur's partitioning framework, I will test novel frameworks to determine if other forest structure variables are more explanatory.

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## **Trends in Forest Structure point toward changes in successional stages in Acadia National Park**

Jesse Wheeler<sup>1</sup>, Camilla Seirup<sup>1</sup> and Kate Miller<sup>1</sup>

1 National Park Service, Northeast Temperate Network, Acadia National Park, Bar Harbor, Maine

The Northeast Temperate Network Inventory & Monitoring Program has been monitoring forest health annually in Acadia National Park since 2006. In addition to ecological integrity metrics of forest health, we have analyzed tree growth, mortality and recruitment rates comparing data collected on the same trees during consecutive sampling visits (data from 2006-2010 compared with data from 2010-2014). Changes in these rates can inform park staff about tree health and vitality and can be influenced by a number of factors, such as environmental stressors or forest successional stages. Ecological integrity metrics related to forest structure suggest that forests in Acadia are beginning to reach mature stages, but continue to lack late successional structure such as medium to large snags and late-successional patterns of regeneration. Tree growth, recruitment and mortality rates revealed differences in forest dynamics and successional stages between Acadia's four management units, MDI-East, MDI-West, Schoodic and Isle-au-Haut. MDI-East forests, post 1947 fire, exhibited a transitional stage from early successional tree species to a more mixed spruce-hardwood phase, demonstrated by a significant increase ( $ES = 3.5\%$ ,  $q = 0.06$ ,  $df = 78$ ) in mean live tree density among conifer species. MDI-West and

Isle-au-Haut forests were characterized as spruce-fir forests of mature to late-successional stages. Schoodic forests were described as mature spruce-fir and coniferous woodlands with slow growth rates, due to harsh growing conditions of thin, exposed soils. As long as forest composition metrics remain stable (e.g., no new invasive species, stable tree condition/forest pests, and continued regeneration), late-successional structure is expected to develop over time.

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## **Acid rain related problems are inhibiting salmon recovery in Downeast Maine**

Mark Whiting

Maine DEP

Water quality surveys and an experimental liming project in Downeast Maine show that seasonal pH, calcium and ionic aluminum are at or below threshold levels for salmon survival. Many other aquatic organisms are also impaired. In most streams, even brook trout are at or below survival thresholds. This results in many streams that are fishless, support only brook trout, or have a very limited species diversity.

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## **The effects of changing weather: Impacts on tourism-related spending on Mount Desert Island, Maine**

Emily Wilkins<sup>1</sup>, Dr. Sandra De Urioste-Stone<sup>1</sup>, Dr. Aaron Weiskittel<sup>1</sup>, Lydia Horne<sup>1</sup>, Ashley Cooper<sup>1</sup>, Matt Scaccia<sup>1</sup>, and Dr. Todd Gabe<sup>2</sup>

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Climate change has already altered weather patterns in the northeastern United States, and is expected to continue altering weather conditions. Evidence shows that changing weather has affected the travel and tourism industry, and locations where tourism is predominantly nature-based, such as Mount Desert Island, are particularly vulnerable to changing weather. Tourism is a critical component of the United States' economy, and is especially important in Maine because it is one of the largest industries in the state. Therefore, understanding how past weather may have changed travel behavior is necessary to aid in discussion regarding potential adaptation strategies needed. This study looks at how past weather might have impacted

tourism-related spending by month on Mount Desert Island, Maine, from 2004-2014. Weather data is collected from the National Oceanic and Atmospheric Administration (NOAA), and economic data is from the Maine Revenue Services. A boosted regression tree is used to find which weather variables are the greatest predictors of tourism-related spending and visitation, and linear regressions are run to find the correlation and significance. Additionally, visitor surveys were conducted in Acadia National Park from May 2015 to August 2015 to better understand the importance of weather for people's travels.

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## **Is stress at the root of eelgrass decline in Frenchman Bay?**

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2 Southern Maine Community College, South Portland, Maine

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Eelgrass (*Zostera marina*), a key component of the marine ecosystem, has been declining in the upper Frenchman Bay since 2007, and in 2013 suffered a complete loss both in restored sites and surrounding naturally occurring Eelgrass areas. To complement and help guide restoration efforts, we wanted to understand the causes of decline. In this study, we aimed to determine if there was any correlation between plant stress, whether biotic (e.g., disease) or abiotic (e.g., heat stress or general stress), and the recent decline. We collected ten eelgrass samples from each of three sites varying in eelgrass health and bed exposure (depth). Following RNA extraction and reverse transcription, I used real-time quantitative PCR to compare the levels of expression of three stress genes known to modulate the responses of plants to heat, disease, and/or general stress among the three sites. Here, I report normalized gene expression from the three sampled sites and explore possible correlations between biotic and abiotic stress, the health and status of the beds, and local eelgrass decline.

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## **Teacher professional development in genomics instruction for rural and urban high schools**

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Teaching the Genome Generation (TtGG) is multifaceted teacher professional development program focused on human genetics, ethics and personalized medicine. TtGG builds upon The Jackson Laboratory's recognized expertise in genomics and genetics research. The primary goals of TtGG are to strengthen STEM education, increase genomic and genetic literacy, train and reinvigorate high school teachers and ultimately provide exciting and personally relevant laboratory experiences to an array of students. TtGG uses an intensive professional development course to train high school teachers and subsequently supplies portable laboratory equipment, reagents, and consumable supplies, as well as lesson plan support throughout the academic year.

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