



Annual Report – FY2016

Research Activity for the period

July 1, 2015 to June 30, 2016





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2016 Annual Report to the Vice President for Research

i. Executive Summary

Major Accomplishments (overarching):

Climate change is a major security issue for our country and the world and a defining element for the 21st century. It impacts human and ecosystem health, the economy, causes geopolitical stress, and increases the likelihood of storms, floods, droughts, wildfires and other extreme events. The Climate Change Institute has a legacy of transformational contributions to the understanding of the physical, chemical, biological and social complexity of climate change and the application of these findings at local to international scales. One of the several transformational contributions made by the Climate Change Institute is the understanding that the wind systems that deliver moisture, heat and pollutants and that impact surface ocean currents and sea surface temperature throughout the planet can shift in a matter of a few months to years with dramatic and sustained changes in water availability, storms and health at local to regional scales. The Institute uses this perspective to understand and aid in prediction of future hemispheric scale weather impacts, notably extreme events, with the most recent being abrupt warming of the Arctic with consequences for Northern Hemisphere climate and the strengthening and poleward migration of winds around Antarctica resulting in massive changes in water availability and sea surface temperatures throughout the Southern Hemisphere. To address the likelihood of continued abrupt changes and extreme events in climate the Institute continues to conduct field research, laboratory analyses, and to develop software to aid in the understanding of non-linear climate responses for use in climate adaptation and sustainability planning.

In 2014 the Institute launched a framework for developing climate change adaptation and sustainability planning that includes continually enhanced, publicly available software to understand past, present and future changes in climate and vulnerability to climate change through the formulation of plausible scenarios for the prediction of decadal to multi-decadal scale climate change. This framework now forms a primary initiative for CCI entitled Climate Futures (<http://www.climatefutures.net/>) (Appendix i). Within Climate Futures CCI is undertaking plausible scenario climate planning for: West Africa, the Southern Hemisphere continents, Central Asia and Maine.

CCI and SPIA continue to share a highly successful NSF IGERT that is the first of its type in the nation – A2C2 (Adaptation to Abrupt Climate Change) - a building block for graduate-faculty involvement in Climate Futures.

In the process of the foregoing, the Institute continues to maintain its high level of research funding, return on indirect, publications, outreach and its role as the focal point for the University of Maine's climate change research excellence.

Selected examples (youngest to oldest based on report) of additional highlights of major accomplishments follow (selection derived from the CCI News and Events section of our website, for more details concerning each item listed below go to: <http://climatechange.umaine.edu/>:

- Mayewski Quoted in WABI-TV5 Report on Arctic, Climate Change

- Dixon, Mayewski Featured in 'Thin Ice' on MPBN July 12
- Accumulation and Marine Forcing of Ice Dynamics in the Western Ross Sea during the Last Deglaciation – Nature Geoscience – Hall/Denton et al.
- Missives from Mongolia: Chasing Down the Ice Age - Putnam/Strand
- Archaeologists Find 4,000-year-old Artifacts at Seabrook Nuclear Plant - Robinson, Nurse, Heller et al.
- Bar Harbor-Boston Bike Ride to Support Green Causes - T. Godaire
- What Happens in Antarctica Does Not Stay in Antarctica - G. Bromley
- An Exemplar to Watch - Paul Andrew Mayewski - WORLD OCEAN Observatory
- Expanding the dialogue: Climate Science in the Classroom (A. Kireta & B. Grigholm)
- AP Speaks with Kelley about Louisiana's Coastal Crisis, Role of Next Governor
- World Ocean Radio Program Hails CCI, Mayewski
- Fernandez Appointed Chair of the Secondary NAAQS Review Panel for Oxides of Nitrogen and Sulfur, a Panel of the U.S. Environmental Protection Agency's Clean Air Scientific Advisory Committee
- Kelley Cited in Journal Tribune Article on Wells Beach Erosion
- Slate Quotes Gill in Article on Paris Climate Talks, Fate of Oceans
- Sandweiss Cited in Hakai Magazine Article
- Sandweiss Quoted in ScienceNews Article, Earliest New World Settlers
- Researchers Study Lobster Shell Disease to Protect Maine's Iconic Industry - S. Belknap, K. Tanaka, J. Homola
- Mayewski Presented with 2016 European Geophysical Union Hans Oeschger Medal for Past, Present and Future Climate
- Tales of a Warmer Planet - New York Times Article - C. Stager
- CCI Collects Ice Cores from South Georgia, Traces Route of Sir Ernest Shackleton - Mayewski et al.
- Gill Hails Herbivores in Science Magazine
- New Research Fellow at the Center for Climate and Security - K. Miner
- Isenhour Speaks about Carbon Footprints on The Takeaway
- Ice Age Forging Inroads Downeast - Machias Valley News - H. Borns
- 2,000 Years of European Climate: First Results from the SoHP Historical Ice Core Project - Spaulding, Mayewski, Kurbatov & Bohleber
- The Once and Future Ocean - Peter Neill's New Book
- CCI, Mayewski Cited in Harvard Gazette Article on Ice Core Data Related to Black Death
- Grad Student Speaks with Media about Follow a Researcher program - K. Hamley
- Recent UMaine Grad's Art Depicting Climate Change Focus of BDN Feature - J. Pelto
- In Greenland, A Climate Change Mystery with Clues Written in Water and Stone - Public Radio Interview - G. Hamilton
- Mayewski Featured in Two-part '207' Radio Piece
- UMaine Researchers Study Impact of Melting Glaciers in Peru - D. Groff, J. Scheick, K. Warner
- Teisl, Ph.D. Students Write BDN Article on Teaching Youth about Climate Change - B. Grigholm & A. Kireta
- For Heller, Ancient Trash Heaps Hold Clues to Healthy Future Fisheries
- Kelley speaks with WLBZ about Eastport Earthquake
- Lyon Quoted in Climate Progress Article on El Nino effects in Africa
- Expanding Your Horizons STEM Conference for Middle School Girls - C. Hamley
- Sandweiss Appears on Discovery Science Show 'What on Earth?'
- S. Belknap Quoted in Hakai Magazine Article on Warming Waters, Lobsters
- ClimateWire Interviews Mayewski about Pioneering Glaciologist
- Putnam Quoted in New Yorker Article Entitled: "The End of Ice"
- UMaine Ph.D. candidate K. Miner awarded Fulbright to Canada

- NOAA's 41st Climate Diagnostics and Prediction Workshop (October 3-6, 2016)
- Ellsworth American Interviews Borns about Predicted Global Sea Level Rise
- AP Previews Gill's Talk on Looking to Past to Inform Modern Conservation
- Roscoe Named 2016 Distinguished Maine Professor
- 2015 Warmest Year, On Average, Across Northern Hemisphere - S. Birkel
- Grigholm: Ice cores Indicate Increases in Atmospheric Heavy Metals in Atmospheric Environment.
- Saltmarsh Sparrow Population Plummet – Olsen, Garey, Correll, Cline, Conway
- S. Elias Focuses on Factors Affecting Spread of Deer Ticks, Diseases

I. Overview

A. Overview

The Climate Change Institute (CCI) (<http://climatechange.umaine.edu>), prior to 2002 known as the Institute for Quaternary Studies, is one of the oldest climate research organizations in the world and likely the first with a multi- and inter-disciplinary focus. CCI is a global leader in research and in combination with its University of Maine academic unit partners the Institute offers a robust array of graduate and undergraduate research opportunities. CCI integrates transformational field, laboratory and modeling activities to understand the physical, chemical, biological and socio-cultural components of the climate system of the past and present, to better predict future changes in climate and their impacts here in Maine and across the globe. Institute investigations span the last 2 million years to the present - a time of multi-millennial to centennial scale climate changes punctuated by abrupt (annual to decadal) shifts in climate. CCI investigations inform predictions for future climate change based upon an understanding of the full dynamic range of the natural climate system and the evolving dramatic influence of human activity. CCI has a legacy of major scientific contributions to understanding the timing, causes, and mechanisms of natural and human-forced climate change, and on the effects of physical and chemical climate changes on the biological, economic, social, and political conditions of humans and the ecosystem.

B. Mission

The mission of the Climate Change Institute is vitally linked to the widely accepted realization that an understanding of climate change (natural and human-forced) and its implications is absolutely critical to the future of society, ecosystems, the economy, and governance. As a consequence CCI continues to experience ever-broadening interaction with other disciplines, with other University of Maine researchers, academic and outreach units, and with local, national and international partners. Because climate change underpins the fabric of our society CCI faces rapidly emerging opportunities for application of its findings and expertise to critical issues including: climate change-induced hazards (e.g., severe storms, floods, sea level rise, coastal erosion, drought, heat waves), health threats (e.g., heat stress, drought/flood, disease, air pollution, storms), other economic and social challenges (e.g., water availability and quality, energy, food security, military security, civil unrest, agriculture, recreation, urbanization), and climate change-based decision-making by individuals, NGOs and governmental units.

C. Vision

The Climate Change Institute's vision for the future is summarized in the following statements:

1. Maintain and expand the Institute's role as a national and international leader in the "exploration and discovery" of the integrated physical, chemical, biological and social components of climate change research, education and outreach.
2. Continue to enhance the quality and expand the scope of the Institute's eight primary themes (see Section VIII later in this report) while continually evaluating the potential and necessity

for change and additional themes in one of the world's most rapidly evolving security issues – climate change.

3. Expand upon the Institute's 40+ year, highly successful, role model status of shared faculty partnerships with academic units to build a fully coupled, world-class undergraduate and graduate climate change research and education program at the University of Maine.
4. Develop a point of coordination and an identifiable framework for University of Maine climate change research, education and outreach that includes Institute and non-Institute University of Maine partners so that the University of Maine's full climate change potential and value can be realized.

D. Status of Strategic Plan

CCI routinely develops 5-year plans. The last was developed early in 2015. In concert with this CCI was selected as one of the University's Signature Research Programs and through this process our latest 5-year plan has been distilled into the Signature Research Area Vision Statement (Appendix ii).

E. Administration and Staffing Structure (CCI Organizational Chart attached – Appendix A)

II. Pathway 1: Serving Maine

A. Community Engagement

1. Numerous public lectures by all CCI faculty and many graduate students to NGOs, public schools, government.
2. Five-year update of *Maine's Climate Future* that provides a basis for Maine's (public, private, government) understanding of climate change and impacts.
3. Monitoring past and present state of Maine's lakes, forests, soils and coast to prepare Maine's people and their way of life for the future.
4. Making climate data accessible to the scientific community and public through CCI-produced innovative, highly transparent software and cyberinfrastructure that allows Mainers and the world to make informed decisions related to environmental change (eg., 10greenTM, Climate ReanalyzerTM, p301, CLAS layers).
5. Informing Maine and the nation of health implications of their changing air quality.
6. Monitoring ice sheet and glacier volume changes to assess current and future sea level rise for coastal Maine's coastal societies and ecosystems.
7. Developing local to global scale climate model predictions to evaluate threats to Maine including: in-migration of biological agents such as Lyme tick and frequency of heat waves.
8. Establishing the intersection of climate and policy for Maine's natural resource industries, notably: lobster, forestry, agriculture and tourism.
9. Examining past and present Native community interactions with Maine's environment.
10. Developing climate and environmental outreach projects for K-12 students and teachers, the public and tourists through lectures, pamphlets, curricula and maps (eg., ECM, ITEST, Maine's Ice Age Trail).
11. Work with the Maine Office of Chief Medical Examiner and Department of Public Safety in death investigation, disaster response, and related policy analysis.
12. Inquiry into sustainability policy including analysis of efforts to balance social, ecological and economic sustainabilities.

B. Economic Development

1. CCI brings research funding into the State that supports students, technicians including analytical equipment, and fabrication of equipment by local contractors.
2. CCI's CLAS platform, Maine's Climate Future, and Climate Futures all provide potential drivers for economic planning at community to State levels.

C. Workforce Development

CCI employs technicians, contractors and students to conduct its research mission.

D. Collaborations with UMaine System Campuses

University of Maine – Presque Isle

Maine School of Law

University of Southern Maine – Muskie Center

E. Collaborations with Other Outside Institutes/Organizations Related to Maine

1. ***Within the University of Maine*** - The Schools of Biology and Ecology, Computing and Information Sciences, Earth and Climate Sciences (half of SECS faculty are also CCI faculty and SECS offers undergraduate and graduate degrees in climate sciences), Marine Sciences, Forest Resources, Food and Agriculture, Policy and International Affairs (CCI and SPIA share an NSF IGERT that will support 25 PhD graduate students over five years – first ever to address abrupt climate change), Department of Anthropology (half of the Anthropology faculty are associated with CCI and they offer undergraduate and graduate degrees associated with climate science), the Honors College, LASST, the Department of Chemistry, the Department of Physics and Astronomy, the Hudson Museum, the Center for Research in STEM Education (RISE Center), the Foster Innovation Center.
2. ***Emerging Associations Within the University of Maine*** – examples include: climate and health with the School of Biology and Ecology and the National Center for Geographical Information and Analysis (NCGIA), environmental sensor development and data transmission with NCGIA and LAAST, innovations in past, present and future climate visualization with VEMI (Virtual Environment and Multimodal Interaction), Abrupt Climate Change, Business and Policy course with the Business School and the School for Policy and International Affairs, and a joint Climate Change Institute, School of Earth and Climate Sciences, School of Biology & Ecology and Department of Anthropology Graduate Certificate in Interdisciplinary Climate Studies.
3. ***Within Maine*** - Bangor, Lewiston-Auburn and Portland Water Districts, the Department of Water Resources, the Maine Department of the Environmental Protection, the Maine Department of Transportation, the Maine Centers for Disease Control, the Maine Geological Survey, the Maine State Museum, the Lobsterman’s Association, the Gulf of Maine Research Institute, The Island Institute, The Nature Conservancy, Audubon, Manomet Observatory, Conservation Law Foundation, Maine Natural Resources Council, Maine Physical Sciences Partnerships, Schoodic Education and Research Center, Acadia National Park, Unity College, College of the Atlantic, Maine Lakes Environmental Association, Kezar Lake Watershed Association, Acadia National Park, Big Reed Forest Reserve, Maine Natural History Observatory, Toothacher Pond Association, Maine Coastal Island Wildlife Reserve, Penobscot Bay Teacher’s Collaborative, Preti Flaherty Law, MicMac Environmental Monitoring Laboratory, Maine Lung Association, Eastern Maine Medical Center, Maine Estuarine Research Institute.

F. Collaborations with Other Outside Institutes/Organizations Outside of Maine

1. ***Federal including*** - Acadia National Park, US Department of Agriculture, US Forest Service, US Geological Survey, Oak Ridge Laboratory, National Center for Atmospheric Research, University Corporation for Atmospheric Research, National Weather Center, US Fish and Wildlife, Homeland Security.

2. ***US institutions including*** - Dartmouth College, Harvard University, Lamont-Doherty Earth Observatory, Princeton University, University of Washington, University of Nebraska, University of Oklahoma, Appalachian State University, University of Cincinnati, Texas Tech University, Kansas State University, University of Wisconsin, Brown University, University of Wyoming, Harvard Forest, University of Minnesota Natural Resources Institute, Minnesota Pollution Control Agency, Washington State University, Washington Central University, Konza Prairie Long-Term Ecological Research Station, McMurdo (Antarctica) Long-Term Ecological Research Station, American Museum of Natural History, Boston Museum of Science, University of California – Santa Cruz, Berkeley, Santa Barbara, Brigham Young University, Michigan Technical University, Woods Hole Oceanographic Institute, Appalachian State University, Central Washington University, Pennsylvania State University.
3. ***International including*** - Academic, governmental and non-governmental organizations in Australia, New Zealand, Canada, Brazil, Chile, Colombia, Argentina, Peru, India, Nepal, Czech Republic, Ecuador, China, South Korea, Tajikistan, Kazakhstan, England, Scotland, Ireland, Denmark, Switzerland, Germany, France, Italy, Spain, Sweden, Norway, Greenland, Iceland and most recently: association with the University of the Arctic consortium and the South Atlantic Environmental Research Institute (Falkland Islands).

III. Pathway 2: Financial Sustainability

A. E&G Support: Salary & Operating Support

E&G Funding for CCI Salaries* (minus fringe): \$767,888

E&G Funding for CCI Operating: \$12,780

B. MEIF Support

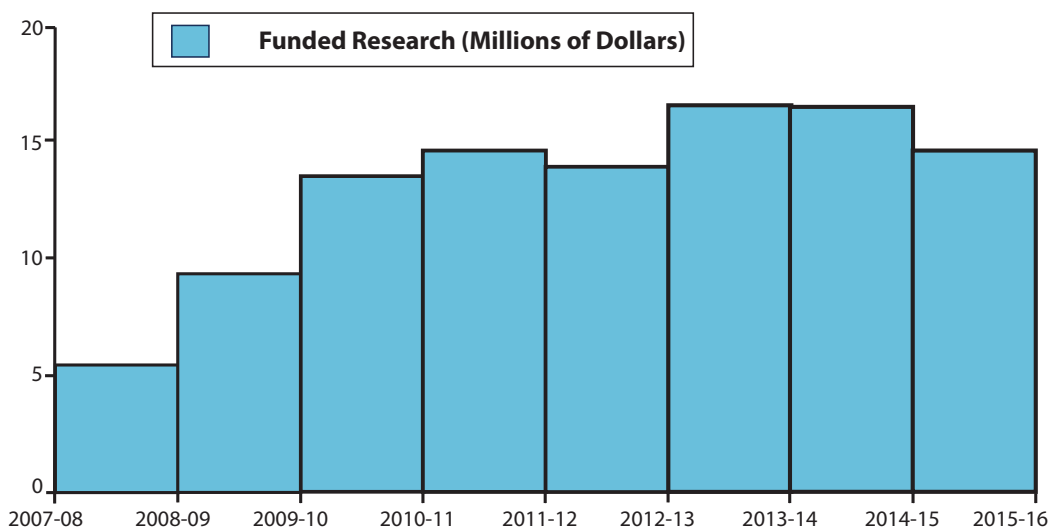
MEIF Funding for CCI Salaries* (minus fringe): \$499,012

MEIF Funding for CCI Operating: \$27,600

*almost exclusively tenure track faculty with joint appointments in academic units

C. Research Funding: Submitted & Awarded, Trends (Appendix B)

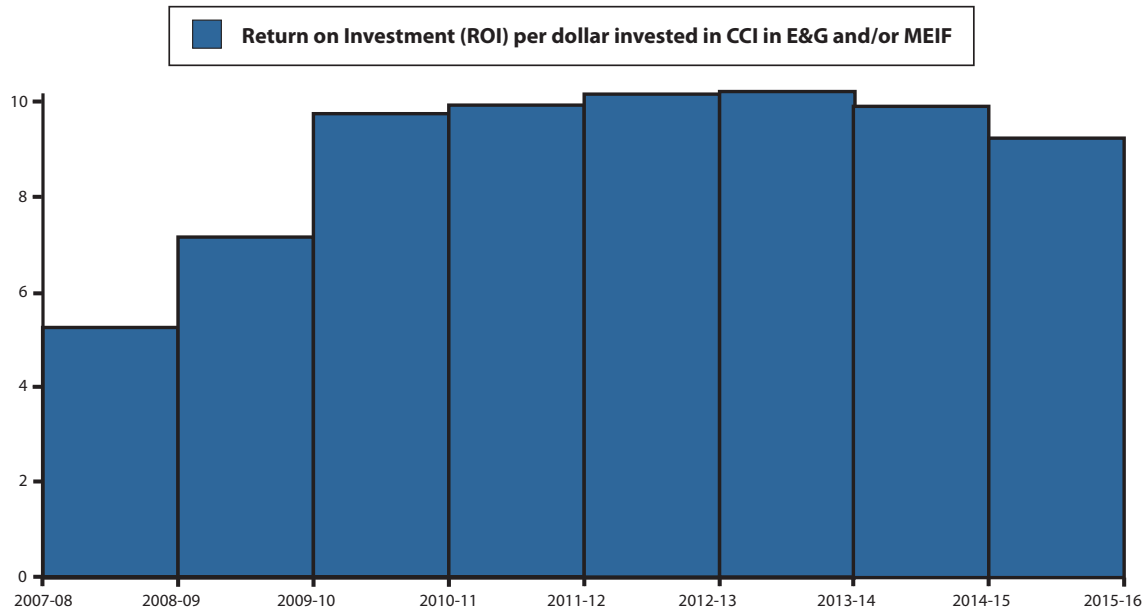
Proposal driven funds (in millions of dollars per year) raised by CCI members.



D. Brief Overview of Each Major New Award (Appendix C)

E. Return on Investment

FY 2016 ROI is \$8.637 down from FY2015 ROI at \$9.843 dollars per \$1 invested in CCI MEIF and CCI E&G.



% SUCCESS RATE (based on ALL FY2016 submissions + continuation grants from BPL listing of current awards).

58 new grants/72 (58 [new, continuation, and supplemental awards] + 14 grants declined)
New = 23, Continuation = 33, Supplemental = 2

SUCCESS RATE: 80.56%

F. Revenue Centers

NA

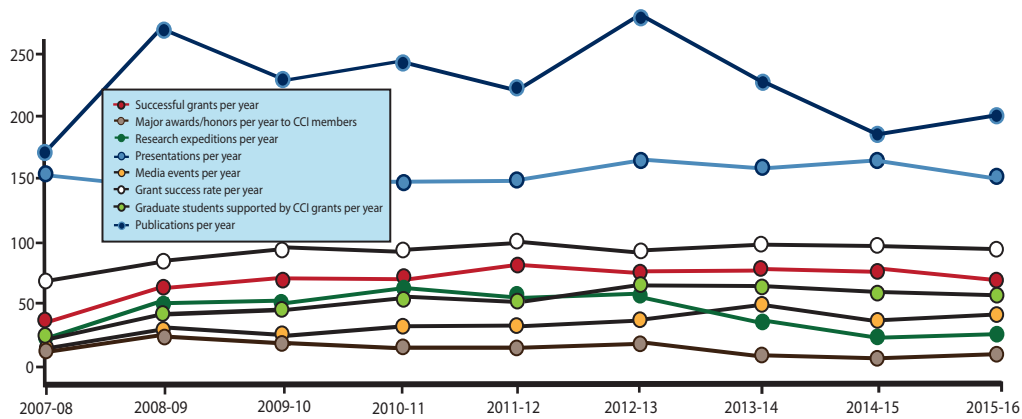
G. Private Giving/Alumni Cultivation

Dan & Betty Churchill Fund
The William Bingham Foundation
Muharram & Barbara Gokcen Fund
Plus several private donors

H. Initiatives to Increase Efficiency

CCI has discontinued base phone service for all CCI graduate students; toll calls related to research are debited to grants.

II. Pathway 3: Culture of Excellence



A. Faculty Achievements (e.g. awards, recognitions, prestigious appointments etc.)

Special Recognitions/Awards/Honors Received for Research, Scholarship, Creativity	
Denton, George	Distinguished Career Award, Division of Quaternary Geology and Geomorphology, Geological Society of America
Gill, Jaquelyn	2015-2016 University of Maine Faculty Fellow Nominated and inducted into the Sigma Xi scientific society. Nominated and inducted into Phi Kappa Phi. Invited Perspective in the journal Science (on African herbivores).
Hamilton, Gill	Nominated by the US State Department to be Co-Lead Author (Ch 4 - The Ocean's Role in the Hydrological Cycle) for the World Ocean Assessment I, United Nations
Isenhour, Cynthia	The Materials Management Research group that she co-leads received the "Outstanding Progress on the Road to Solutions" Interdisciplinary Team Award by the Mitchell Center for Sustainability Solutions.
Jain, Shaleen	"J-S. Kim, S. Jain, J.-M Yuk, and Y.-I. Moon, Sensitivity of flow metrics to climate variability and extremes in Korea" Best Paper Award, Korea Water Resources Association 2016 Annual Meeting, Seoul, Korea
Mayewski, Paul	European Geophysical Union Hans Oeschger Medal for Climate (Past, Present and Future) (2016) Ocean Exemplar (Special Citizen of the Ocean) designated by the World Ocean Observatory (2015)
McGill, Brian	Invited John Muir lecturer, U of Edinburgh Distinguished Scholar Lecturer in SESYNC (Socio-Environmental Synthesis Center) postdoctoral immersion program
Northington, Robert	Early Career Travel Grant, Association for the Sciences of Limnology and Oceanography
Norton, Stephen	American Geophysical Union, 2015 Editor's Citation for Excellence in Refereeing for outstanding service to the authors and readers of JGR-Biogeosciences
Roscoe, Paul	Distinguished Maine Professor
Sorg, Marcella	Promoted to research professor – September 2016

B. Research and Scholarship Summary (e.g., publications, presentations, editorships, exhibits, etc.) (Appendix D)

C. Curricular Innovations/Integration with the UMaine Education Mission

CCI Graduate certificate in interdisciplinary climate studies approved by the Graduate School 2014, course credit goes to academic units

D. Program Integration (N/A)

V. Pathway 4: Student Engagement, Student Success

A. Undergraduate Student Research, Scholarship or Creative Activities*

Undergraduate Student Research – Field Expeditions			
# Undergraduate Students	Advisor	Date	Description
1	Belknap, Daniel	July 2015	8 day trips aboard R/V Mud Queen mapping the Damariscotta Estuary with Olex-Wassp multibeam sonar. Part of NOAA-SeaNet project with Joe Kelley. MS Student Emily Chandler thesis, Robin Arnold MS student and undergraduate Eliza Kane field assistants on several days.
1	Hall, Brenda	Summer 2015	Geologic field work in Maine, including in Acadia National Park, on Pineo Ridge (Cherryfield), and at Eagle Hill.
3	Isenhour, Cynthia	March 2016	Maine Science Festival- Designed and Presented Exhibit on Waste Recovery
2	Kreutz, Karl	May 2016	Glaciological research on Eclipse Icefield, Yukon Territories, Canada
150	Northington, Robert	Summer 2016	Schoodic Experience for new biology undergraduates
11	Zaro, Gregory	May-July 2015	Nadia-Gradina Archaeological Project, Croatia
7	Zaro, Gregory	May-July 2016	Nadia-Gradina Archaeological Project, Croatia

Note – All CCI graduate students participate in at least one and in many cases several field programs with CCI faculty.

B. Undergraduate Student Awards

The Churchill Award for Outstanding Exploration (2016) – Honorary Mention: Marissa Bovie

C. Graduate Student Research, Scholarship or Creative Activities See Borns Symposium appendix of mini-papers – (Appendix E)

D. Graduate Student Awards

The Churchill Award for Outstanding Exploration (2016) – 1st Place: Catherine Hamley

Harold W. Borns Symposium – Best Presentation Award (2016) – 1st Place: Benjamin Partan; 2nd Place: Kisei Tanaka; 3rd Place: Samuel Belknap III

Harold W. Borns Symposium – Best Poster Award (2016) – 1st Place: Carl Tugend

CCI Student Outstanding Service Award (2016) – Catherine Hamley

North Atlantic Chapter of the Society of Environmental Toxicology and Chemistry (2016) –

Best Graduate Platform Talk: Kimberley Miner

Grad. Expo (2016) – Best Poster – Natural Sciences: Courtney King

E. Retention and Graduation Numbers, Initiatives - n/a since CCI supports graduate students but they get degrees in associated academic units.

F. Degrees Granted - n/a since CCI supports graduate students but they get degrees in associated academic units.

G. Highlighted Student Profile: Samuel Belknap & Kisei Tanaka (Appendix F)

VI. Pathway 5: Preserving-Restoring Infrastructure

- A. Renovation /Construction Projects Initiated/Completed
Considerable renovation to Sawyer 2nd floor (refurbishing for the new Sawyer Water Research Lab (SWRL)) under the direction of J. Saros and parts of first floor. Details available on request.
- B. Renovation/Construction Projects Planned for Coming Year (i.e., vetted with Facilities Management)

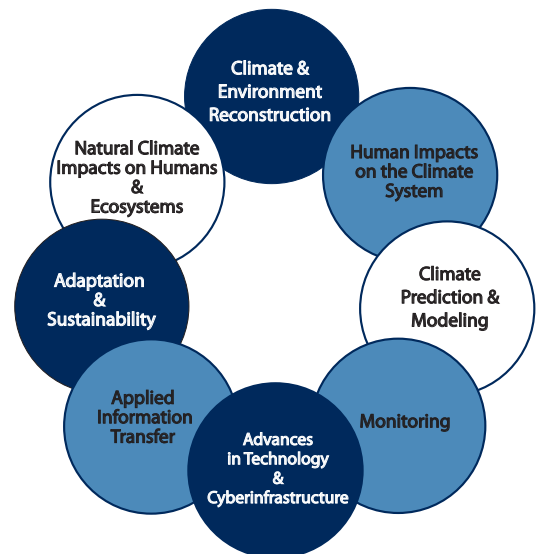
VII. Summary of Anticipated Challenges

For climate change and the Climate Change Institute at the University of Maine to continue to function at the cutting edge of climate change and continue to thrive and lead in the nation and the world requires the following:

- Continued growth in tenure track faculty positions shared between CCI and its legacy academic partners (School of Earth and Climate Sciences, Department of Anthropology, School of Biology and Ecology) and continued collaboration between CCI and cooperating faculty in several academic and research units such as: School of Computing and Information Sciences, the Department of Chemistry, School of Marine Sciences, School of Forest Resources, School of Business.
- Addition to CCI of research faculty supported at least partially by E&G and/or MEIF with compensation for teaching.
- Expansion and/or addition of transformative new directions for CCI and climate change at the University of Maine including cyberinfrastructure with an emphasis on data integration, analysis and visualization.
- Resources to enhance outreach via CCI and CCI partners to address the increasing demand for climate information, mitigation support, and adaptation and sustainability strategies.

VIII. Summary of New Initiatives

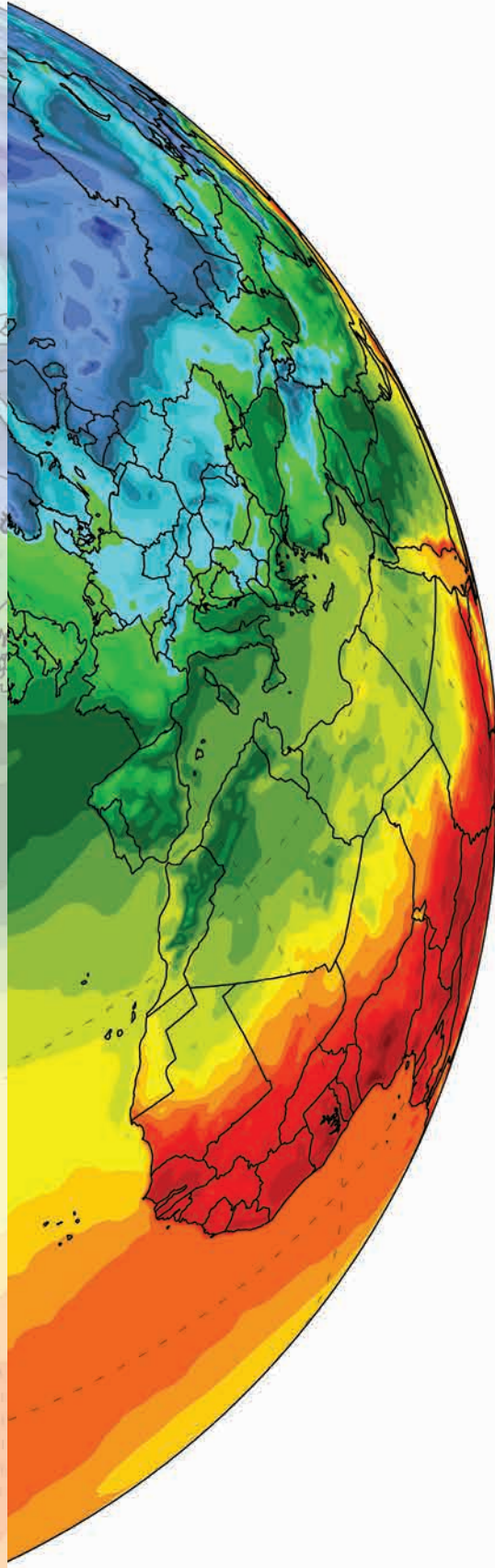
1. Climate change and CCI are a UM Signature Research program.
2. The Institute has eight major themes that together describe its breadth of contributions and linkages across the University of Maine and at state, national and international levels, and expectations for the future of CCI and climate change at the University of Maine. These eight themes represent the current evolution of the Institute's approach to the rapidly emerging understanding of climate change and the implications of change.
3. Climate Futures initiative emanating from the CCI themes and NSF IGERT A2C2 (Adaptation to Abrupt Climate Change).



Climate Change Institute

The University of Maine's Climate Change Institute has a legacy of major contributions to the understanding of the physical, chemical, biological and social complexity of climate change and the application of these findings at local to international scales. Perhaps most notable is the Institute's role in the discovery and interpretation of abrupt climate change (ACC) – dramatic changes in temperature, precipitation and storm patterns that can occur in a matter of years and last decades to centuries. ACC events occur in the naturally forced climate system, but today human activity is accelerating and magnifying the role of these controls leading to modern day ACC events such as the fast decay of Arctic summer sea ice and the Antarctic ozone hole with consequences such as increased frequency and magnitude of extreme weather events.

CCI's unique perspective combines first-hand understanding of robust archives of past climate and the environment (e.g., ice cores, lake sediments, and human artifacts calibrated with instrumentally recorded data); a diverse array of environmental monitoring systems (e.g., weather, sea level rise, glacier dynamics, lake chemistry, coastal erosion); and in-house generated understanding of weather- to climate-scale descriptions of past, current and future conditions. This climate understanding coupled with local- to global-scale understanding of climate change impacts, vulnerabilities, assets and potential for innovative solutions and opportunities, significantly enhances the potential success of climate change driven planning outcomes, including guidance in climate adaptation, mitigation, sustainability, and resilience planning.



Framework Building: The Climate Futures Team

Key elements of the basic software for the Climate Futures Framework are already operational. In particular Climate Reanalyzer™ and 10green™ attract significant attention and use (>1000 hits/day, several peer reviewed scientific and public media publications by CCI and many other researchers).

CCI and its University of Maine partner the School of Policy and International Affairs are completing a National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) grant, the first of its kind, entitled: Adaptation to Abrupt Climate Change (A2C2). It is a doctoral training program for students in earth sciences, ecology, anthropology, archaeology, international affairs, and economics. A2C2 is designed to train the next generation of natural and social scientists to meet the critical societal challenge of human adaptation to abrupt climate change (ACC). A2C2 IGERT graduate fellows are trained by IGERT faculty to be experts and leaders on the issue of climate and abrupt climate change in their disciplinary field; to understand the dynamics of coupled natural and human systems in response to abrupt climate change; to conduct collaborative, interdisciplinary research across natural and social sciences; to develop innovative policy and management solutions from their research to foster resilience and adaptation; and to develop an international perspective on adaptation to abrupt climate change including national and international experiences.

Climate Futures will build a team based upon the interdisciplinary faculty interactions and graduate student training model successes learned and developed from A2C2 IGERT. The Climate Futures team will include:

- (1) Climate Futures Team Oversight**
Paul Mayewski (Director, Professor, CCI)
- (2) CCI Generated Software Unit**
Lead developer and enhancements leader, Sean Birkel (Research Asst. Professor, CCI) and post-doctoral fellow (TBD)
- (3) Climate Futures Inputs Unit**
Vulnerabilities, impacts and assets: CCI ecosystem and social science faculty team and graduate student (TBD)
Rates of change, magnitude, timing: CCI physical sciences faculty team and graduate student (TBD)
- (4) Climate Futures Products Unit**
Plausible scenario and applications: CCI business and economics faculty team and graduate student (TBD)



For more information on how you can contribute contact:

Dr. Paul Andrew Mayewski, Director, Climate Change Institute
207.581.3019, paul.mayewski@maine.edu

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Climate Futures

A Pathway



climatechange.umaine.edu

Introduction

Climate change defines the 21st century in ways that we are only beginning to understand.

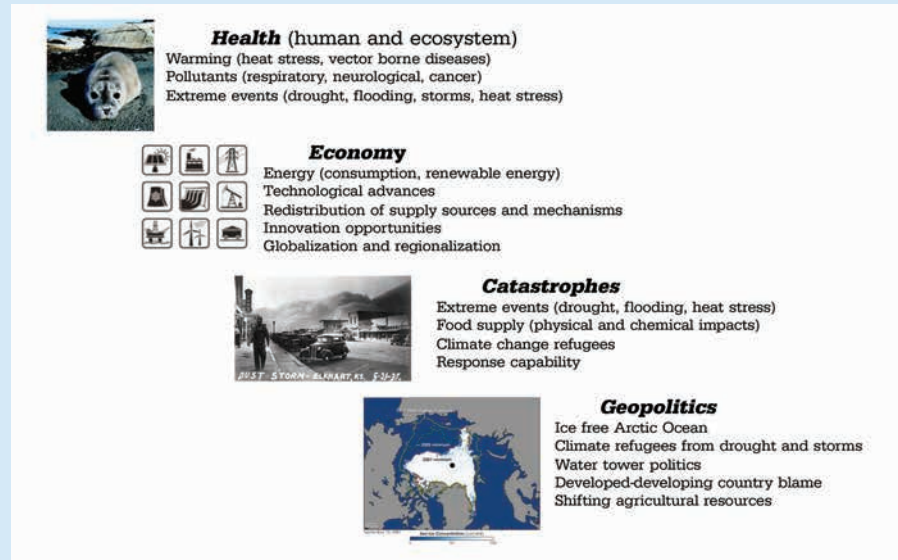
How can we plan for the future without understanding climate change impacts on human and ecosystem health, food systems, energy production, the economy, geopolitics, and the future of storms, floods, droughts, wildfires and other extreme events?

Climate Change

Climate and its building block, weather, extend from the uppermost reaches of Earth's atmosphere into the oceans, lakes, streams, soils, fields, forests, rocks and into our homes. Climate and weather have been molding the Earth's surface through long-term variations and catastrophic changes ever since Earth gained an atmosphere. Climate and weather have been feared and revered ever since humans emerged, and plants, animals and humans migrated, thrived, adapted, and ceased to exist in some cases in response to climate change. Climate change influences where we live, our health, our economy, our art and music, and our overall quality of life.

Over the last two decades, science has clearly demonstrated the realities of a changing climate and the highly significant role of human activity in these changes. With this realization, the White House, the Pentagon, and governments around the world understand that climate change is amongst the most serious and ever-present issues on the planet.

Climate Change is a Security Issue



Climate Futures Requirements

A transparent framework is needed for assessing impacts and addressing vulnerability in a changing climate where intended goals are: mitigation, adaptation, sustainability, resilience, opportunity, and entrepreneurship.

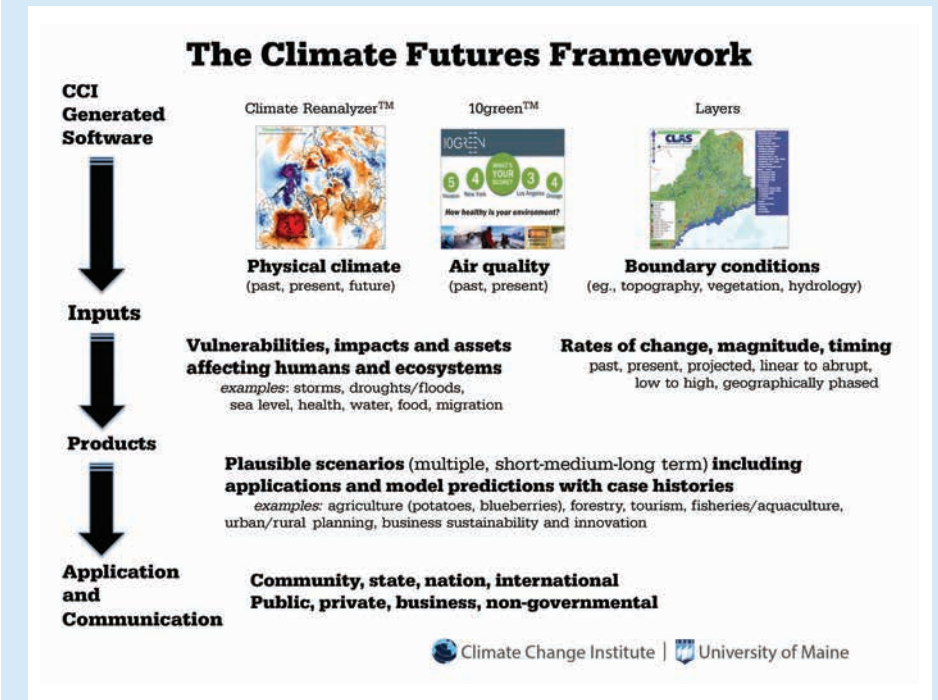
Thinking Outside the Box

Climate prediction models are an essential element in planning for the impacts of climate change. However, existing climate models based on classic IPCC (Intergovernmental Panel on Climate Change) while essential stepping blocks, do not capture the full local- to regional-scale climate change known to exist in the past; nor do they capture the realities of non-linearities such as abrupt climate change (ACC) in the past and currently emerging climate system, or the full health consequences of changes in the chemistry of the atmosphere, and as a consequence the full range of plausible scenarios for future climate.

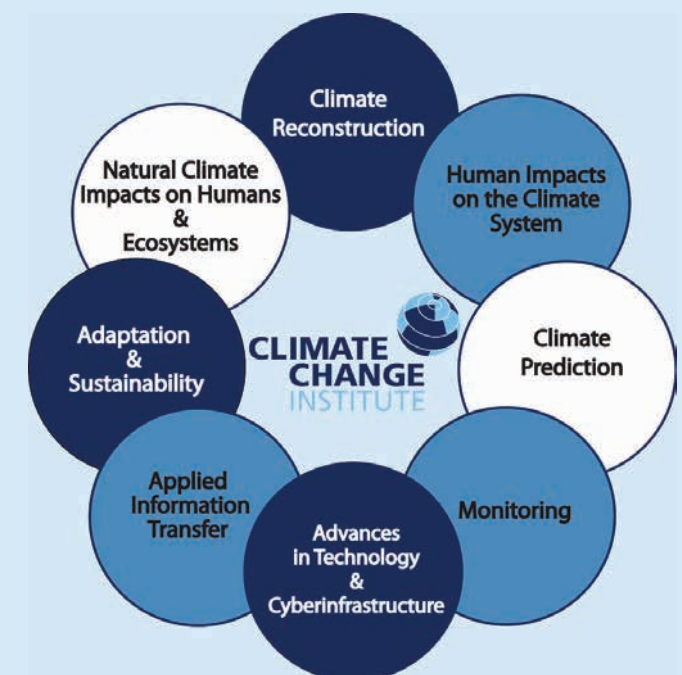


The Climate Futures Framework

The Climate Futures Framework offers a transformative mechanism and a platform for assessing and quantifying climate change, vulnerability, impacts, and opportunities based on classic IPCC and past climate analog change predictions, presented in the form of locale-specific plausible scenarios, that go beyond standard linear climate predictions.



Major themes that describe the breadth of CCI's contributions and abilities.



Academic Affairs Signature Area Vision for the Future Fall 2014 – COVER SHEET – White Papers

I. Designation/Name of Area (Select one):

X Signature; Area name: Climate Change and the Climate Change Institute

II. Submitter information:

Lead Faculty:

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Vision

What is climate change? We (humans, animals, plants) are all connected to, affected by and integrally involved in the climate system. Climate and its building block, weather, extend from the uppermost reaches of Earth's atmosphere into the oceans, lakes, streams, soil, fields, forests, rocks and into our dwellings. Climate and weather have been molding the Earth's surface through long-term variations and catastrophic changes ever since Earth gained an atmosphere some 4.5 billion years ago. Climate and weather have been feared and revered ever since humans emerged and plants, animals and human groups migrated, thrived, adapted and ceased to exist in response to climate change. It influences where we can live, our health, our economy, our art and music, and our overall quality of life. Controls on climate and weather, underlying mechanisms of change, human and ecological impacts and their implications cannot be defined by a simple disciplinary description. Rather, climate change calls for (if not demands) multi- and inter-disciplinary approaches that include physical, chemical, biological and social dimensions and feedbacks.

The climate and environment of Maine has changed dramatically in the last several thousand years. Melting ice sheets have forced the evolution of sea level, lakes and rivers; forests and animals have migrated into and out of the region; agriculture and industry have emerged; population distribution has changed; cultural patterns and socio-economic complexity have changed; energy and transportation needs have increased; air and water quality has changed; and Maine's interaction with national and global economies and the changing dynamics of security has intensified dramatically. Woven within all of the foregoing is climate change and the realization by the scientific community, the White House, the Pentagon, and governments around the world that climate change is amongst the most

serious and ever-present security issues on the planet (Figure 1). Assessing Maine's place in this security web is essential to planning Maine's future.

Climate change defines the 21st century in ways we are only beginning to understand. How can Maine plan for the future without understanding its changing climate and environment and without understanding climate change impacts on human and ecosystem health, the economy, geopolitics, and the future of storms, floods, droughts, wildfires and other extreme events?

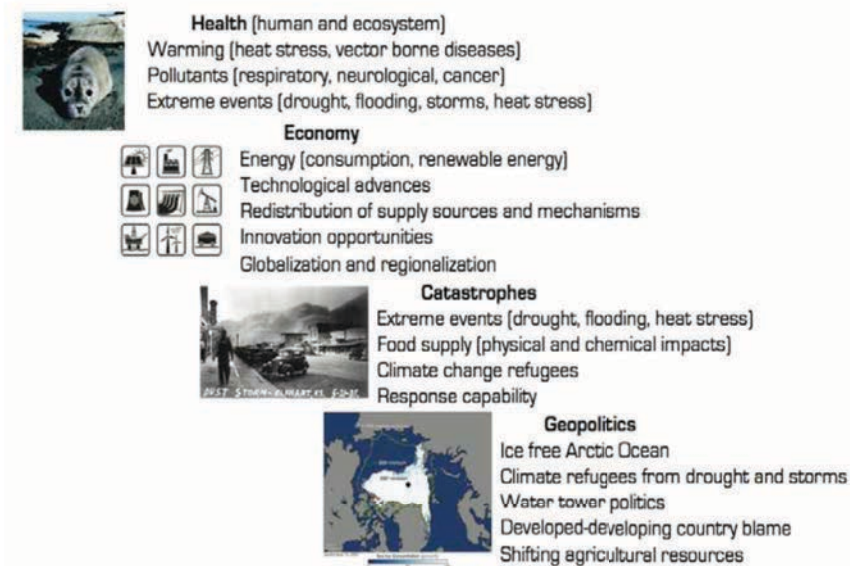


Figure 1. Climate change is a security issue.

The Climate Change Institute has a legacy of major contributions to the understanding of the physical, chemical, biological and social complexity of climate change and the application of these findings at local to international scales. Climate change has already impacted our lives dramatically and it will only continue to do so.

What is climate change at the University of Maine? Climate change is one of the primary signature research strengths of the University of Maine. It includes integrated undergraduate and graduate education and research opportunities and service products that are dedicated to improving the well being of the University, Maine, the nation and the world.

The Climate Change Institute's role as "nucleus" and "framework" for the University of Maine's climate change strength. The breadth of climate change cannot be captured within a single discipline or unit. That said a significant portion of the momentum for the growing reputation of the University of Maine in climate change has been leveraged from the international reputation of the research strengths of the Climate Change Institute. The Institute's historical and ongoing contributions have grown to be an integrating framework across many disciplines and units on Maine's flagship campus and beyond, encompassing undergraduate and graduate education, a broad array of research, and outreach to stakeholders and governments. The Climate Change Institute has emerged as the focal point for climate change at the University of Maine.

“Exploration and Discovery” is the Institute’s slogan following the example of its Honorary Member, the great explorer Thor Heyerdahl, and the 40+ years of exploration and discovery by Institute members. The Institute fosters exploration, learning and discovery through excellence in faculty and graduate student research, addresses local through global needs through basic and applied research, and contributes research-based knowledge. The Institute is dedicated to improving the quality of life for people in Maine and around the world, and to promoting responsible stewardship of human, natural and financial resources, now and in the future.

The Institute has eight major themes (Figure 2) that together describe its breadth of contributions and linkages across the University of Maine and at state, national and international levels. These eight themes represent the current evolution of the Institute’s approach to the rapidly emerging understanding of climate change and the implications of change.

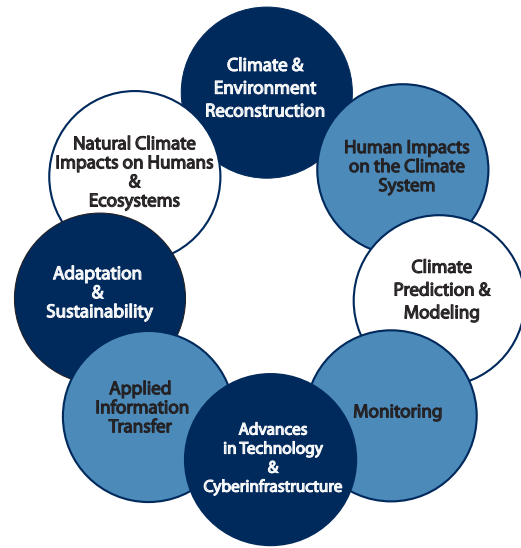


Figure 2. CCI themes.

Vision Summary for the Next Level of Excellence. The Climate Change Institute’s vision for the future is summarized in the following statements:

1. Maintain and expand the Institute’s role as a national and international leader in the “exploration and discovery” of the integrated physical, chemical, biological and social components of climate change research, education and outreach.
2. Continue to enhance the quality and expand the scope of the Institute’s eight primary themes (Figure 2), while continually evaluating the potential for improving this approach by incorporating additional and revisiting existing themes for one of the world’s most rapidly evolving security issues – climate change.
3. Expand upon the Institute’s 40+ year, highly successful, role model status of shared faculty partnerships with academic units to build a fully coupled, world-class undergraduate and graduate climate change research and education program at the University of Maine.
4. Develop a point of coordination and an identifiable framework for University of Maine climate change research, education and outreach that includes Institute and non-Institute University of Maine partners so that the University of Maine’s full climate change potential and value can be realized.

Needs and Justification to Achieve the Next Level of Excellence

1. Graduate Fellowships and Post-doctoral Associates: Following a long line of successful grant-funded support for graduate students by the Institute, the creation of prestigious Signature Graduate Fellowships will further sustain our ability to attract excellent graduate students who are vital to our research success. Funding for an Institute Post-doctoral Associate will also grow our program, as our grant-funded post-docs have often remained in the Institute and become Research Assistant Professors, expanding the breadth of our expertise.

2. Increased Investment in Research: Research programs in the Climate Change Institute are world renowned, and additional investment in infrastructure and personnel (eg., technicians) will grow our capacity. Institute researchers have worked hard to attract millions

of dollars of equipment from federal and private foundation support including technical expertise. However, we still have aging facilities and equipment that slows research progress, and lack the resources to nimbly invest in equipment as new methods and collaborations emerge.

3. Return of Indirect Costs (IDC): Widely recognized for many years is the advantage to the research mission for reinvestments through the return of indirect costs. This has been proposed in several University strategic plans, and other proposals such as the faculty incentive plan. A long-term guaranteed return of 40% IDC to 'soft-money' positions affiliated with the Climate Change Institute would be a significant incentive to build research expertise in this signature area. This is one of only a handful of areas at the university that has the critical mass and momentum to provide a high return on investment with this type of policy. The full 40% would be available only to research faculty who are not paid by University base funding, until such time that a broader university policy of indirect cost returns can be implemented.

4. Shared Faculty Positions: The Climate Change Institute has already established a remarkable record of success in additional shared faculty positions with academic units (notably Schools of Earth and Climate Sciences, Biology and Ecology, and Department of Anthropology). This has benefited programs in all participating units, and made the Institute a fertile framework for interdisciplinary initiatives that brings disparate units on campus together, and enhanced climate change science through academic units and institutes across campus. Using this model, the university should invest in 7-10 tenure-track, CCI shared faculty positions over the next five-year period. As with current shared positions, these should be positions providing linkages with other units heavily invested in the consequences of a changing climate for their students and stakeholders (e.g., Anthropology, Earth and Climate Sciences, Economics, Business, Computing and Information Sciences, Biology and Ecology, Food and Agriculture, Forest Resources, Marine Sciences, Policy and International Affairs, College of Engineering). CCI is currently in the process of developing its latest five-year plan including proposed shared positions. Once complete in early 2015 linkages will non-Institute University partners will be pursued.

5. E3RB – The Extreme Environment Education and Research Building: This facility is currently in final planning stages with expected construction Spring 2015. It will provide much needed space for staging of the Institute's ~40 expeditions per year and space and facilities for students to design innovative equipment for research in extreme environments. In addition E3RB will provide a space for the public to observe extreme environment research planning and facilities in a venue where student involvement can be highlighted.

6. Climate Coordination and a Climate Coordination Office: The University needs a point of departure on climate change that works to connect interested students, stakeholders, and the public to resources at the University that meet their needs on this subject, and a point of coordination for University planning on this issue, from curriculum development to large, multidisciplinary research initiatives. Such an entity would not be a required clearinghouse, but an advocate for new initiatives where it could be helpful. This could be built on and in coordination with the existing State Climatologist Office, and could include a broad range of outreach such as Maine Climate News, an ongoing Dashboard of environmental indicators for Maine, an information listing of climate change mitigation and adaptation efforts in Maine, and facilitate the university linkages to state agencies, industry, and municipalities on this subject. This office could also coordinate with the university point of contact for the USDA Northeast Climate HUB, housed in the Maine Agricultural and Forest Experiment Station. The office would require a full-time professional position (new hire) to carry out office day-to-day functions under the direction of a faculty supervisor.

7. State Climatologist Office: The University of Maine has been the home for the State Climatologist largely through in-kind support from the Climate Change Institute. Dr. George Jacobson contributed his time over six years through summer 2014, following several years of unpaid involvement by Dr. Greg Zielinski, and this fall Dr. Sean Birkel, a Research Assistant Professor without base funding, will assume the role of Maine State Climatologist. This position and associated travel throughout Maine should be funded from State and University base funding as outreach in the areas of Maine climate research and teaching, thereby stabilizing this critically important office in a fashion similar to other states. Dr. Birkel has been responsible for transformative climate change software that is used by researchers, the public and in many courses on this and other entities worldwide. The State Climatologist Office also offers Maine Climate News in partnership with Sea Grant and Cooperative Extension, which would continue and be integrated with the Climate Coordination Office.

8. University-wide Climate Gen Ed Class: As the signature programs develop, we would expect the evolution of various curricula across campus to build on these growing areas of strength and interest among our students. One component of this evolution could be to establish a general education course aimed at lower class levels (100-200) on Climate, Ecosystems and Society that provides core concepts, terminology, and an awareness of current events. We envision that this course will be developed in cooperation and administered through existing units represented within CCI. With appropriate resources, this could be developed into an on-line UMS, national and international-wide course offering. Graduate student support requested.

8.a (alternative or added to 8. above): *Establishing a Climate Gen Ed Category* in the form of Climate, Ecosystems, and Society that would broaden the existing Population and the Environment category, and could be fulfilled by any number of courses that would explicitly include these core concepts. Much like other Gen Ed categories, students would have a variety of options to fulfill this requirement, but not necessarily from a single course. The option, then, would be to have a number of courses that address these concepts in the context of a variety of curricular matters (8a), or a single course that tackles these core concepts specifically (8). Graduate student support requested.

9. Graduate Study Certificates: The Climate Change Institute recently initiated with approval by the Graduate School, a certificate program in Interdisciplinary Climate Studies. The Institute has the potential to pioneer additional certificate programs. Courses are and would be offered for credit through University academic units with impetus and oversight by the Institute.

Estimated Budget in addition to current E&G and MEIF support to CCI

Need	New MEIF/ year	Private Giving/ year	State	Federal/ year	UMS	E&G/ year	MEIF
1. Signature graduate & post-doc fellowships	250K	250K		>500K Note [1]			
2. Equipment and technical	150K			>500K Note [2]			
3. 40% return res. faculty Indirect						40% Note [3]	
4. shared tenure track Faculty [7-10]	450K					450K	
5. E3RB facility			500K Note [4]				
6. Climate coordination office	40K					40K	
7. State Climatologist	50K					50K	
8./8a University-wide Gen Ed						60K	
9. Graduate Study certificates						50K	

Note [1] based on federal funds currently raised by CCI in support of graduate students and post-docs.

Note [2] based on federal and private foundation funds currently raised for equipment.

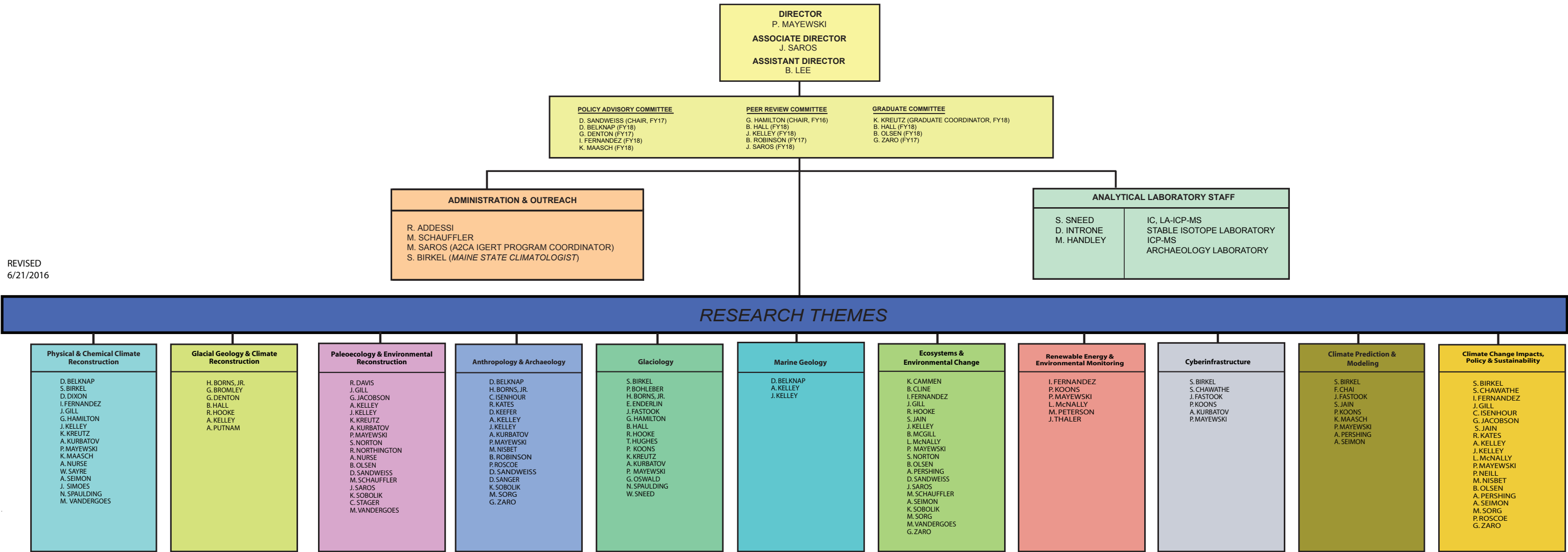
Note [3] could result in considerable revenue to the University. 60% of something is better than 0% without Research Faculty.

Note [4] 500K already allocated for E3RB so this is not a new request. The building is planned for construction in Spring 2015.

APPENDIX A: ADMINISTRATION & STAFFING STRUCTURE



ORGANIZATIONAL CHART



REVISED
6/21/2016

APPENDIX B. RESEARCH FUNDING - SUBMITTED & AWARDED GRANTS - CLIMATE CHANGE INSTITUTE - FY 2016
LISTING INCLUDES ALL ACTIVE CCI GRANT AWARDS ADDED IN AS CONTINUATION GRANTS.

Person	Title	Role	Unit	RESP Sponsor	Status	Sponsor Req	Cost Sharing	Type
Birkel, Sean	BIGDATA: Collaborative Research: IA: Scalable Multi-resolution Data Management for	Data Analytics i	Co-PI (Zhu)	Lead PI's Department	0.1 National Science Foundation	Pending	499,114.00	0.00 New
Birkel, Sean	Glaciological and Mass Balance Modeling of Walker Basin, Nevada	PI	Climate Change Institute	1 US Dept. of Interior	Funded	21,066.00		Continuation
Birkel, Sean	Regional Climate Modeling for Future Environment & Species ... S. California	PI	Climate Change Institute	1 US Dept. of Defense	Pending	50,000.00		New
Birkel, Sean	Coll. Res.: Response of the NW Greenland Cryosphere to Holocene Climate Change	PI	Climate Change Institute	1 National Science Foundation	FundedC	60,437.00		Continuation
Birkel, Sean	Coll. Res.: Testing the Orbital Theory of Ice Ages	PI	Climate Change Institute	1 National Science Foundation	FundedC	21,450.00		Continuation
Birkel, Sean	GreenTRACS: A Greenland Traverse for Accumulation & Climate Studies	PI	Climate Change Institute	1 National Science Foundation	FundedC	169,567.00		Continuation
Bromley, Gordon	Request for REU Supplement for NSF grant 1443321	PI	Climate Change Institute	1 National Science Foundation	Funded	5,789.00	0.00	Supplement
Bromley, Gordon	Blowing Hot or Cold? Resolving the terrestrial impact of North Atlantic stadials	PI	Climate Change Institute	1 Waitt Foundation	Pending	14,045.00	5,797.00	New
Bromley, Gordon	Relating historical, present and future volcanogenic activity to deglaciation and isostatic rebound in th	PI	Climate Change Institute	1 National Aeronautics & Space Administratio	Declined	98,367.00	0.00	New
Bromley, Gordon	Collaborative Research: A tropical glacial-geologic approach to testing the role of CO2 in the last glacia	PI	Climate Change Institute	1 National Science Foundation	Declined	227,706.00	0.00	New
Bromley, Gordon	Collaborative Research: Potential direct geologic constraints on ice sheet thickness ..	PI	Climate Change Institute	1 National Science Foundation	Funded	291,563.00		New
Bromley, Gordon	Islands in the Sky: Assessing impacts of abrupt climate change on the high páramo	PI	Climate Change Institute	1 National Geographic Society	Pending	19,637.00		New
Chai, Fei	The Spatial Effects of Ocean Acidification on Fe Availability in the Subarctic Pacific and its Projected Co	Co-PI (Wells)	School of Marine Sciences	0.2 National Science Foundation	Pending	688,490.00	0.00	New
Chai, Fei	Inundation modeling for Saco, Maine	Co-PI (Xue)	School of Marine Sciences	0.5 US Dept of Commerce	Pending	70,000.00	36,663.00	New
Chai, Fei	Technical Support on Tidal Stream Resource Characterization Modeling in Western Passage, Maine	PI	School of Marine Sciences	1 US Dept of Energy	Pending	20,000.00	0.00	New
Chai, Fei	Oceanographic, meteorological and climatic conditions regulating large and unprecedented Noctiluca	PI	School of Marine Sciences	0.6 National Aeronautics & Space Administratio	Pending	221,832.00	0.00	New
Chai, Fei	Improving tide-estuary representation in MPAS-Ocean	PI	School of Marine Sciences	1 US Dept of Energy	Pending	225,410.00	0.00	New
Chai, Fei	Decision and Information System for the Coastal waters of Oman (DISCO) An integrative tool for mana	PI	School of Marine Sciences	0.6 National Aeronautics & Space Administratio	Pending	299,672.00	0.00	New
Denton, George H.	Heinrcih Summers	PI	Climate Change Institute	1 Comer Science and Educational Foundation	Pending	40,000.00	17,120.00	New
Denton, George H.	What forced the last termination in southern middle latitudes?	PI	Climate Change Institute	0.5 National Science Foundation	Declined	399,047.00	0.00	New
Denton, George H.	Southern Context for the WAIS Divide Temperature Record	PI	Climate Change Institute	1 National Science Foundation	Declined	399,952.00		New
Denton, George H.	Quesada Fund: Furthering Gary Comer's Work	PI	Climate Change Institute	1 Quesada Funds	FundedC	250,000.00		Continuation
Denton, George H.	Putting the WAIS into Context	PI	Climate Change Institute	1 National Science Foundation	FundedC	379,130.00		Continuation
Denton, George H.	The Last Glacial Termination in Southern Mid-Latitudes	PI	Climate Change Institute	1 National Science Foundation	FundedC	393,844.00		Continuation
Denton, George H.	The Last Glacial Termination in the MacKenzie Valley	PI	Climate Change Institute	1 Comer Science & Educational Foundation	FundedC	56,763.00		Continuation
Dixon, Daniel	Campuses for Environmental Stewardship / Davis Educational Foundation	PI	Climate Change Institute	1 Maine Campus Compact	Funded	4,000.00	2,340.00	New
Dixon, Daniel	Mandela Washington Fellowship Energy Institute - The University of Maine	Co-PI (Hecker)	Lead PI's Department	0.45 US Dept of State	Funded	150,000.00	109,938.00	New
Enderlin, Ellyn	Intra-annual Force Balance Analysis of Tidewater Glaciers	PI	Climate Change Institute	1 National Aeronautics & Space Administratio	Funded	145,289.00	0.00	Continuation
Enderlin, Ellyn	A New Remote Sensing Approach to Investigating Glacier-Ocean Interactions	PI	Climate Change Institute	1 National Aeronautics & Space Administratio	Declined	300,997.00	19,236.00	New
Enderlin, Ellyn	Antarctic Submarine Melt Variability from Remote Sensing of Icebergs	PI	Climate Change Institute	0.75 National Science Foundation	Pending	367,133.00	0.00	New
Enderlin, Ellyn	Validation of Calving Laws for Greenland's Tidewater Glaciers	PI	Climate Change Institute	1 National Aeronautics & Space Administratio	Pending	433,575.00	0.00	New
Enderlin, Ellyn	Assessing glacier meltwater hazards in High Mountain Asia from remote sensing and numerical mode	PI	Climate Change Institute	0.7 National Aeronautics & Space Administratio	Pending	686,536.00	0.00	New
Enderlin, Ellyn	Collaborative research: Controls on seasonal patterns of outlet glacier velocities and implications for t	PI	Climate Change Institute	0.95 National Science Foundation	Pending	887,022.00	0.00	New
Enderlin, Ellyn	Quantifying Greenland Iceberg Melt Rates	PI	Climate Change Institute	1 National Science Foundation	FundedC	172,372.00		Continuation
Fernandez, Ivan J.	Nitrogen controls on detrital organic matter dynamics in the Northern Forest: Evidence from a 26-year Co-PI (Grusel	Co-PI (Grusel)	School of Forest Resources	0.15 US Dept of Agriculture	Pending	79,957.00	33,221.00	New
Fernandez, Ivan J.	Wildlife in winter: developing a coordinated research strategy to address impacts of changing winters	Co-PI (Nelson)	School of Forest Resources	0.05 ME Dept of Inland Fisheries & Wildlife	Pending	16,610.00	33,707.00	New
Fernandez, Ivan J.	Undergraduate Fellowships for Science-based Climate Change Adaptation for Farms and Forests in the	PI	School of Forest Resources	1 US Dept of Agriculture	Pending	6,000.00	2,568.00	New
Fernandez, Ivan J.	Quantifying and predicting soil carbon storage and turnover in the Northern Forest	PI	Lead PI's Department	1 US Dept of Agriculture	Pending	10,293.00	11,778.00	New
Fernandez, Ivan J.	Buried dead wood: The missing carbon pool in the Northern Forest?	PI	School of Forest Resources	0.4 US Dept of Agriculture	Pending	77,559.00	0.00	New
Fernandez, Ivan J.	LTREB: Renewal: Biogeochemical Mechanisms of Response Yr5	PI	Lead PI's Department	1 National Science Foundation	Funded	89,721.00	0.00	Continuation
Gill, Jacquelyn	Isoscapes, Models & a Novel Proxy of the SH Westerlies	PI	Climate Change Institute	1 National Aeronautics & Space Administratio	Declined	30,000.00	11,506.00	New
Gill, Jacquelyn	Collaborative research: A mouse's eye view of Rancho La Brea: Assessing millennial-scale community s	PI	Climate Change Institute	1 National Science Foundation	Pending	296,534.00	0.00	New
Gill, Jacquelyn	Collaborative Research: LEADING- AND TRAILING-EDGE RESPONSES OF THE PLEISTOCENE BOREAL FOR	PI	Climate Change Institute	1 National Science Foundation	Declined	344,679.00	0.00	New
Hall, Brenda L.	Signature of the Last Termination in Maine	PI	Climate Change Institute	1 The Comer Science and Education Foundatio	Funded	30,000.00	12,840.00	New
Hall, Brenda L.	Collaborative Research:The influence of past warm periods on the behavior of Greenland outlet glacie	PI	Climate Change Institute	1 National Science Foundation	Declined	293,296.00	0.00	New
Hall, Brenda L.	Response of the Antarctic Ice Sheet to the last great global warming	PI	Climate Change Institute	0.5 National Science Foundation	Pending	382,268.00	0.00	New
Hall, Brenda L.	Coll. Res.: Exploring the Vulnerability of Southern Ocean Pinnipeds to Climate	PI	Climate Change Institute	1 National Science Foundation	FundedC	269,584.00		Continuation
Hall, Brenda L.	Coll. Res.: Assessing the Antarctic Contribution to Sea-Level Change (Hatherton)	PI	Climate Change Institute	1 National Science Foundation	FundedC	200,803.00		Continuation
Hall, Brenda L.	The Termination of the Last Ice Age in the Falkland Islands (NGS)	PI	Climate Change Institute	1 National Geographic Society	FundedC	20,625.00		Continuation

Hamilton, Gordon	Antarctic Submarine Melt Variability from Remote Sensing of Iceberg Co-PI (Enderlin)	Climate Change Institute	0.25 National Science Foundation	Pending	367,133.00	0.00 New
Hamilton, Gordon	Remote Sensing of Icebergs in Greenland's Fjords and Coastal Water PI	Climate Change Institute	1 National Aeronautics & Space Administration	Funded	90,000.00	New
Hamilton, Gordon	Spatial and Temporal Patterns in Submarine Melt Rates around Antar PI	Climate Change Institute	1 National Science Foundation	Pending	302,171.00	New
Hamilton, Gordon	Collaborative Research: 79 North Project - Oceanic and Glaciological PI	Climate Change Institute	1 National Science Foundation	Pending	348,237.00	New
Hamilton, Gordon	Development & Deployment of an Autonomous Greenland Outlet Glacier PI	Climate Change Institute	1 Heising Simon Foundation	FundedC	558,718.00	Continuation
Hamilton, Gordon	Linking Greenland Ice Sheet Mass Loss to Decadal Circulation (NASA) PI	Climate Change Institute	1 National Aeronautics & Space Administration	FundedC	217,421.00	0.00 Continuation
Hamilton, Gordon	Collaborative Research: Flow and Fracture Dynamics in an Ice Shelf PI	Climate Change Institute	0.75 National Science Foundation	FundedC	357,356.00	0.00 Continuation
Hamilton, Gordon	Linking ice mélange characteristics to variability in outlet glacier dynamics PI	Climate Change Institute	0.5 National Science Foundation	Pending	425,577.00	0.00 New
Isenhour, Cynthia	Maine's Community Waste Toolbox: Resources for Healthier People Co-PI (Hart)	Senator George J. Mitchell Center	0.25 Elmina B. Sewall Foundation	Pending	97,621.00	0.00 New
Isenhour, Cynthia	RRII Track-2 FEC: Food Energy Water Nexus in Northern New England: Co-PI (Rubin)	Margaret Chase Smith Center	0.25 National Science Foundation	Pending	1,456,168.00	0.00 New
Isenhour, Cynthia	MEASURING AND MODELLING THE VALUE OF REUSE ECONOMIE: TOPI	Senator George J. Mitchell Center	0.35 National Science Foundation	Declined	779,719.00	0.00 New
Koons, Peter O.	Topographic stress and anisotropy PI	Lead PI's Department	0.9 National Science Foundation	Pending	140,942.00	0.00 New
Koons, Peter O.	BIGDATA: Coll. Res. IA: Scalable Multi-resolution Data Management for Co-PI (Zhu)		National Science Foundation	Pending	499,638.00	New
Koons, Peter O.	Coll. Res.: Influence of Natural Ice Microstructure on Rheology in Greenland Co-PI (Gerbi)		National Science Foundation	FundedC	420,937.00	Continuation
Koons, Peter O.	Coll. Res.: Rivers, Faults, and Growing Mountains PI		National Science Foundation	FundedC	169,044.00	Continuation
Koons, Peter O.	Coll. Res.: Modeling Sediment Production from Glaciers off the Alaska PI		National Science Foundation	FundedC	165,005.00	Continuation
Kreutz, Karl J.	MRI: Acquisition of LA-HR-ICP-MS equipment for in situ trace element analysis Co-PI (Cruz-Uribe)	Climate Change Institute	0.1 National Science Foundation	Pending	682,528.00	536,496.00 New
Kreutz, Karl J.	Cordillera Darwin Glacier and Paleoclimate Assessment PI	Climate Change Institute	1 National Geographic Society	FundedC	11,952.00	Continuation
Kreutz, Karl J.	P2C2 CR: Reconstructing Central Alaskan Precipitation (Denali) PI	Climate Change Institute	1 National Science Foundation	FundedC	364,770.00	Continuation
Kreutz, Karl J.	SPICE Core Chronology & Climate Records Using Chemical & Microprobe PI	Climate Change Institute	1 National Science Foundation	FundedC	389,306.00	Continuation
Kreutz, Karl J.	Geophysical Reconnaissance to Expand Ice core Hydroclimate Reconstruction PI	Climate Change Institute	1 National Science Foundation	Funded	214,890.00	New
Kurbatov, Andrei	Collaborative research: Expanding an Antarctic tephra database for ice PI	Climate Change Institute	1 National Science Foundation	Pending	49,973.00	0.00 New
Kurbatov, Andrei	Collaborative Research: Imprinting Concepts of Paleoclimate Research PI	Climate Change Institute	0.2 National Science Foundation	Declined	223,073.00	0.00 New
Kurbatov, Andrei	Mapping preserved volcanic products near Greenland Summit station PI	Climate Change Institute	1 National Science Foundation	Declined	299,457.00	0.00 New
Kurbatov, Andrei	Coll. Res.: Developing an Antarctic Tephra Database ... (AntT) PI	Climate Change Institute	1 National Science Foundation	FundedC	365,095.00	Continuation
Kurbatov, Andrei	Coll. Res.: Tephrochronology of a South Pole Ice Core (SPICE TEPHRA) PI	Climate Change Institute	1 National Science Foundation	Funded	205,000.00	New
Lyon, Bradfield	Leveraging CMIP5 and NASA/GMAO Coupled Modeling Capacity for SPI	Climate Change Institute	1 National Aeronautics & Space Administration	Funded	46,441.00	0.00 New
Lyon, Bradfield	Diagnostics, Trends and Climate Model Projections of U.S. Summer Heat PI	Climate Change Institute	1 US Dept of Commerce	Funded	113,998.00	0.00 New
Lyon, Bradfield	Drying Versus Wetening of the East African Climate PI	Climate Change Institute	1 National Science Foundation	Funded	120,655.00	0.00 New
Lyon, Bradfield	Crop per Drop per Watt in the Food-Energy-Water Systems' Nexus PI	Climate Change Institute	1 National Science Foundation	Pending	186,271.00	0.00 New
Mayewski, Paul	Arcadia Ice Core Proposal - Initiatives on the Science of the Human Past PI	Climate Change Institute	1 Arcadia Fund	FundedC	358,897.00	Continuation
Mayewski, Paul	NSFGEO-NERC: Collaborative Research: FERTILISE (Future Ecosystem PI	Climate Change Institute	1 National Science Foundation	Pending	208,285.00	0.00 New
Mayewski, Paul	High resolution approach to Eemian layers in a Greenland ice core: G PI	Climate Change Institute	0.6 National Science Foundation	Pending	668,149.00	0.00 New
Mayewski, Paul	Coll. Res: Pleistocene/Holocene Climate Reconstruction ... (PAMIR) PI	Climate Change Institute	1 National Science Foundation	FundedC	590,831.00	Continuation
Mayewski, Paul	Collaborative Research: Ultra-High-Resolution Investigation of High Arctic PI	Climate Change Institute	0.75 National Science Foundation	Funded	725,107.00	0.00 New
Mayewski, Paul	Coll. Res.: Investigating Hypothesized Bolide Signatures PI	Climate Change Institute	1 National Science Foundation	FundedC	33,587.00	Continuation
Mayewski, Paul	Coll. Res: Window Into the 40kyr World ... Allan Hills Blue Ice Area PI	Climate Change Institute	1 National Science Foundation	Funded	98,988.00	New
Mayewski, Paul	Arcadia Ice Core Proposal - 2016 Submission PI	Climate Change Institute	1 Arcadia Fund	Funded	318,897.00	New
McGill, Brian	NRT-DESE: Change Analysis in Heterogeneous and Complex Datasets Co-PI (Beard-Tisd)	National Center for Geographic Information	0.02 National Science Foundation	Pending	2,999,716.00	0.00 New
McGill, Brian	NNX11AP72G: Integrating global species distributions, remote sensing PI	Senator George J. Mitchell Center	1 National Aeronautics & Space Administration	Funded	66,082.00	0.00 Supplement
McGill, Brian	Collaborative Research: ABI Development: Creating a generic workflow PI	Senator George J. Mitchell Center	1 National Science Foundation	Pending	89,964.00	0.00 New
McGill, Brian	REMOTE SENSING FOR EPIDEMIOLOGY IN AFRICAN CITIES PI	Senator George J. Mitchell Center	1 belspo	Pending	97,912.00	176,833.00 New
Norton, Stephen A.	Evaluating potential for lake water quality decline by partnering with Co-PI (Amirbahman)	Lead PI's Department	0.4 National Science Foundation	Pending	97,815.00	0.00 New
Olsen, Brian	Determining bird and invertebrate food-web connections and use of Co-PI (Klemmer)	Lead PI's Department	0.5 ME Dept of Inland Fisheries & Wildlife	Pending	18,315.00	3,112.00 New
Olsen, Brian	Tidal wetlands after Hurricane Sandy: Baseline restoration assessment PI	Climate Change Institute	1 US Dept. of Interior	Funded	291,092.00	New
Olsen, Brian	Resilience of Tidal Marsh Bird Community to Hurricane Sandy (SAND) PI	Climate Change Institute	1 US Dept. of Interior	FundedC	1,409,127.00	Continuation

Peterson, Michael L.	Thermal Shock and Impact Fracture Resistance of Ceramic-Metal Interpenetrating Phase C Co-PI (Jin)	PI	Lead PI's Department	0.3 National Aeronautics & Space A	Pending	743,749.00	230,002.00	New
Peterson, Michael L.	Equipment for Alternative Feed for Aquaculture	PI	Lead PI's Department	1 National Science Foundation	Pending	13,424.00	0.00	New
Peterson, Michael L.	Assembly and Testing of Photo Bio Reactor	PI	Lead PI's Department	1 National Science Foundation	Pending	49,777.00	0.00	New
Putnam, Aaron	CAREER: The Last Glacial Termination in Interior Asia	PI	Lead PI's Department	1 National Science Foundation	Funded	591,098.00	0.00	New
Putnam, Aaron	The Last Glacial Termination at the Heart of Asia in the Mongolian Altai	PI	Climate Change Institute	1 Comer Science & Educational Fc	FundedC	83,300.00		Continuation
Robinson, Brian S.	Alaska Tangle Lakes Research Project	PI	Climate Change Institute	1 Research In Archeology	Funded	11,510.00	4,926.00	New
Robinson, Brian S.	Nevin DOT-Funded Project	PI	Lead PI's Department	1 US Dept of Transportation	Funded	15,000.00	2,644.00	New
Saros, Jasmine	Collaborative Research: Imprinting Concepts of Paleoclimate Research (iCPR)	Co-PI (Kurbatov)	Climate Change Institute	0.2 National Science Foundation	Declined	223,073.00	0.00	New
Saros, Jasmine	The Future of Four Seasons in Maine: A Scientist-Teacher-Student Partnership to Investiga	Co-PI (Nelson)	Senator George J. Mitchell Center	0.15 US Dept of Commerce	Funded	58,049.00	683.00	Continuation
Saros, Jasmine	NRT-INFIEWS: Integrating Renewable Energy, Fisheries, and Aquaculture: Advancing the Si	Co-PI (Zydlowski)	School of Marine Sciences	0.02 National Science Foundation	Pending	2,999,948.00	0.00	New
Saros, Jasmine	Jordan Pond Buoy Project	PI	Climate Change Institute	1 Friends of Acadia	Funded	19,962.00	6,934.00	New
Saros, Jasmine	Jordan Pond Buoy Project Year 2	PI	Climate Change Institute	1 Friends of Acadia	Funded	24,997.00	9,089.00	New
Saros, Jasmine	Assessing the Vulnerability of Maine's Drinking Water Resources to Extreme Precipitation	PI	Climate Change Institute	0.8 US Dept of the Interior	Funded	27,277.00	67,773.00	New
Saros, Jasmine	Collaborative Proposal: MSB-FRA Climate change-induced divergence of ecosystem structu	PI	Climate Change Institute	1 National Science Foundation	Pending	79,951.00	0.00	New
Saros, Jasmine	NERC-NSFGEO: Frozen Arctic lakes as biological hotspots	PI	Climate Change Institute	1 National Science Foundation	Pending	199,172.00	0.00	New
Saros, Jasmine	Collaborative Research: Predicting the response of boreal lakes to climate change: in-lake	PI	Climate Change Institute	1 National Science Foundation	Declined	207,259.00	0.00	New
Saros, Jasmine	IGERT: Adaptation to Abrupt Climate Change	PI	Climate Change Institute	0.4 National Science Foundation	FundedC	2,929,087.00	0.00	Continuation
Saros, Jasmine	Collaborative Research: Quantifying the role of lakes in a rapidly changing arctic carbon cy	PI	Climate Change Institute	0.8 National Science Foundation	Declined	471,569.00	0.00	New
Saros, Jasmiine	Deciphering the Ecology of Key Diatom Taxa to Understand (W. Greenland)	PI	Climate Change Institute	1 National Science Foundation	FundedC	353,980.00		Continuation
Sorg, Marcella H.	Drug Death Monitoring 2015-2016	PI	Margaret Chase Smith Center	1 ME Attorney General	Funded	40,265.00	5,673.00	New
Sorg, Marcella H.	Maine-Vermont Violent Death Reporting System Yr 2	PI	Margaret Chase Smith Center	1 US Dept of Health & Human Ser	Funded	131,829.00	0.00	Continuation
Spaulding, Nicole	Coll. Res.: Allan Hills Englacial Site (ACHILLES) Selection	PI	Climate Change Institute	1 National Science Foundation	Funded	35,594.00		New
Zaro, Gregory	Investigation of an Ottoman Fortress at Nadin-Gradina, Croatia	PI	Lead PI's Department	1 Rust Family Foundation	Funded	5,700.00	1,482.00	New

TOTAL SUBMISSIONS INCLUDES FUNDED, PENDING, CONTINUATION, DECLINED & WITHDRAWN GRANTS	COUNT=118	\$37,275,164.00
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APPENDIX C: BRIEF OVERVIEW OF EACH MAJOR NEW AWARD

(This listing includes only the listing of new grant awards for FY2016. A listing of continuing awards through FY2016 are included in the supplemental listing at the end of this document).

Project Title: Collaborative Research: Potential direct geologic constraints on ice sheet thickness in the central Transantarctic Mountains during the Pliocene warm period

National Science Foundation

\$291,563

REU: \$5,789

PI: Gordon Bromley

The proposed research will investigate glacial deposits corresponding to the East Antarctic Ice Sheet in the central Transantarctic Mountains in order to expand the geologic record of past ice-sheet behavior. The overarching research objectives are to improve our understanding of the East Antarctic Ice Sheet (EAIS) configuration during periods of warmer-than-present climate, such as the Pliocene, and to determine whether the ice sheet underwent significant volume changes or remained relatively stable in response to warming. This information is crucial for understanding past and future contributions of the EAIS to sea level. To address these goals, the investigation will map and date glacial deposits preserved at sites immediately adjacent the EAIS. Specifically, the project will: (i) use multiple cosmogenic nuclides to establish more fully the surface-elevation history of the upper Shackleton and Beardmore Glaciers; (ii) use this record to identify periods during which the EAIS was at least as extensive as today (and, conversely, when the ice sheet was less extensive); (iii) use these data to assess long-term ice-sheet variability in East, with particular emphasis on Pliocene warm episodes. This proposal requires fieldwork in the Antarctic.

Project Title: Campuses for Environmental Stewardship/Davis Educational Foundation

Maine Campus Project

\$4,000

PI: Daniel Dixon

The University of Maine's comprehensive sustainability efforts improve lives and communities throughout the state of Maine and beyond. This deep-rooted dedication to sustainability began in 1865 with the University's establishment as Maine's flagship Land Grant institution. Its greatest contribution towards sustainability is through interdisciplinary education, research, and public service. UMaine's world-renowned research programs contribute cutting-edge knowledge at local, national, and international levels, knowledge that is used to protect and enhance the health and well-being of humans and ecosystems. UMaine's ongoing outreach efforts engage the expertise of the university community to address the ecological and social challenges that we face now and in the future. For example, for more than 100 years, the UMaine Extension has been putting university research to work in homes, businesses, farms, and communities in every corner of Maine. Educational outreach efforts focus on the Maine Food System, Positive Youth Development, and Community and Economic Development. With sixteen county offices and over one hundred active outreach programs throughout the state, the Cooperative Extension is an excellent example of dedication to public service. One of UMaine's educational goals is to inspire core sustainability values in all its graduates while at the same time inspiring them to become the next generation of environmental leaders and innovators, skilled in ways that promote responsible stewardship of human, natural, and financial resources. The Campuses for

Environmental Stewardship (CES) project complements the mission of the University by promoting environmental service-learning courses that encourage students to work with community partners on issues of pressing environmental concern. Such service-learning projects will stimulate community-campus partnerships and teach students to apply their knowledge to real-world problems. The CES project will cultivate diversified skill sets amongst participants via cross-course interactions at multiple academic levels and will provide professional development opportunities for associated faculty. The Campuses for Environmental Stewardship initiative aligns seamlessly with the UMaine Blue Sky Strategic Plan. While focusing on UMaine's Signature and Emerging Areas of excellence in research and education, the Blue Sky Plan's ultimate goal is to transform the University of Maine into the *most student-centered and community-engaged of the American Research Universities*. Participating in this CES initiative will move UMaine closer to that goal.

Project Title: Mandela Washington Fellowship Energy Institute – The University of Maine

US Dept. of State

\$150,000

PI: Daniel Dixon

UMaine's Institute on Public Management will provide an overview of public management and Leadership in the areas of regional economic and workforce development; financial management in public and non-profit organizations; environmental policy management, and planning and the global knowledge economy. The Institute will emphasize active learning that integrates the use of data, scientific methods of inquiry, and the use of technology. Founded in 1865, the University of Maine is a Land and Sea Grant institution and the flagship campus of the University of Maine System. Our vibrant and dynamic University serves the residents of Maine, the nation, and the world through our acclaimed programs in teaching, research, and outreach.

Our Public Management Institute will be supported by faculty from the School of Economics, the School of Policy and International Affairs, the Foster Center for Innovation, the Climate Change Institute, and the School of Marine Sciences. We have site visits to our capital city (Augusta, ME) planned where we will discuss management of public infrastructure with utility regulators and legislative leaders. We are partnering with Bangor AmeriCorps to provide community service programs that focus on critical basic needs, while simultaneously working to increase employment opportunities through job/skill training and education.

Project Title: Signature of the Last Termination in Maine

Comer Science & Education Foundation

\$30,000

PI: Brenda Hall

The timing and sequence, as well as global (a)synchrony, of events during Termination I are prerequisite for understanding the mechanisms by which the earth exits an ice age. The last decade has seen significant improvement in the Southern Hemisphere climate record, resulting in the documentation there of large-scale warming at the start of Heinrich Stadial 1 (HS-1; 14.5-17.5 ka). With improvements to the Southern Hemisphere climate record well underway, we now can turn our attention to the Northern Hemisphere. What was Northern Hemisphere climate during HS-1? Largely winter-centric climate proxies from the North Atlantic region suggest cold conditions during HS-1, supporting the concept of a bipolar seesaw in climate (i.e., Broecker,

1998). However, a limited number of mountain-glacier records (i.e., Italian Alps - Ravazzi et al., 2014, Brooks Range - Pendleton et al., 2015, Wind River Range - Putnam, pers. comm.), thought to document summer temperature, appear to indicate warming and Northern Hemisphere glacier recession during HS-1. Moreover, marine cores off the Channel River suggest rapid melting of the European ice sheet at the same time (Toucanne et al., 2015). If this pattern of Northern Hemisphere summer warming can be confirmed, it would favor the idea that HS-1, the first major step of the termination, was characterized by extreme seasonality in the North Atlantic region. Moreover, it leaves open the possibility that the warming that characterized the start of the termination in the Southern Hemisphere at ~18 ka was global.

Our approach towards addressing this question is to compare the timing of glacier recession - a proxy for warming climate - from both hemispheres. Specifically, I propose to examine the behavior of the southeastern sector of the Laurentide Ice Sheet (LIS) where it covered Maine. I will improve significantly the deglaciation chronology using 50^{10}Be surface-exposure ages of carefully selected, glacially molded granite boulders, from sites above the former marine limit between the present-day coast and the late-glacial moraine belt. These ages will afford a chronology for deglaciation that will allow us to test whether or not rapid and widespread deglaciation (and by inference, summer warming), occurred during HS-1 in the Northern Hemisphere.

Project Title: Remote Sensing of Icebergs in Greenland's Fjords and Coastal Waters

National Aeronautics & Space Administration

\$90,000

The response of the Greenland Ice Sheet to climate changes over the past several decades has motivated numerous investigations of the mechanisms controlling dynamic mass loss at the marine boundaries of outlet glaciers. Icebergs are a scientifically interesting component of the ice-ocean interactions occurring in Greenland's fjords and coastal waterways, yet they have been the focus of a relatively limited number of studies. This proposal seeks to use icebergs to gain insights into key characteristics of Greenland's ice-ocean environment. Specifically, we aim to quantify the size and distribution characteristics of icebergs in Greenland's coastal waters, infer bathymetry based on iceberg freeboards, and gain insight into circulation patterns using icebergs as "drifters" by exploiting the ~30 year archive of optical satellite imagery (e.g. Landsat, ASTER, Worldview, Quickbird). These objectives align with the NASA Science Mission Directorate's objective 2.2, to advance knowledge of Earth as a system to meet the challenges of environmental change, and to improve life on our planet. The proposed work will provide important information to further our understanding of ice-ocean interactions in Greenland's fjords and coastal waters and support the development of safe navigation and related marine policies.

Project Title: Coll. Res.: Tephrochronology of a South Pole Ice Core (SPICE TEPHRA)

National Science Foundation

\$205,000

PI: Andrei Kurbatov

Ice cores in polar regions offer unparalleled records of earth's climate over the past 800,000 years. Accurate chronology of individual ice cores, and chronological correlations between different ice cores is critically important to interpretation of the climate record.

Tephrochronology, analysis and correlation of volcanic ash layers, is one of a set of tools that

may yield a chronological record in ice, one with the advantage of being completely independent of the earth's climate or atmosphere. The field of Antarctic tephrochronology has been progressing steadily, with a greater body of work developing for cores in East Antarctica, and an incredibly rich tephra record preserved in the WAIS Divide core. Major advances in this field have been made due to the acquisition of a number of cores with well-preserved volcanic records, the improvement of analytical techniques, and recent positive identification, by the PIs, of well-dated tropical tephra in Antarctic ice. This proposal seeks to investigate the volcanic record in the 1500 m. SPICE ice core that will be completed at the South Pole during the 2015/16 field season. This site offers the opportunity to link East and West Antarctic tephra records, as well identifying tephra derived from well-dated large, tropical eruptions that affected global climate. Tephra layers have been identified in portion of the ice core drilled during 2014/15, and more are likely to be found.

Project Title: Leveraging CMIP5 and NASA/GMAO Coupled Modeling Capacity for SERVIR East Africa Climate Projections

National Aeronautics & Space Administration

\$46,441

PI: Bradfield Lyon

This work will leverage global climate modeling capabilities and incorporate statistical approaches in the development and refining of a statistical-dynamical model for generating an array of plausible hydro meteorological scenarios spanning seasonal to multi-decadal time horizons that will serve various SERVIR East Africa decision support system applications. This effort will also include building the capacities of our in-region partners on the utilization of this model. In this one-year effort the PI will: (i) develop, test and run the statistical-dynamical model to generate plausible future climate scenarios on timescales of seasons to decades, and (ii) use the model to generate regionally and temporally downscaled climate information to be used as input to crop and hydrologic models to be run by project collaborators.

Project Title: Diagnostics, Trends and Climate Model Projections of U.S. Summer Heat Waves

US Dept. of Commerce

\$113,998

PI: Bradfield Lyon

This proposal will leverage infrastructure currently in place at the IRI/Columbia University to access and diagnose the observational and model data used in this study. The relevant data sets already reside in the IRI Data Library (DL). Routines to access the CMIP5 climate model data via the IRI DL have already been developed and will be implemented in this study. Additional routines have also already been developed to compute the unconditional probability of heat waves, based on multiple heat wave definitions and datasets as well as the conditional probabilities based on land surface conditions (either based on a proxy drought index or modeled soil moisture anomalies). Routines to conduct the compositing analysis are also in hand as is the code to perform the required EOF analysis. Thus, the proposed work can begin immediately.

Project Title: Drying Versus Wettening of the East African Climate

National Science Foundation

\$120,655

PI: Bradfield Lyon

In the final year of the project, emphasis will be on completing the diagnostic analysis of climate model projections for East Africa. This will include:

- Completing the examination of the “thermodynamic” and “dynamic” contributions to the overall CMIP5 water budget in climate projections over East Africa;
- Write a summary of the main results of the effort above in a manuscript to be submitted to a peer-reviewed journal;
- Build on earlier results by comparing CMIP5 sea surface temperature (SST) projections (emphasis on tropical Indian and Pacific Oceans) with biases in CMIP5 SST simulations of the current climate. Examine associated changes in the atmospheric circulation of relevance to the climate of Eastern Africa. Summarize main results in a second manuscript to be submitted to the Journal of Climate.

Project Title: Collaborative Research: Ultra-High-Resolution Investigation of High Andean Snow and Ice Chemistry To Improve and Ice Stratigraphy from the Reanalysis Era as a basis for Paleoclimatic Reconstructions

National Science Foundation

\$725,107

PI: Paul Mayewski

Overview: This project combines transformative advances in ice core sampling technology, cyberinfrastructure, as well as climate modeling and analysis. These advances will be applied to fresh snow, snowpits and ice cores we will recover from ice caps in Peru and Bolivia. We will investigate South American atmospheric circulation features (e.g. El Niño/Southern Oscillation (ENSO), the Southern Hemisphere trades and westerlies), tropical-mid-latitude-polar teleconnections (e.g. impacts of recent warming on the Antarctic Peninsula and stratospheric ozone depletion induced strengthening and poleward migration of the westerlies), the significance of key global-scale forcings (e.g. solar variability, volcanic activity, dusts, and greenhouse gases) that control atmospheric circulation, all of which have significant relevance to moisture and heat transport over South America. We will investigate these cores at unprecedented resolution (μm) yielding hundreds of samples per year to examine the timing, magnitude, and frequency of, for the first time, the sub-seasonal scale components that yield climate changes (notably abrupt climate change events) as potential analogs for future change - most of which cannot be captured by coarser conventional ice core sampling techniques. This project builds on our recent W.M. Keck Foundation and NSF supported transformative laser sampling of ice cores and our newly released, NSF supported cyberinfrastructure and climate analysis tools.

Project Title: Collaborative Research: Window into the 40 kyr world from climate records in 1 Ma ice from the Allan Hills Blue Ice Area

National Science Foundation

\$98,988

PI: Paul Mayewski

Overview: Between about 2.8-0.9 Ma, Earth’s climate was characterized by 40kyr cycles, driven or paced by changes in the tilt of Earth’s spin axis. Much is known about the 40 kyr world from studies of deep-sea sediments, but our understanding of climate change during this period is incomplete because we lack records of Antarctic climate and direct records of atmospheric

greenhouse gas concentrations.

We propose to address these issues by building on our recent studies of ancient ice from the Main Ice Field, Allan Hills, Antarctica. During previous field seasons we recovered ice extending from 0.1 Ma-1 Ma based on $^{40}\text{Ar}_{\text{ATM}}$ dating of Ar in the trapped gases. Our discovery of million year-old ice demonstrates that there is gas-record quality ice from the 40k world in the Allan Hills Main Ice Field. We have identified 2 different sites, each overlying bedrock at ~ 200 m depth, that are attractive targets for coring ice dating to 1 Ma and beyond. We request support to core at these 2 sites, re-occupy our previous site with million year-old ice, drill it to the bedrock, and generate 10-20 short (~10 meter) cores in areas where terrestrial meteorite ages suggest ancient surface ice. We also request support to date the ice using the $^{40}\text{Ar}_{\text{ATM}}$ dating of trapped Ar and characterize its continuity by comparing the chemistry of the ice and trapped gases.

Project Title: Arcadia Ice Core Proposal – The Last Two Thousand Years of European History and Environmental Change – 2016 Submission

Arcadia Foundation

\$318,897

PI: Paul Mayewski

The extraordinarily deep and rich historical and archaeological record of Europe makes it an exceptionally revealing landscape within which to investigate environmental change and human response over the last two thousand years. Although recent years have seen the development of selected European high-resolution (near-annual, annual, sub-annual) climate records from natural scientific proxy evidence such as tree rings and speleothems (calcium carbonate deposits in caves that under some circumstances, preserve records of the chemistry and abundance of precipitation), without question the most robust of all paleo-environmental archives is the ice core record. These, however, have been largely lacking for Europe at the fine resolution required to truly capitalize upon the potential for synthesis with the region's rich written and archaeological heritage. The path-breaking insights likely to emerge from this synthesis have been awaiting the creation of such an ice-core record for Europe.

Project Title: CAREER: The Last Glacial Termination in Interior Asia

National Science Foundation

\$591,098

PI: Aaron Putnam

The climate event that ended the last ice age – dubbed the “last glacial termination” – involved the greatest natural global warming of the recent geologic past. This was also the last time in which atmospheric CO_2 rose by a substantial amount prior to the industrial period. The last glacial termination therefore represents a spectacular natural experiment played out by the Earth system that can be studied in order to decipher the underlying dynamics of the climate system and its sensitivity to forcing factors, such as atmospheric CO_2 . This project aims to determine when, and how rapidly, glaciers receded and the climate warmed at the end of the last ice age in the heart of Asia – Earth's largest and most populous continent. The glacier-inferred climate chronologies developed from this study will help to identify the forcing factors that produced this last great global warming, and to clarify the role of atmospheric CO_2 in ice-age climate cycles. This work will provide immersive, field-based, and cooperative educational experiences for the next generation of scientists. The project will bring together a research team that includes

underrepresented high-school students and STEM teachers from the South Side of Chicago, graduate and undergraduate students from the U.S.A., Mongolia, and China, and graduate students of science journalism. The overarching goal is to establish and nurture international and cross-cultural educational and scientific partnerships that are built to last well beyond the duration of this project. Identifying the causes of the last glacial termination is a major objective of the earth and climate sciences, and requires detailed chronologies of sensitive paleoclimate proxies that monitored the last glacial-to-interglacial transition across the planet. The purpose of this CAREER research is to develop such chronologies from the center of Asia for the reduction of mountain glacier extent from the peak of the last ice age to today's conditions. Glacier chronologies will be based on precise and accurate ¹⁰Be surface-exposure dating of glacial landforms in the mid-latitude Altai range of Mongolia and in the monsoonal eastern Himalaya of China. Glaciological modeling will convert these glacier reconstructions into records of glacier-inferred atmospheric temperature, which will in turn be compared with signatures of incoming solar radiation, greenhouse gases, as well as other proposed drivers, to discriminate among possible causes of the last termination. This project will be carried out following an integrated research and education plan that implements a cooperative, field-based learning strategy in which students at different levels learn by teaching each other. The collaborative, cross-cultural, multi-national, and multi-generational team will share knowledge and experiences in the field and throughout the scientific process. This team will consist of (1) graduate and undergraduate students from the University of Maine, (2) students and researchers from Mongolian and Chinese institutions, (3) students and science teachers from the Gary Comer College Preparatory school – a public charter school devoted to improving the lives of underserved minority students from the South Side of Chicago, and (4) embedded science journalism graduate students from the Medill School of Journalism who will produce stories for publication and broadcast, thus documenting scientific outcomes for the public.

Project Title: Alaska Tangle Lakes Research Project

Research in Archeology

\$11,510

PI: Brian Robinson

This proposal is for archaeological research on the Tangle Lakes Region of Central Alaska. The purpose is to finish research and publication that was conducted before 2004 when the principal investigator took a faculty position at the University of Maine. The work includes completing a book on the region and then returning several dozen boxes of Alaskan materials to Alaska. The grant covers student and temporary worker fees for these sites and a concurrently analyzed Paleoindian site in Massachusetts.

Project Title: Nevin DOT-Funded Project

US Dept. of Transportation

\$15,000

PI: Brian Robinson

The replacement or upgrade of the bridge next to the Nevin Shell Heap archaeological site in Blue Hill, ME initiated consultations between Maine Department of Transportation (DOT), the Maine Historic Preservation Commission (MHPC), the Tribal Historic Preservation Officers (THPO) of the Penobscot and Passamaquoddy Tribes, the University of Maine, and the University of Southern Maine. Initial excavations at the Nevin site in 1930s did not include

methods considered standard archaeological practice today, such as screening backdirt, collecting samples for fine screen analysis, and performing a detailed faunal analysis. Due to the potential disturbance to the site by Maine DOT activities, the MHPC is cooperating with the University of Maine to perform archaeological survey and recovery tasks prior to the bridge replacement. The role of the University of Maine in this project is twofold: 1) record site stratigraphy, relocate the grid from the 1930s excavations, tie modern excavations into this grid, and recover archival and research column samples for fine screen analysis from an actively eroding portion of the site as part of Sky Heller's dissertation research, and 2) collection, preparation, and analysis of micromorphology samples by Andrew Heller. The latter will produce both archival samples and analysis of selected profiles. In both cases this brief project will recover sufficient material to support multiple years of research, although our contract funds are allocated for one year.

Project Title: Jordon Pond Buoy Project

Friends of Acadia

\$19,962 (YR1)

\$24,997 (YR2)

PI: Jasmine Saros

The Aquatic Scientist for the Jordan Pond Buoy project will assist Bill Gawley, Acadia National Park Biologist, with all aspects of buoy maintenance and data management.

Protocols: *Tasks:* Refine existing protocols as needed.

Data management: *Tasks:* Perform data checks during deployment every 1-2 days to ensure no issues with buoy hardware or data transmission, perform data processing after take-down, create summary plots/figures/datafiles, possible final presentation to Friends of Acadia and NPS regarding project details and findings.

Take-down of buoy: *Tasks:* Remove buoy and met station from Jordan Pond, storage & off-season maintenance scheduled if needed.

Maintenance: *Tasks:* Set up scheduling with NPS personnel for routine de-fouling and maintenance, make trips needed to address special issues with fouling, troubleshooting issues with buoy and/or data collection (flexible time, as needed when issues arise)

Outreach: *Tasks:* Maintain website and display kiosk.

Project Title: Drug Death Monitoring 2015-2016

ME Attorney General

\$40,265

PI: Marcella Sorg

This is a proposal for an agreement between the Department of Attorney General and the University of Maine to continue monitoring Maine's drug-induced and drug-related deaths. Project Year 1 would cover deaths that occurred during calendar year 2015 and the first quarter of CY 2016. Project Year 2 would cover deaths that occurred during CY 2016 and the first quarter of CY 2017. The project activities would begin in March of 2016 and end in June of 2017. The project could also be renewed for subsequent years. Dr. Marcella Sorg at the University of Maine, Margaret Chase Smith Policy Center has been monitoring Maine's drug deaths since 2001 in collaboration with the Maine Office of Chief Medical Examiner and Department of Attorney General. She has developed a database of those deaths that goes back to 1997, and over the past decade has been able to respond to public requests for information. She

has utilized funding from various sources to do that work, beginning in 2001 with funding from the Byrne fund block grant, continuing with federal funding from the Department of Justice and the U.S. Attorneys in 2008. She will be assisted by Research Associate Jamie Wren, MPH. The scope of work includes review of all cases accepted by the Office of Chief Medical Examiner in order to identify those cases where drugs were identified as a cause of death or significant contributing factor. Quarterly and end of year reports will be done. Dr. Sorg will be available to assist the Office of Chief Medical Examiner and the Office of Attorney General with data inquiries, as well as in the preparation of media releases. The reports will tabulate the number of cases for each calendar year to date, including trend lines for the previous decade. Additional analysis will be done on key drugs, such as heroin, fentanyl, methadone, and oxycodone, including an assessment of prescription status for pharmaceuticals. New and emerging drug problems will be analyzed as needed. As in the past, the analysis and reporting will be done in close cooperation with the Office of Chief Medical Examiner.

Project Title: Coll. Res.: Allan Hills Englacial Site (ACHILLES) Selection

National Science Foundation

\$35,594

PI: Nicole Spaulding

The Allan Hills Blue Ice Area (AH BIA) has recently been demonstrated to contain a continuous climate record covering the last 400 ka along an established glaciological flow line. This major finding was overshadowed by the discovery of the oldest ice on Earth (~1 Ma) at a site only 2 km east of the known flow line and accessible just 120 m below the surface. Still older ice may be present in the AH BIA, as meteorites collected in the area are reported to be as old as 1.8 Ma. Combined these data strongly suggest that the Allan Hills could contain a continuous, well-resolved environmental record, spanning at least the last 1 Ma, that could be collected within a single season by the newly built IDDO Intermediate Depth Drill. We expect that in the future this new system will recover an exceptional quality core from bubbly Allan Hills blue ice because its winch design, chip evacuation system, and use of drilling fluid should minimize ice fracturing. This proposal seeks funding to conduct a comprehensive ground penetrating radar (GPR) survey, model the ice flow three-dimensionally and trace the signature of the 1 Ma ice lens throughout the region. The most important deliverable of the project will be the selection of the ideal drill site for future collection of the 1 Ma+ ice core.

Project Title: Investigation of an Ottoman Fortress at Nadin-Gradina, Croatia

Rust Family Foundation

\$5,700

PI: Gregory Zaro

The Ottomans ruled over a complex empire in the Middle East for six centuries. Initial expansion of the small Ottoman state began in the early fourteenth century in what is now Turkey, taking over the former Byzantine capital of Constantinople by the middle of the fifteenth century. By the 1500s, the multi-ethnic and multi-religious Ottoman Empire was a major power in the eastern Mediterranean, ruling over parts of Southwest Asia, North Africa, and the Balkans, and its cultural legacy is still felt among the modern nation states of the eastern Mediterranean and beyond. Although the Ottoman Empire has received significant historical attention, much less effort has been directed towards an Ottoman Archaeology. The proposed 2016 work of the Nadin-Gradina Archaeological Project (NGAP) is a response to recent calls for greater

archaeological contributions to Ottoman studies. Funds from the Rust Family Foundation are specifically requested to evaluate the material nature of the Ottoman Empire at a frontier settlement. The proposed work will complete a plan of test excavations and mapping at the Ottoman era fortress on the summit of Nadin-Gradina, a hill fort site along the historic Ottoman-Venetian frontier near the ancient coastal city of Zadar, Croatia. Nadin-Gradina reflects approximately 2,500 years of occupational history: from Iron Age, to Roman, Late Antiquity, Late Medieval, and culminating with Ottoman imperial incursion in the sixteenth and seventeenth centuries. Test excavations will target areas within the Ottoman fortress to determine depth of deposits and architectural integrity, and to characterize the material assemblage. Architecture visible on the surface will also be mapped using digital aerial photography and Structure from Motion software to create a high-resolution three dimensional model of the structure, which will then be incorporated into a digital elevation model of the Nadin-Gradina archaeological site. The results of this work will accomplish three main objectives: (1) begin a catalog of Ottoman era artifacts and architectural remains at the Nadin-Gradina site; (2) evaluate the material consequences of Ottoman imperial rule in a frontier zone; and (3) by addressing the latest archaeological and historical materials component of Nadin-Gradina, the proposed work will make a crucial contribution to the overarching research aim of the NGAP, which is to evaluate 2,500 years of urbanization, landscape change, and climate in the eastern Adriatic.

CONTINUING GRANT AWARDS – FY2016

Project Title: Glaciological and Mass Balance Modeling of Walker Basin, Nevada

U.S. Department of Interior

\$21,066

PI: Sean Birkel

Project Title: Collaborative Research: Response of the Northwest Greenland Cryosphere to Holocene Climate Change

National Science Foundation

\$60,437 (YR1, YR2, YR3)

PI: Sean Birkel

Project Title: Collaborative Research: A Test of the Orbital Theory of Ice Ages from Glacial Deposits in Southern South America

National Science Foundation

\$21,450 (YR1, YR2, YR3)

PI: Sean Birkel

Project Title: Collaborative Research: GreenTrACS: A Greenland Traverse for Accumulation and Climate Studies

National Science Foundation

\$169,567 (YR1, YR2, YR3)

PI: Sean Birkel

Project Title: Quesada Fund: Furthering Gary Comer's Work

Quesada Fund
\$250,000 (Multiple Years)
PI: George Denton

Project Title: Putting the West Antarctic Ice Sheet into Context

National Science Foundation
\$379,130 (YR1, YR2, YR3)
PI: George Denton

Project Title: The Last Glacial Termination in Southern Middle Latitudes

National Science Foundation
\$393,844 (YR1, YR2, YR3)
PI: George Denton

Project Title: The Last Glacial Termination in the MacKenzie Valley

Comer Science & Education Foundation
\$56,763
PI: George Denton

Project Title: Intra-annual Force Balance Analysis of Tidewater Glaciers

National Aeronautics & Space Administration
\$270,355 (YR1, YR2, YR3)
PI: Ellyn Enderlin

Project Title: Quantifying Greenland Iceberg Melt Rates

National Science Foundation
\$172,086 (YR1, YR2, YR3)
PI: Ellyn Enderlin

Project Title: LTREB: Renewal: Biogeochemical Mechanisms of Response

National Science Foundation
\$89,721 (YR5)
PI: Ivan Fernandez

Project Title: Collaborative Research: Exploring the Vulnerability of Southern Ocean Pinnipeds

National Science Foundation
\$269,584 (YR1, YR2, YR3)
PI: Brenda Hall

Project Title: Collaborative Research: Assessing the Antarctic Contribution to Sea-level Change

National Science Foundation
\$200,803 (YR1, YR2, YR3)
PI: Brenda Hall

Project Title: The Termination of the Last Ice Age in the Falkland Islands

National Geographic Society

\$20,625

PI: Brenda Hall

Project Title: Development & Deployment of an Autonomous Greenland Outlet Glacier

Heising Simon Foundation

\$558,718 (YR1, YR2, YR3)

PI: Gordon Hamilton

Project Title: Linking Greenland Ice Sheet Mass Loss to Decadal Circulation Changes

National Aeronautics & Space Administration

\$217,421 (YR1, YR2, YR3)

PI: Gordon Hamilton

Project Title: Collaborative Research: Flow and Fracture Dynamics in an Ice Shelf Lateral

National Science Foundation

\$357,356 (YR1, YR2, YR3)

PI: Gordon Hamilton

Project Title: Collaborative Research: Influence of Natural Ice Microstructure on Rheology in General Shear: In-situ Studies in the Alaska Range

National Science Foundation

\$420,937 (YR1, YR2, YR3)

Project Title: Collaborative Research: Rivers, Faults, and Growing Mountains: Dynamic Feedback between Crustal Deformation, Rock Strength, and Erosion

National Science Foundation

\$169,044 (YR1, YR2)

PI: Peter Koons

Project Title: Collaborative Research: Modeling Sediment Production from Glaciers off the Alaska Peninsula during Quaternary Climate Oscillations

National Science Foundation

\$165,005 (YR1, YR2)

PI: Peter Koons

Project Title: Cordillera Darwin Glacier and Paleoclimate Assessment

National Geographic Society

\$11,951

PI: Karl Kreutz

Project Title: P2C2 – Collaborative Research: Reconstructing Central Alaskan Precipitation

National Science Foundation

\$364,770 (YR1, YR2, YR3)
PI: Karl Kreutz

Project Title: SPICE Core chronology and Climate Records Using Chemical and Microparticle Measurements

National Science Foundation
\$389,306 (YR1, YR2, YR3)
PI: Karl Kreutz

Project Title: Geophysical Reconnaissance to Expand Ice Core Hydroclimate Reconstructions in the Northeast Pacific

National Science Foundation
\$214,890 (YR1, YR2, YR3)
PI: Karl Kreutz

Project Title: Collaborative Research: Developing an Antarctic Tephra Database for Interdisciplinary Paleoclimate Research (AntT)

National Science Foundation
\$365,096 (YR1, YR2, YR3)
PI: Andrei Kurbatov

Project Title: Arcadia Ice Core Proposal - Initiatives on the Science of the Human Past (Harvard University)

Arcadia Fund (Harvard University)
\$358,897 (YR1, YR2, YR3)
PI: Paul Mayewski

Project Title: Collaborative Research: Pleistocene/Holocene Climate Reconstruction at Mid-Low Latitudes of the Northern Hemisphere Using a Pamir High Resolution Deep Ice Core

National Science Foundation
\$590,831 (YR1, YR2, YR3)
PI: Paul Mayewski

Project Title: Collaborative Research: Investigating Hypothesized Bolide Signatures in Greenland Ice at the Younger Dryas Onset

National Science Foundation
\$33,587
PI: Paul Mayewski

Project Title: Integrating Global Species Distribution Data

National Aeronautics & Space Administration
\$66,504 (YR4)
PI: Brian McGill

Project Title: Tidal Wetlands after Hurricane Sandy: Baseline Restoration Assessment and

Future Conservation Planning

U.S. Department of the Interior

\$291,092

PI: Brian Olsen

Project Title: Resilience of the Tidal Marsh Bird Community to Hurricane Sandy

U.S. Dept of Interior

\$1,409,127 (YR1, YR2, YR3)

PI: Brian Olsen

Project Title: The Last Glacial Termination at the heart of Asia in the Mongolian Altai

Comer Science and Education Fund

\$83,300

PI: Aaron Putnam

Project Title: The Future of Four Seasons in Maine

U.S. Department of Commerce

\$100,279 (YR1, YR2, YR3)

PI: Jasmine Saros

Project Title: IGERT: Adaptation to Abrupt Climate Change

National Science Foundation

\$2,929,087 (YR1, YR2, YR3, YR4, YR5)

PI: Jasmine Saros

Project Title: Deciphering the Ecology of Key Diatom Taxa to Understand Climate-Induced Changes in West Greenland Lakes

National Science Foundation

\$353,980 (YR1, YR2, YR3)

PI: Jasmine Saros

Project Title: Maine-Vermont Violent Death Reporting System – YR2

US Dept. of Health & Human Services

\$131,829

PI: Marcella Sorg

APPENDIX D: RESEARCH & SCHOLARSHIP SUMMARY

PUBLICATIONS: ABSTRACTS/BOOKS/BOOK CHAPTERS/JOURNAL ARTICLES/POSTERS/PROCEEDINGS/TECHNICAL REPORTS

Name	Type	Status	Citation	Referred	Category	GS	US
Belknap, Daniel F	Journal Article	Published	Plets, R.M.K., Callard, S.L., Cooper, J.A.G., Long, A.J., Quinn, R.J., Belknap, D.F., Edwards, R.G., Jackson, D.W.T., Kelley, J.T., Long, D., Milne, G.A., and Monteys, X., 2015, Late Quaternary evolution and sea-level history of a glaciated marine embayment, Bantry Bay, SW Ireland, Marine Geology, v. 369, p. 251-272. DOI: 10.1016/j.margeo.2015.08.021	Yes	Basic	2	0
Belknap, Daniel F	Book Chapter	Published	Belknap, D.F. and Kelley, J.T., 2015, Geology of the nearshore and coastal Presumpscot Formation from high-resolution seismic profiling and vibracores. In: Landon, M. and Nickerson, C., eds., 2nd Symposium on the Presumpscot Formation, advances in Geotechnical, Geologic and Construction Practice, October 28, 2015. University of Maine, Orono, ME, 14 pp. http://umaine.edu/presumpscot-symposium/2015-symposium-proceedings/	Yes	Basic	0	0
Belknap, Daniel F	Book Chapter	Published	Kelley, J.T., Belknap, D.F., and Walsh, J.A., 2015, Tidal flat-barrier spit interactions in a fetch-limited, macro-tidal embayment, Lubec, Maine, USA, In: Randazzo, G., Jackson, D., and Cooper, J.A.G., eds., Sand and Gravel Spits, Springer Publishing Company, Berlin, Germany, p. 195-216 http://www.springer.com/us/book/9783319137155	Yes	Basic	0	0
Belknap, Daniel F	Book Chapter	Accepted	Brothers, L.L., Legere, C., Hughes Clarke, J.E., Kelley, J.T., Barnhardt, W.A., Andrews, B.D., and Belknap, D.F., 2016 in press, Pockmarks in Passamaquoddy Bay, New Brunswick Canada, In: Dowdeswell, J.A., Canals, M., Jakobsson, M., Todd, B.J., Dowdeswell, E.K., and Hogan, K. A., eds., Atlas of Submarine Glacial Landforms: Modern, Quaternary and Ancient, Geological Society, London, Memoirs, v. p. http://www.submarineglacialatlas.com/	Yes	Basic	0	0
Belknap, Daniel F	Abstract	Published	Chandler, E.A., Kelley, J.T., and Belknap, D.F., 2015, Sedimentation accumulation patterns in the Damariscotta River estuary: Geological Society of America Abstracts with Programs. Vol. 47, No. 7 (Annual Meeting, Baltimore MD, November 1-4) Abstract 93-1, p. 264 https://gsa.confex.com/gsa/2015AM/webprogram/Paper267425.html	Yes	Basic	1	0
Belknap, Daniel F	Abstract	Published	Kelley, A.R., Mauricio, A.C., Sandweiss, D.H., Kelley, J.T. and Belknap, D.F., 2016, Combining GPR and archeological excavations at Los Morteros: looking “inside” a complex preceramic coastal Peruvian site: Society of American Archaeology Annual Meeting, Orlando, FL, April 6-9, Abstract 243, p.	Yes	Basic	1	0
Belknap, Daniel F	Abstract	Published	Chandler, E.A., Belknap, D.F., and Kelley, J.T., 2016, Sedimentation patterns in the Damariscotta River estuary: Geological Society of America Abstracts with Programs, Vol. 48, No. 2 (NE Section Meeting, Albany, NY, March 21-23) https://gsa.confex.com/gsa/2016NE/webprogram/start.html Theme 5, doi:	Yes	Basic	1	0

			10.1130/abs/2016NE-272497				
Belknap, Daniel F	Abstract	Published	Salacup, J., McDaniel, J. and Belknap, D.F., 2016, A comparison of Holocene land and sea surface temperature from the Gulf of Maine based on GDGTs and alkenones: Geological Society of America Abstracts with Programs, Vol. 48, No. 1 (NE Section Meeting, Albany, NY, March 21-23) https://gsa.confex.com/gsa/2016NE/webprogram/start.html Theme 22, doi: 10.1130/abs/2016NE-272498	Yes	Basic	1	0
Birkel, Sean	Journal Article	Published	Strock, K.E., Saros, J.E., Nelson, S.J., Birkel, S.D., Kahl, J.S., McDowell, W.H., 2016. Extreme weather years drive episodic changes in lake chemistry: implications for recovery from sulfate deposition and long-term trends in dissolved organic carbon. Biogeochemistry, 127, p. 353-365, http://link.springer.com/article/10.1007/s10533-016-0185-9	Yes	Basic	0	0
Birkel, Sean	Journal Article	Published	Putnam, A.E., Putnam, D.E., Andreu-Hayles, L., Cook, E.R., Palmer, J.D., Clark, E.H., Wang, C., Chen, F., Denton, G.H., Boyle, D.P., Bassett, S.D., Birkel, S.D., Martin-Fernandez, J., Hajdas, I., Southon, J., Garner, C.B., Cheng, H., Broecker, W.S., 2016. Little Ice Age wetting of interior Asian deserts and the rise of the Mongol Empire. Quaternary Science Reviews, 131(A), p. 33-50, doi:10.1016/j.quascirev.2015.10.033 http://www.sciencedirect.com/science/article/pii/S0277379115301542	Yes	Basic	0	0
Birkel, Sean	Journal Article	Published	Mayewski, P.A., Bracegirdle, T., Goodwin, I., Schneider, D., Bertler, N.A.N., Birkel, S.D., Carleton, A., England, M.H., Kang, J.-H., Khan, A., Russell, J., Turner, J., Veliconga, I., 2015. Potential for Southern Hemisphere climate surprises. Journal of Quaternary Science, 30(5), p. 391-395 http://onlinelibrary.wiley.com/doi/10.1002/jqs.2794/full	Yes	Basic	0	0
Birkel, Sean	Journal Article	Published	Saros, J.E., Osburn, C.L., Northington, R.M., Birkel, S.D., Auger, J.D., Stedmon, C.A., Anderson, N.J., 2015. Recent decrease in DOC concentrations in Arctic lakes of southwest Greenland. Geophysical Research Letters, 42(16), p. 6703-6709 http://onlinelibrary.wiley.com/doi/10.1002/2015GL065075/full	Yes	Basic	0	0
Birkel, Sean	Technical Report	Published	Birkel SD, Mayewski PA. 2015. Analysis of Historical and Projected Future Climate of Mali, West African Sahel. CCAFS Project Report. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) https://cgspace.cgiar.org/handle/10568/73419		Basic	0	0
Birkel, Sean	Newsletter	Published	Maine Climate News, quarterly climate newsletter https://extension.umaine.edu/maineclimatenews/update/		Basic	0	0
Borns Jr., Harold W.	Book		Borns, H., and Massch,K., 2016, Footsteps of the Ancient Great Glacier of North America: A long Lost Document of a Revolution in 19th Century Geological Theory; Springer - Nature, 202 p.				
Borns Jr., Harold W.	Book		Borns,H., and Plourde, J.,2015, Apple App: Maine’s Ice Age Trail: Down East, Map and Guide				
Borns Jr., Harold W.	Scientific Paper		Dieffenbacher-Krall, A., Borns,H., and others, 2016, Younger Dryas Paleoenvironments and Ice Dynamics in Northern Maine: A Multi-Proxy Case History, Northeastern Naturalist,v. 23, no.1, p. 67 - 87				

Borns Jr., Harold W.	Scientific Paper		Bromley, G., Borns,H., and others, 2015, Younger Dryas of Scotland Driven by Warmer Summers; Proc. National Acad. of Sciences, v. 111, p. 6215-6219					
Borns Jr., Harold W.	Scientific Paper		Bromley, G., Borns,H., and others, IN PRESS, Early Rise and Demise of Scottish Ice During the Younger Dryas Stadial; Science Advances					
Chai, Fei	Journal Article	Published	Andrew P. Nosal, Yi Chao, John D. Farrara, Fei Chai, Philip A. Hastings (2016): Olfaction contributes to pelagic navigation and homing in a coastal shark. Proceedings B of the Royal Society of London	Yes	Basic	0	0	
Chai, Fei	Journal Article	Published	Ke Huang, Sergio Derada, Huijie Xuea, Peng Xiu, Fei Chai, Qiang Xie, Dongxiao Wang (2015): 1/8° Coupled Biochemical-Physical Regional Indian Ocean Model: Physical Results and Validation. Ocean Dynamics	Yes	Basic	1	0	
Chai, Fei	Journal Article	Published	Shu, Y., H. Xue, D. Wang, F. Chai, Q. Xie, S. Cai, R. Chen, J. Chen, J. Li, and Y. He (2016): Persistent and energetic bottom-trapped topographic Rossby waves observed in the southern South China Sea. Scientific Reports, 6:24338, DOI: 10.1038/srep24338	Yes	Basic	0	0	
Chai, Fei	Journal Article	Published	Gomes, Helga do Rosario, Sergio deRada, Joaquim I. Goes, John Kindle, and Fei Chai (2016): Examining Features of Enhanced Phytoplankton Biomass in the Bay of Bengal Using a Coupled Physical-Biological Model. Journal of Geophysical Research – Oceans. DOI 10.1002/2015JC011508	Yes	Basic	0	0	
Chawathe, Sudarshan S	Other	Published	Sudarshan S. Chawathe. Toward a Domain-Specific Language for Patterns in Ice-Core Data. Borns Symposium, April 2016.			0	0	
Chawathe, Sudarshan S	Other	Published	Mark Royer and Sudarshan S. Chawathe. The P301 Web API. Borns Symposium. April 2016			1	0	
Denton, George	Journal Article	Published	Hall, B.L., Denton, G.H., Heath, S.L., Jackson, M.S., and Koffman, T.N.B., 2015, Accumulation and marine forcing of ice dynamics in the western Ross Sea during the last deglaciation. Nature Geoscience 8, 625-628	Yes	Basic	3	0	
Denton, George	Journal Article	Published	Kaplan, M.R., Schaefer, J.M., Strelin, J. A., Denton, G.H., Anderson, R.F., Vandergoes, M.J., Finkel, R.C., Schwartz, R., Travis, S.G., Garcia, J.L., Martini, M.A., and Nielsen, S.H.H., 2016, Patagonian and southern South Atlantic view of Holocene climate. Quaternary Science Reviews 141, 1-14	Yes	Basic	1	0	
Denton, George	Journal Article	Published	Putnam, A.E., Putnam, D.E., Andreu-Hayes, L., Cook, E.R., Palmer, J.G., Clark, E.H., Wang, C., Chen, F., Denton, G.H., Boyle, D.P., Bassett, S.D., Birkel, S.D., Martin-Fernandez, J., Hajdas, I., Southon, J., Garner, C.B., Cheng, H., Broecker, W.S., 2016, Little Ice Age wetting of interior Asia and the rise of the Mongol Empire. Quaternary Science Reviews 131, 33-50.	Yes	Basic	0	0	
Denton, George	Journal Article	Published	Moreno, P.I., Denton, G.H., Moreno, H., Lowell, T.V., Putnam, A.E., Kaplan, M.R., 2015, Radiocarbon chronology of the last glacial maximum and its termination in northwestern Patagonia. Quaternary Science Reviews 122, 233-249.	Yes	Basic	0	0	
Denton, George	Journal Article	Submitted	Koffman, T.N.B., Schaefer, J.M., Putnam, A.E., Denton, G.H., Barrell, D.J.A., Rowan A.V., Finkel, R.C., Rood, D.H., Schwartz, R., Plummer, M.A., Brocklehurst, 2016, A beryllium-10 chronology of late-glacial moraines in the upper Rakaia valley, Southern Alps, New	Yes	Basic	1	0	

			Zealand. Quaternary Science Reviews, submitted.					
Enderlin, Ellyn	Journal Article	Published	Lenaerts, J. T. M., D. Le Bars, L. van Kampenhout, M. Vizcaino, E. M. Enderlin, & M. R. van den Broeke, 2015. Representing Greenland ice sheet freshwater fluxes in climate models. Geophys. Res. Lett., 42, doi:10.1002/2015GL064738	Yes	Applied	0	0	
Enderlin, Ellyn	Journal Article	Published	Xu, Z., E. Schrama, W. van de Wal, M. van den Broeke, & E. M. Enderlin, 2016. Improved GRACE regional mass balance estimates of the Greenland Ice Sheet cross-validated with the input-output method. Cryosphere, 10, 1-18, doi: 10.5194/tcd-10-1-2016	Yes	Applied	0	0	
Enderlin, Ellyn	Journal Article	Submitted	Talpe, M. J., R. S. Nerem, E. Forootan, M. Schmidt, F. G. Lemoine, E. M. Enderlin, & F. W. Landerer, in review. Ice mass change in Greenland and Antarctica between 1993 and 2014 from satellite gravity measurements. J. Geod	Yes	Applied	0	0	
Enderlin, Ellyn	Journal Article	Submitted	Van den Broeke, M., E. Enderlin, I. Howat, P. K. Munneke, B. Noël, W. van de Berg, E. van Meijgaard, & B. Wouters, in review. On the recent contribution of the Greenland ice sheet to sea level change. Cryosphere Special Issue: Mass balance of the Greenland Ice Sheet	Yes	Applied	0	0	
Enderlin, Ellyn	Journal Article	Submitted	Enderlin, E. M., G. S. Hamilton, S. O`Neel, & T. Bartholomaus, in review. An empirical approach for estimating stress-coupling lengths for marine-terminating glaciers. Frontiers Cryo. Sci.	Yes	Applied	0	0	
Enderlin, Ellyn	Journal Article	Submitted	Enderlin, E. M., G. S. Hamilton, F. Straneo, & D. A. Sutherland, in review. Iceberg meltwater fluxes dominate the freshwater budget in Greenland`s glacial fjords. Nature Geosci.	Yes	Applied	0	0	
Fastook, James L	Journal Article	Published	A. C. Dieffenbacher-Krall, H. W. Borns Jr., A. M. Nurse, G. E.C. Langley, S. Birkel, L. C. Cwynar, L. A. Doner, C. C. Dorion, J. Fastook, G. L. Jacobson Jr. and C. Sayles, Younger Dryas Paleoenvironments and Ice Dynamics in Northern Maine: A Multi-Proxy, Case History, Northeastern Naturalist, 23(1), 67-87,2016	Yes		0	0	
Fastook, James L	Abstract	Published	J. L. Fastook and J. W. Head, LATE NOACHIAN ICY HIGHLANDS ICE FLOW SYNTHESIS, Lunar and Planetary Science Conference XLVII, #1161, 2016	Yes		0	0	
Fastook, James L	Abstract	Published	J. L. Fastook and J. W. Head, COLD-BASED GLACIATION ON MERCURY: ACCUMULATION AND FLOW OF ICE IMPERMANENTLY-SHADOWED CIRCUM-POLAR CRATER INTERIORS, Lunar and Planetary Science Conference XLVII, #1162, 2016	Yes		0	0	
Fastook, James L	Abstract	Published	K. E. Scanlon, J. W. Head, J. L. Fastook, and R. D. Wordsworth, THE DORSA ARGENTEA FORMATION AND THE NOACHIAN-HESPERIAN TRANSITION: CLIMATE AND GLACIAL FLOW MODELING, Lunar and Planetary Science Conference XLVII, #1315, 2016	Yes		1	0	
Gill, Jacquelyn	Journal Article	Accepted	Bakker, E. S., J. L. Gill, C. N. Johnson, F. W. M. Vera, C. J. Sandom, G. P. Asner, J.-C.Svenning. 2015. Combining paleo-data and modern exclosure experiments to assess the impact of megafauna extinctions on woody plant vegetation. Proceedings of the National Academy of Sciences. doi: 10.1073/pnas.1502545112	Yes	Basic	0	0	
Gill, Jacquelyn	Journal Article	Published	Incomplete Bayesian model rejects contradictory radiocarbon data for being contradictory M Boslough, K Nicoll, TL Daulton, AC Scott, P Claeys, JL Gill, JR Marlon. Proceedings of	Yes	Basic	0	0	

			the National Academy of Sciences 112 (49), E6722-E6722 http://www.pnas.org/content/112/49/E6722.short				
Gill, Jacquelyn	Journal Article	Published	Learning from Africa's herbivores. 2015. J.L. Gill. Science 350 (6264), 1036-1037 http://science.sciencemag.org/content/350/6264/1036	Yes	Basic	0	0
Gill, Jacquelyn	Journal Article	Published	Pronounced variations in Fagus grandifolia abundances in the Great Lakes region during the Holocene Y Wang, J Gill, J Marsicek, A Dierking, B Shuman, JW Williams The Holocene, 0959683615612586 http://hol.sagepub.com/content/early/2015/11/18/0959683615612586.abstract		Basic	2	2
Hall, Brenda	Journal Article	Published	Marra, K.M., Elwood Madden, M.E., Soreghan, G.S., and Hall, B.L., 2015. BET surface area distributions in polar stream sediments: Implications for silicate weathering in a cold-arid environment. Applied Geochemistry 52, 31-42.	Yes	Basic	1	0
Hall, Brenda	Journal Article	Published	Bromley, G.R.M., Hall, B.L., Thompson, W.B., Kaplan, M.R., *Garcia, J.L., and Schaefer, J.M., 2015. Late-glacial fluctuations of the Laurentide Ice Sheet in the White Mountains of Maine and New Hampshire, U.S.A. Quaternary Research 83, 522-530.	Yes	Basic	0	0
Hall, Brenda	Journal Article	Published	Hall, B., Denton, G., *Heath, S., *Jackson, M., and *Koffman, T., 2015. Accumulation and marine forcing of ice dynamics in the western Ross Sea during the last deglaciation. Nature Geoscience 8, 625-629	Yes	Basic	3	0
Hall, Brenda	Journal Article	Published	Garcia, J.L.*, Strelin, J., Vega, R., Hall, B., and Stern, C., 2015. Deglacial ice-marginal glaciolacustrine environments and structural moraine building in Torres del Paine, south Patagonia. Andean Geology 42, 190-212 (includes cover illustration).	Yes	Basic	1	0
Hall, Brenda	Journal Article	Submitted	Marra, K.M., Elwood Madden, M.E., Soreghan, G.S., and Hall, B.L., 2016. Physical and chemical weathering in stream sediments of the McMurdo Dry Valleys, Antarctica. Chemical Geology, in review	Yes	Basic	1	0
Hall, Brenda	Journal Article	Accepted	Levy, L., Kelly, M., Lowell, T., Hall, B., Howley, J., and Smith, C., 2016. Coeval fluctuations of the Greenland Ice Sheet and a local glacier, central East Greenland, during late-glacial and early Holocene time. Geophysical Research Letters, in press	Yes	Basic	1	0
Hall, Brenda	Journal Article	Accepted	Hall, B.L., *Bromley, G., Stone, J., and Conway, H., 2016. Holocene ice recession at Polygon Spur, Reedy Glacier, Antarctica. The Holocene, accepted	Yes	Basic	1	0
Hall, Brenda	Journal Article	Accepted	Hall, B.L., Bromley, G., Stone, J., and Conway, H., 2016. Holocene ice recession at Polygon Spur, Reedy Glacier, Antarctica. The Holocene, accepted	Yes	Basic	1	0
Hall, Brenda	Journal Article	Submitted	Bromley, G., Schaefer, J., Hall, B., Rademaker, K., Putnam, A., Todd, C., Hegland, M., Winckler, G., Jackson, M., Strand, P., 2016. A cosmogenic ¹⁰ Be chronology for the local last glacial maximum and termination in the Cordillera Oriental, southern Peruvian Andes: Implications for the tropical role in global climate. Quaternary Science Reviews, in review	Yes	Basic	0	0
Hall, Brenda	Abstract	Published	Levy, L., Kelly, M., Lowell, T., Hall, B., Howley, J., and Smith, C., 2016. Coeval fluctuations of the Greenland Ice Sheet and a local ice cap during the Younger Dryas: implications for late-glacial climate. European Geophysical Union, Vienna, Austria, 2016	Yes	Basic	1	0
Hall, Brenda	Abstract	Published	Bromley, G., Schaefer, J., Hall, B., Rademaker, K., Todd, C., and Winckler, G., 2016. A glacier-derived record of tropical temperature during Termination 1 from the Cordillera	Yes	Basic	0	0

			Oriental, southern Peru. Northeast Section Geological Society of America, March 21-23, 2016					
Hall, Brenda	Abstract	Published	Brault, E.K., Welch, A.J., Nye, J.W., Rosenfield, A.P., McCarthy, M.D., Hall, B.L., Hoelzel, A.R., and Koch, P.L., 2016. Ross Sea Ecosystem Responses to Climatic Changes during the Mid-to-Late Holocene as Indicated by Bulk Stable Isotope Analyses of Antarctic Seals. Ocean Sciences Meeting, New Orleans, LA	Yes	Basic	2	0	
Hall, Brenda	Abstract	Published	King, C., Hall, B., Stone, J., and Hillebrand, T., 2015. The timing of the last glacial maximum and subsequent recession alongside Hatherton Glacier, Antarctica. Interdisciplinary Antarctic Earth Science Meeting. Sylvan Dale, CO	Yes	Basic	2	0	
Hall, Brenda	Abstract	Published	Koutnik, M., Conway, H., Hillebrand, T., Stone, J., Spector, P., Hall, B., and King, C., 2015. Assimilating geochronological data into ice-flow models to constrain the deglaciation of Transantarctic outlet glaciers. 22nd Annual WAIS Meeting, Loveland, CO	Yes	Basic	3	0	
Hall, Brenda	Abstract	Published	King, C., Hall, B., Stone, J., and Hillebrand, T., 2015. The timing of the last glacial maximum in the Lake Wellman area, Hatherton Glacier, Antarctica. 22nd Annual WAIS Meeting, Loveland, CO	Yes	Basic	2	0	
Hall, Brenda	Abstract	Published	Spector, P., Stone, J., Cowdery, S., Hall, B., Conway, H., and Bromley, G., 2015. Rapid early-Holocene deglaciation of the southern Ross Sea. 22nd Annual WAIS Meeting, Loveland, CO	Yes	Basic	1	0	
Hall, Brenda	Abstract	Published	Hall, B., Denton, G., Heath, S., Jackson, M., and Koffman, T., 2015. Timing of the last glacial maximum and deglaciation in the Ross Sea. 22nd Annual WAIS Meeting, Loveland, CO	Yes	Basic	3	0	
Hall, Brenda	Abstract	Published	Brault, E.K., Koch, P.L., McCarthy, M.D., Hall, B.L., Hoelzel, A.R., Welch, A.J., and Nye, J.W., 2015. Shifts in the Ross Sea ecosystem during the mid-to-late Holocene as indicated by bulk isotopic analyses of Antarctic seals. Marine Mammal Society Conference, San Francisco, CA	Yes	Basic	2	0	
Hall, Brenda	Abstract	Published	Koch, P.L., Brault, E.K., Welch, A.J., Nye, J.W., Niven, L., Hall, B.L., Hoelzel, A.R., 2015. Assessing the vulnerability of Antarctic seals to environmental change: Insights from studies of seal mummies. Society of Vertebrate Paleontology, Dallas, TX	Yes	Basic	2	0	
Hall, Brenda	Abstract	Published	Welch, A.J., Irvine, A., Brault, E., Nye, J., Koch, P.L., Hall, B.L., and Hoelzel, A.R., 2015. Temporal responses of a community of Antarctic seals to local environmental change. Ecological Society of America, Baltimore, MD	Yes	Basic	2	0	
Hamilton, Gordon	Journal Article	Published	Arcone, S.A., J.H. Lever, L.E. Ray, B.S. Walker, G.S. Hamilton, & I Kaluziński. 2016. Ground-penetrating radar profiles of the McMurdo Shear Zone, Antarctica, acquired with an unmanned rover: Interpretation of crevasses, fractures, and folds within firn and marine ice. Geophysics, 81(1), WA21-WA34, doi:10.1190/GEO2015-0132.1	Yes	Basic	1	0	
Hamilton, Gordon	Journal Article	Published	Sneed, W.A & G.S. Hamilton. 2016. Recent changes in the Norske Øer Ice Barrier, coastal Northeast Greenland. Annals of Glaciology, 57(73), doi: 10.1017/aog.2016.21	Yes	Basic	1	0	
Hamilton, Gordon	Journal Article	Published	Stearns, L.A., G.S. Hamilton, C. J. van der Veen, D.C. Finnegan, S. O'Neel, J.B. Scheick & D. E. Lawson. 2015. Glaciological and marine geological controls on terminus dynamics of Hubbard Glacier, southeast Alaska. Journal of Geophysical Research, 120, 1065-1081,	Yes	Basic	1	0	

doi:10.1029/2014JF003341

Hamilton, Gordon	Journal Article	Submitted	Enderlin, E.M., G.S. Hamilton, S.O'Neel and T.C. Bartholomaus. 2016. An empirical approach for estimating stress-coupling lengths on marine-terminating glaciers. <i>Frontiers in Earth Science (Cryosphere)</i> , in review	Yes	Basic	0	0
Hamilton, Gordon	Journal Article	Submitted	Enderlin, E.M., G.S. Hamilton and F. Straneo. 2016. Iceberg melt is a major contributor to liquid freshwater export from Greenland's glacial fjords. <i>Nature Geoscience</i> , in review	Yes	Basic	0	0
Hamilton, Gordon	Journal Article	Submitted	Straneo, F., L.A. Stearns, D. Sutherland and G.S. Hamilton. 2016. Connecting the ice sheet and the ocean: a case study of Helheim Glacier and Sermilik Fjord. <i>Oceanography</i> , in review	Yes	Basic	0	0
Hamilton, Gordon	Book Chapter	Published	Byrne D., C. Garcia-Soto, G.S. Hamilton, E. Leuliette, L. , E. Campos, P.J. Durack, G.M.R. Manzella, K. Tadokoro. R.W. Schmitt, P. Arkin, H. Bryden, L. Nurse, J. Milliman, L. Inniss, P. Bernal. 2016. The Ocean's role in the hydrological cycle (Chapter 4). in <i>World Ocean Assessment I</i> , L. and A. Simcock (eds), Division for Ocean Affairs and the Law of the Sea, Office of Legal Affairs, United Nations, 101-126	Yes	Basic	0	0
Hooke, Roger	Journal Article	Published	Jones, R. and Hooke, R. LeB., 2015, Racetrack Playa: Rocks moved by wind alone. <i>Aeolian Research</i> , v. 19, p. 1-3		Basic	0	0
Hooke, Roger	Journal Article	Published	Hooke, R. LeB. and Ridge, J.C., 2016, Glacial lake deltas in New England record continuous, not delayed, postglacial rebound. <i>Quaternary Research</i> , v. 85, p. xxx-xxx		Basic	0	0
Hooke, Roger	Journal Article	Submitted	Hooke, R. LeB., Hanson, P.R., Belknap, D.F., and Kelley, A.R., 2016. Late glacial and Holocene history of the Penobscot River in the Penobscot Lowland, Maine. Submitted to <i>The Holocene</i> on 31 May 2016			0	0
Hooke, Roger	Other	Published	Hooke, R. LeB. and Jones, R., 2016, Reply to comments., <i>Aeolian Research</i> , v. 20, p. 198		Basic	0	0
Isenhour, Cynthia	Journal Article	Accepted	Isenhour, Cindy. 2016. Unearthing Human Progress? Ecomodernism and Contrasting Definitions of Technological Progress in the Anthropocene. <i>Economic Anthropology</i> 4(1)	Yes	Basic	0	0
Isenhour, Cynthia	Journal Article	Accepted	Isenhour, Cindy, Travis Wagner, Travis Blackmer, Linda Silka, John Peckenhams, Jena Rudolph, David Hart & Jean McRae. Moving Up the Waste Hierarchy in Maine: Learning from "Best Practice" State-Level Policy for Waste Reduction and Recovery. <i>Maine Policy Review</i> 24(3)	Yes	Applied	0	1
Isenhour, Cynthia	Journal Article	Published	Thomas Love and Cindy Isenhour. 2016. Energy and Economy: Recognizing High-Energy Modernity as a Historical Period. <i>Economic Anthropology</i> 3(1):1-18.	Yes	Basic	0	0
Isenhour, Cynthia	Journal Article	Published	Sorenson, Amanda; Rachael Shwom, Rebecca Jordan, Diane Ebert-May, Cindy Isenhour, Aaron McCright, Jennifer Meta-Robinson. 2016. Model-based Reasoning to Foster Environmental and Socio-scientific Literacy in Higher Education. <i>Journal of Environmental Studies and Sciences</i> DOI: 10.1007/s13412-015-0352-7.	Yes	Applied	1	0
Isenhour, Cynthia	Journal Article	Submitted	Isenhour, Cindy, Jessica O'Reilly and Heather Yocum. Accounting for Climate Change: Measurement, Management, Morality and Mysticism. Under review with <i>Human Ecology</i>	Yes		0	0
Isenhour, Cynthia	Book Chapter	Accepted	Isenhour, Cindy. When 'Gestures of Change' Demand Policy Support: Social Change and the Structural Underpinnings of Consumer Culture. <i>Social Change and Sustainable Consumption: Theoretical Advances and Policy Implications</i> . Maurie Cohen, Halina Brown	Yes		0	0

and Philip Vergragt, eds. Routledge Press (2016)

Isenhour, Cynthia	Book Chapter	Accepted	Isenhour, Cindy. Taking Responsibility for Climate Change: On Human Adaptation, Sustainable Consumption and Environmental Governance. In the Handbook of Environmental Anthropology. Helen Kopnina and Eleanor Shoreman-Ouimet, eds. Routledge International. In Press.	Yes	Basic	0	0
Isenhour, Cynthia	Book Chapter	Published	Isenhour, Cindy. 2015. Sustainable Consumption and its Discontents. In Sustainability: Key Issues. Helen Kopnina and Eleanor Shoreman-Ouimet, eds. Earthscan Publishers	Yes		0	0
Isenhour, Cynthia	Technical Report	Published	Blackmer, Travis, George Criner, David Hart, Cindy Isenhour, John Peckenham, Chet Rock, Avinash Rude, Linda Silka. 2015. Materials and Solid Waste Management in Maine: Past, Present and Future. Senator George J. Mitchell Center Working Paper		Applied	1	0
Isenhour, Cynthia	Technical Report	Published	Isenhour, Cindy and Travis Blackmer. 2015. The Future of Materials Management in Maine: Stakeholder Engagement Outcomes Report. Senator George J. Mitchell Center Working Paper presented to the Maine State Legislature's Environment and Natural Resources Committee August, 2015			0	0
Koons, Peter	Journal Article	Published	Enkelmann, E., Koons, P.O., Pavlis, T.L., Hallet, B., Barker, A., Elliott, J., Garver, J.I., Gulick, S.P.S., Headley, R.M., Pavlis, G.L., Ridgway, K.D., Ruppert, N., van Avendonk, H. Cooperation among tectonic and surface processes in the St. Elias Range, Earth's highest coastal mountains. Geophysical Research Letters; 42, 1-9, 10.1002/2015GL064727			1	0
Koons, Peter	Journal Article	Accepted	Roy, S.G.1; Koons, P.O.1; Upton, P.1,2; Tucker, G.E. (2016) Dynamic links between rock damage, erosion, and strain during orogenesis	Yes		1	0
Koons, Peter	Journal Article	Published	Roy, S.G., Koons, P.O., Osti, B., Upton, P., and Tucker, G.E. (2015) Multi-scale characterization of topographic anisotropy: Computers & Geosciences, p. 1–15 DOI: 10.1016/j.cageo.2015.09.02	Yes		2	0
Koons, Peter	Journal Article	Accepted	Roy, S.G., Koons, P.O., Upton, P., Tucker, G.E. (2015). The influence of crustal strength fields on patterns and rates of fluvial incision. Journal of Geophysical Research: Earth Surface 120, 275-299, doi 10.1002/2014JF003281	Yes		1	0
Koons, Peter	Journal Article	Published	Zeitler, P.K, Koons, P.O., Hallet, B. Meltzer, A.S. (2015) Comment on "Tectonic control of Yarlung Tsangpo Gorge Revealed by a Buried Canyon in Southern Tibet" SCIENCE 349(6250):799 DOI: 10.1126/science.aaa9380 AUGUST 2015	Yes		0	0
Koons, Peter	Journal Article	Submitted	Campbell, S., Kreutz, K., Arcone, S., Osterberg, E., Conway, H., Koons, P., Hamilton, G. (2015) Mass balance estimates of the temperate Juneau Icefield, Alaska from shallow GPR stratigraphy. Submitted to Cryosphere	Yes		0	0
Koons, Peter	Journal Article	Submitted	Campbell, S; Arcone, S; Kreutz, K; McNeil, C; Conway, H; Braddock, S; Koons, P; Osterberg, E. 2014; Surface-based ground penetrating radar profiles of the Juneau Icefield: Interpretation of the winter mass balance and previous year's snow horizon (submitted to GEOPHYSICS)	Yes		0	0
Koons, Peter	Abstract	Published	ENKELMANN, E., KOONS, P.O., PAVLIS, T.L., HALLET, B., BARKER, A., ELLIOTT, J., GARVER, J. I., PAVLIS, G. and RUPPERT, N. COOPERATION AMONG TECTONIC AND SURFACE PROCESSES IN THE ST. ELIAS RANGE; EARTH'S HIGHEST COASTAL MOUNTAINS. 2015 GSA Annual Meeting in Baltimore, Maryland,	Yes		1	0

USA (1-4 November 2015) Abstract #261213

Koons, Peter	Abstract	Published	Boucher, A.L., Koons, P.O., Roy, S.G., Birkel, S.D., Kaluzienski, L.M., Campbell, S.W. (2015) Implications of Fault Damaged Bedrock to Tectonic and Landscape Evolution in Coastal Alaska, Abstract present at the 2015 Fall meeting, AGU, San Francisco, CA, 14-18 Dec.			2	0
Kelley, Alice	Abstract	Published	Kelley, Alice, Ana Cecilia Mauricio , Daniel Sandweiss , Joseph Kelley and Daniel Belknap Combining GPR and Archeological Excavations at Los Morteros: Looking “Inside” a Complex Preceramic Coastal Peruvian Site, Society for American Archaeology, 81st Meeting, April 6-10, Orlando, Florida http://www.saa.org/Portals/0/SAA/MEETINGS/2016%20Abstracts/1_L.pdf	Yes		0	0
Kreutz, Karl	Journal Article	Published	Grigholm, B., P.A. Mayewski, V. Aizen, K.J. Kreutz, C.P. Wake, E. Aizen, S. Kang, K.A. Maasch, M.J. Handley, and S.B. Sneed, 2016, Mid-twentieth century increases in anthropogenic Pb, Cd, and Cu in central Asia set in hemispheric perspective using Tien Shan ice core, Atmospheric Environment, 131, 17-28, 0.1016/j.atmosenv.2016.01.030	Yes	Basic	1	0
Kreutz, Karl	Journal Article	Published	WAIS Divide project members (C. Buizert, B. Adrian, J. Ahn, M. Albert, R.B. Alley, D. Baggenstos, T. K. Bauska, R.C. Bay, B.B. Bencivengo, C.R. Bentley, E.J. Brook, N.J. Chellman, G.D. Clow, J. Cole-Dai, H. Conway, E. Cravens, K.M. Cuffey, N.W. Dunbar, J.S. Edwards, J.M. Fegyveresi, D.G. Ferris, J.J. Fitzpatrick, T. J. Fudge, C.J. Gibson, V.Gkinis, J.J. Goetz, S. Gregory, G.M. Hargreaves, N. Iverson, J. Johnson, T.R. Jones, M.L. Kalk, M.J. Kippenhan, B.G. Koffman, K.J. Kreutz, T.W. Kuhl, D.A. Lebar, J.E. Lee, S.A. Marcott, B.R. Markle, O.J. Maselli, J.R. McConnell, K.C. McGwire, L.E. Mitchell, N.B. Mortensen, P.D. Neff, K.Nishiizumi, R.M. Nunn, A.J. Orsi, D.R. Pasteris, J.B. Pedro, E.C. Pettit, P.B. Price, J.C. Prisco, R.H. Rhodes, J.L. Rosen, A.J. Schauer, S.W. Schoenemann, P.J. Sendelbach, J.P. Severinghaus, A.J. Shturmakov, M. Sigl, K.R. Slawny, J.M. Souney, T.A. Sowers, M.K. Spencer, E.J. Steig, K.C. Taylor, M.S. Twickler, B.H. Vaughn, D.E. Voigt, E.D. Waddington, K.C. Welten, A.W. Wendricks, J.W.C. White, M. Winstrop, G.J. Wong, and T.E. Woodruff), 2015, Precise interpolar phasing of abrupt climate change during the last ice age, Nature, 520 (7549), 661-665	Yes	Basic	1	0
Kurbatov, Andrei	Journal Article	Published	Higgins, J. A., A. V. Kurbatov, N. E. Spaulding, E. J. Brook, D. S. Introne, L. M. Chimiak, Y Yan, P. A. Mayewski, and M. L. Bender (2015). “Atmospheric composition 1 million years ago from blue ice in the Allan Hills, Antarctica”. PNAS 112(22), 6887–6891 http://www.pnas.org/content/112/22/6887.abstract	Yes	Basic	2	0
Kurbatov, Andrei	Journal Article	Published	Haines, S. A., P. A. Mayewski, A. V. Kurbatov, S. B. Sneed, K. A. Maasch, P. D. Bohleber, N. E. Spaulding, and D. A. Dixon (2016). Ultra-High Resolution Snapshots of Three Multi-decadal Periods in an Antarctic Ice Core. Journal of Glaciology: 62(231), 31-36 http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=10315366&fileId=S0022143016000058	Yes	Basic	1	0
Kurbatov, Andrei	Journal Article	Submitted	Haines, S. A., P. A. Mayewski, A. V. Kurbatov, S. B. Sneed, K. A. Maasch, D. A. Dixon, P. D. Bohleber, and N. E. Spaulding (in prep. 2016). Sub-Seasonal Reconstruction of an Ice Core Recorded Abrupt Climate Change Transition ~84.5 Thousand Years Ago		Basic	1	0
Kurbatov, Andrei	Journal Article	Submitted	Iverson, N. A., D. Kalteyer, N. W. Dunbar, A. Kurbatov, and M. Yates (in review., 2015). “Advancements and best practice for analysis and correlation of tephra and cryptotephra in ice”. Quaternary Science Reviews	Yes	Basic	2	0

Kurbatov, Andrei	Journal Article	Submitted	Kalteyer, D. A., N. A. Bertler, N. A. Iverson, M. G. Yates, N. W. Dunbar, A. V. Kurbatov, B. Alloway, T. M. Beers, P. D. Neff, T. Fudge, and C. C. Gerbi (in prep., 2016). Visible tephra layers in Roosevelt Island Climate Evolution (RICE) project Ice Core. <i>Geology</i>	Yes	Basic	4	0
Kurbatov, Andrei	Journal Article	Submitted	Potocki, M., P. A. Mayewski, A. V. Kurbatov, J. Simoes, D. A. Dixon, E. Korotkikh, M. J. Handley, I. Goodwin, and R. Jan-a (in prep., 2016). Recent increase in Antarctic Peninsula ice core uranium concentrations.	Yes	Basic	2	0
Kurbatov, Andrei	Journal Article	Published	Sneed, S. B., P. A. Mayewski, W. Sayre, M Handley, A. V. Kurbatov, K. C. Taylor, P. Bohleber, D. Wagenbach, T. Erhardt, and N. E. Spaulding (2015). New LA-ICP-MS cryocell and cali- bration technique for sub-millimeter analysis of ice cores. <i>Journal of Glaciology</i> 61(226), 233– 242 https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKewiwKQsYnNAhUQRVlKHZ52AyIQFggdMAA&url=http%3A%2F%2Fwww.igsoc.org%3A8080%2Fjournal%2F61%2F226%2Fj14j139.pdf&usg=AFQjCNGbwB5xWwCCU3QpTLPaLCRGLzaA4Q&sig2=cJ7xu2qg_CgYhQ7GG5E5zg	Yes	Basic	1	0
Kurbatov, Andrei	Journal Article	Submitted	Korotkikh, E., P. A. Mayewski, A. V. Kurbatov, M Handley, and S. B. Sneed (2016 in prep). Natural and anthropogenic source arsenic partitioned using a 2060 year long South Pole ice core	Yes		1	0
Maasch, Kirk	Journal Article	Published	SKYLAR A. HAINES, PAUL A. MAYEWSKI, ANDREI V. KURBATOV, KIRK A. MAASCH, SHARON B. SNEED, NICOLE E. SPAULDING, DANIEL A. DIXON and PASCAL D. BOHLEBER (2016). Ultra-high resolution snapshots of three multi-decadal periods in an Antarctic ice core. <i>Journal of Glaciology</i> , 62, pp 31-36 doi:10.1017/jog.2016.5	Yes	Basic	1	0
Maasch, Kirk	Journal Article	Published	Grigholm, B., Mayewski, P.A., Aizen, V., Aizen, E., Kang, S., Maasch, K.A., K., Handley, M., and Sneed, S., 2016, Mid-twentieth century increases in anthropogenic Pb, Cd and Cu in central Asia set in hemispheric perspective using a Tien Shan ice core, <i>Atmospheric Environment</i> 131, 17-28, doi.org/10.1016/j.atmosenv.2016.01.030	Yes	Basic	1	0
Maasch, Kirk	Journal Article	Submitted	Auger, J.D., Birkel, S.D., Maasch, K.A., Mayewski, P.A., and Schuenmann, K., in review, An ensemble to test differences in the current generation global climate analysis		Basic	1	0
Maasch, Kirk	Abstract	Published	Carleton, A M, Auger, J, Birkel, S D, Maasch, K A, Mayewski, P A, and Claud, C, Ocean-Atmosphere Environments of Antarctic-Region Cold-Air Mesocyclones: Evaluation of Reanalyses for Contrasting Adjacent 10-Day Periods (Macro-Weather) in Winter, Abstract A12D-06 presented at 2015 Fall Meeting, AGU, San Francisco, Calif., 14-18 Dec.		Basic	1	0
Mayewski, Paul	Journal Article	Accepted	Zhang, Y.L., Kang, S.C., Grigholm, B., Zhang, Y.J., Kaspari, S., Morgenstern, U., Ren, J.W., Qin, D.H., Mayewski, P.A., Zhang, Q.G., Cong, Z.Y., Sillanpaa, M, Schwikowski, M. and Chen, F., 2015, The 20th century warming preserved in a Mt. Geladaindong ice core, central Tibetan Plateau, <i>Annals of Glaciology</i> 71. DOI: http://dx.doi.org/10.3189/2016AoG71A001 .	Yes	Applied	1	0
Mayewski, Paul	Journal Article	Accepted	Grigholm, B., Mayewski, P.A., Kang, S., Zhang, Y., Morgenstern, U., Schwikowski, M., Kaspari, S., Aizen, V., Aizen, E., Takeuchi, N., Maasch, K., Birkel, S., Handley, M., and Sneed, S., 2015, 20th century dust lows and the weakening of the westerly winds over the Tibetan Plateau. <i>Geophys. Res. Lett.</i> , 42, 2434-2441. DOI: 10.1002/2015GL063217 .	Yes	Applied	1	0

Mayewski, Paul	Journal Article	Accepted	Tuohy, A., Bertler, N., Neff, P., Edwards, R., Emanuelsson, D., Beers, T. and Mayewski, P.A., 2015, Transport and deposition of toxic metals in the Ross Sea Region, Antarctica, J. Geophys. Res. Atmos., 120, 10,996-11,011, doi:10.1002/2015JD023293.	Yes	Basic	1	0
Mayewski, Paul	Journal Article	Accepted	(372) Mayewski, P.A., Bertler, N., Birkel, S., Bracegirdle, T., Carleton, A., England, M., Goodwin, I., Kang, J-H., Mayewski, P., Russell, J., Schneider, S., Turner, J. and Vellicogna, I., 2015, Potential for Southern Hemisphere climate surprises, Journal of Quaternary Science (Rapid Communication) 30, 391-395, DOI: 10.1002/jqs.2794.	Yes	Applied	0	0
Mayewski, Paul	Journal Article	Submitted	Haines, S.A., Mayewski, P.A., Kurbatov, A.V., Sneed, S.B., Maasch, K.A., Bohleber, P.D., Spaulding, N.E. and Dixon, D.A., in review, Sub-seasonal reconstruction of an ice core recorded abrupt climate change transition 84.6ka years ago	Yes	Basic	1	0
Mayewski, Paul	Journal Article	Accepted	Potocki, M., Mayewski, P.A., Kurbatov, A., Simoes, J.C., Dixon, D.A., Goodwin, I., Carleton, A.M., Handley, M.J., Jana, R. and Korotkikh, E., accepted, Recent increase in Antarctic Peninsula ice core uranium concentrations, Atmospheric Environment	Yes	Applied	2	0
Mayewski, Paul	Journal Article	Accepted	Haines, S. A., Mayewski, P.A., Kurbatov, A.V., Maasch, K.A., Sneed, S.B., Spaulding, N.E., Dixon, D.A., Bohleber, P.D., 2016, Ultra-high resolution snapshots of three multi-decadal periods in an Antarctic ice core, Journal of Glaciology 62, 31-35, doi:10.1017/jog.2016.5.	Yes	Basic	1	0
Mayewski, Paul	Journal Article	Accepted	Higgins, J.A., Kurbatov, A.V., Spaulding, N.E., Brook, E.J., Introne, D.S., Chimiak, L., Yan, Y., Mayewski, P.A. and Bender, M., in press 2015, Atmospheric composition 1 million years ago from blue ice in the Allan Hills, Antarctica, Proc. Nat. Acad. Sci.	Yes	Basic	0	0
Mayewski, Paul	Journal Article	Accepted	Mayewski, P.A., Kuli, A., Casassa, G., Arevalo, M., Dixon, D., Grigholm, B., Handley, M., Hoffman, H., Introne, D., Kuli, A. G., Potocki, M. and Sneed, S., 2016, Initial reconnaissance for a South Georgia ice core, Journal of Glaciology, doi:10.1017/jog.2016.9.	Yes	Basic	2	0
Mayewski, Paul	Journal Article	Accepted	Schwanck, F., Simoes, J., Handley, M., Mayewski, P.A. and Bernardo, T., Aquino, F.E., 2016, Anomalous high arsenic concentration in a West antarctic ice core and its relationship to copper mining in Chile, Atmospheric Environment, vol 124, part A, 257-264, doi:10.1016/j.atmosenv.2015.11.02.	Yes	Applied	0	0
Mayewski, Paul	Journal Article	Submitted	Korotkikh, E. V., Mayewski, P.A., Kurbatov, A.V., Handley, M.J. and Sneed, S.B., in review, Natural and anthropogenic source arsenic over the past ~20000 years from a South Pole ice	Yes	Basic	1	0
Mayewski, Paul	Journal Article	Accepted	Zhang, Y., Kang, S., Zhang, Q., Grigholm, B., Kaspari, S., You, Q., Qin, D., Mayewski, P.A., Cong, Z., Huang, J., Sillanpaa, M., and Chen, F., 2015, A 500 year atmospheric dust deposition retrieved from a mT. Geladaindong ice core in the central Tibetan Plateau, Atmospheric Research 166, 1-9, http://dx.doi.org/10.1016/j.atmosres.2015.06.007.	Yes	Basic	1	0
Mayewski, Paul	Journal Article	Submitted	Auger, J.D., Birkel, S.D., Maasch, K.A., Mayewski, P.A., and Schuenmann, K., in review, An ensemble to test differences in the current generation global climate analysis	Yes	Applied	1	0
Mayewski, Paul	Journal Article	Accepted	Grigholm, B., Mayewski, P.A., Aizen, V., Aizen, E., Kang, S., Maasch, K.A., K., Handley, M., and Sneed, S., 2016, Mid-twentieth century increases in anthropogenic Pb, Cd and Cu in central Asia set in hemispheric perspective using a Tien Shan ice core, Atmospheric	Yes	Applied	1	0

			Environment 131, 17-28 doi.org/10.1016/j.atmosenv.2016.01.030 .					
Mayewski, Paul	Journal Article	Accepted	Albani, S., N. M. Mahowald, L. N. Murphy, R. Raiswell, J. K. Moore, R. F. Anderson, D. McGee, L. I. Bradtmiller, B. Delmonte, P. P. Hesse, et al. (2016), Paleodust variability since the Last Glacial Maximum and implications for iron inputs to the ocean, <i>Geophys. Res. Lett.</i> , 43, 3944–3954, doi:10.1002/2016GL067911 .	Yes	Basic	0	0	
Mayewski, Paul	Journal Article	Submitted	Schwanck, F., Simoes, J.C., Handley, M., Mayewski, P.A., Auger, J., Bernardo, R.T. and Aquino, F.E., in review, A 125-year record of climate and chemistry variability at the Pine Island Glacier ice divide, Antarctica, <i>Science of the Total Environment</i>	Yes	Basic	1	0	
Mayewski, Paul	Journal Article	Submitted	Kaspari, S., Jenkins, M., Kang, S., Grigholm, B. and Mayewski, P.A., in review, Tibetan Plateau Geladaindong black carbon ice core record (1834-1982): Recent increase due to higher emissions and lower snow accumulation, <i>Advances in Climate Change research</i> .	Yes	Applied	1	0	
Mayewski, Paul	Journal Article	Accepted	Aizen, E.M., Aizen, V.B., Takeuchi, N., Mayewski, P.A., Grigholm, B., Joswiak, D.R., Nikitin, S.A., Fujita, K., Nakawo, M., Zapf, A. and Schwikowski, M., 2016, Abrupt and moderate climate changes in the mid-latitudes of Asia during the Holocene, <i>Journal of Glaciology</i> , doi:10.1017/jog.2016.34 .	Yes	Basic	1	0	
Mayewski, Paul	Journal Article	Accepted	Bracegirdle, T., Bertler, N.A.N., Carleton, A., Ding, Q., Fogwill, C., Fyfe, J., Hellmer, H., Karpechko, A., Kushara, K., Larour, E., Mayewski, P.A., Meier, W., Polvani, L., Russell, J., Stevenson, S., Turner, J., van Wessem, J., van de Berg, W., and wainer, I., 2015, A multi-disciplinary perspective on climate model evaluation for Antarctica, <i>Bull. Amer. Meteor. Soc.</i> , doi:10.1175/BAMS-D-15-00108.1	Yes	Applied	0	0	
Mayewski, Paul	Journal Article	Submitted	Xiao, C., Du, Z., Handley, M., Mayewski, P.A., Schupbach, S., Li, Y., Zhang, T., Li, C. and Vellelonga, P.T., in review, Bioavailable iron in the NEEM ice core in relation to Asian dust records over the past 110 kyr.	Yes	Basic	0	0	
Mayewski, Paul	Journal Article	Accepted	Hua, R., Hou, S., Li, Y., Pang, H., Mayewski, P., Sneed, S., An, C. and Handley, M., 2016, Arsenic record from a 3m snowpit at Dome Argus, Antarctica, <i>Antarctic Science</i> , 0.1017/S0954102016000092	Yes	Basic	0	0	
Mayewski, Paul	Journal Article	Submitted	(401) Grigholm, B., Mayewski, P.A., Aizen, V., Kreutz, K., Aizen, E., Kang, S., Maasch, K.A., Handley, M. and Sneed, S.B., in review, A 20th century major soluble ion record of dust and anthropogenic pollutants from Inilchek Glacier, Tien Shan.	Yes	Applied	1	0	
Mayewski, Paul	Journal Article	Submitted	Bohleber, P., Sld, L., Hardy, D., Schwikowski, M., Klenk, P., Fischer, A., Potocki, P., Hoffmann, H., and Mayewski, P.A., in review, Ground-penetrating radar reveals ice thickness and undisturbed englacial layers at Kilimanjaro's Northern Ice Field	Yes	Basic	1	0	
Mayewski, Paul	Journal Article	Submitted	Luono, M.T., Kurbatov, A.V., Bohleber, P., Spaulding, N.E., Kalteyer, D., Whealey, S., Yates, M., More, A.F.M., Mayewski, P.A. and McCormick, M., in review, First example of Icelandic tephra found in alpine ice core at Colle Gnifetti	Yes	Basic	0	1	
Mayewski, Paul	Journal Article	Submitted	Massam, A., Sneed, S., Lee, G., Tuckwell, R., Mulvaney, R., Mayewski, P.A. and Whitehouse, P., in review, A comparison of annual layer thickness model estimates with observational measurements in deep Antarctic ice cores	Yes	Basic	0	0	
Mayewski, Paul	Technical Report	Accepted	Fernandez, I.J., Schmitt, C.V., Birkel, S., Stancioff, E., Persing, A., Kelley, J.T., Runge, J., Jacobson, G.L. and Mayewski, P.A., 2015, Maine's Climate Future: 2015 Update, Orono,	Yes	Applied	0	0	

			Maine, University of Maine						
Mayewski, Paul	Technical Report	Accepted	Potocki, M., Mayewski, P.A., Kurbatov, A.V., Dixon, D.A., Grigholm, B., Casassa, G., Zamora, R., Korotkikh, E., Handley, M. and Introne, D., 2015, Environmental records from Tupungatito ice core, Central Chilean Andes, Climate Change Institute Mini Paper, University of Maine		Applied	2	0		
Mayewski, Paul	Technical Report	Submitted	Korotkikh, E., Mayewski, P.A., Kurbatov, A. and Bertler, N., 2015, Developing an ultra-high resolution record of the last glacial-interglacial transition from the RICE ice core (Roosevelt Island, Antarctica), Climate Change Institute Mini Paper, University of Maine		Basic	1	0		
Mayewski, Paul	Technical Report	Accepted	Auger, J.D., Birkel, S.D., Maasch, K.A., Mayewski, P.A. and Schuenmann, K., 2015, A four-member monthly ensemble of 3rd generation climate reanalysis models, 1979-2013, Climate Change Institute Mini Paper, University of Maine		Applied	1	0		
Mayewski, Paul	Technical Report	Accepted	Turner J, Sumerhayes, C., Sparrow, M., Mayewski, P., Convey, P., di Prisco, P., Gutt, J., Hodgson, D., Speich, S., Worby, T., Bo, S., and Klepikov, A., in press 2016, Antarctic Climate Change and the Environment - An Update.	Yes	Applied	0	0		
Mayewski, Paul	Technical Report	Accepted	Birkel S.D., and Mayewski, P.A., 2015. Climate Case Study for Mali, West African Sahel. CCAFS Workshop Report. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org	Yes	Applied	0	0		
Mayewski, Paul	Technical Report	Accepted	Potocki, M., Bohleber, P., Mayewski, P.A., Korotkikh, E., Hoffman, H., Sld, L., Hardy, D. and Introne, D., 2016, Kilimanjaro northern ice field 2015 – preliminary results, Climate Change Institute Mini Paper, University of Maine		Basic	2	0		
Mayewski, Paul	Technical Report	Accepted	Korotkikh, E., Mayewski, P.A., Kurbatov, A., Handley, M., Sneed, S., and Introne, D., 2016, A 2060-year long record of atmospheric arsenic deposition from a South Pole ice core, Climate Change Institute Mini Paper, University of Maine		Basic	1	0		
Mayewski, Paul	Editorial	Accepted	Mayewski, P.A. and Lyon, D.W., 2015, Maine is a leader in confronting climate change in the High North, Bangor Daily News OpEd		Applied	0	0		
Mayewski, Paul	Editorial	Accepted	Mayewski, P.A., 2015, Five reasons Maine should care about Arctic warming, invited article, Bangor Daily News		Applied	0	0		
Mayewski, Paul	Other	Accepted	Mayewski, P.A., 2016, Forward to Peter Neill's "The Once and Future Ocean", World Ocean Observatory Press		Applied	0	0		
McGill, Brian	Journal Article	Accepted	Parmentier, Benoit?; Brian McGill, Adam M. Wilson, James Regetz, Walter Jetz, Robert Guralnick, Mao-Ning Tuanmu, Mark Schildhauer – "Using multi-timescale methods and satellite-derived land surface temperature for the interpolation of daily maximum air temperature in Oregon" (International Journal of Climatology , 2015)	Yes	Applied	0	0		
McGill, Brian	Journal Article	Accepted	72. Petchey, Owen; Mikael Pontarp; Thomas M. Massie; Sonia Kefi; Arpat Ozgul; Maja Weilenmann; Gian Marco Palamara; Florian Altermatt; Blake Matthews; Jonathan M. Levine; Dylan Z. Childs; Brian J. McGill; Michael E. Schaepman; Bernhard Schmid; Piet Spaak; Andrew P. Beckerman; Frank Pennekamp; Ian S. Pearce - "The ecological forecast horizon, and examples of its uses and determinants" (Ecology Letters 2015 online early)	Yes	Basic	0	0		

Northington, Robert	Journal Article	Published	Saros, J.E., C.L. Osburn, C.A. Stedmon, R.M. Northington, S. Birkel, J. Auger, and N.J. Anderson. 2015. Recent decrease in DOC concentrations in Arctic lakes of southwest Greenland. <i>Geophysical Research Letters</i> 42: 6703-6709, doi: 10.1002/2015GL065075			0	0
Northington, Robert	Journal Article	Published	Burpee, B.T., J.E. Saros, R.M. Northington, and K.S. Simon. 2016. Microbial nutrient limitation in Arctic lakes in a permafrost landscape of southwest Greenland. <i>Biogeosciences</i> 13: 1-10, doi:10.5194/bg-13-1-2016			1	0
Northington, Robert	Journal Article	Published	Saros, J.E., R.M. Northington, C.L. Osburn, B.T. Burpee, and N.J. Anderson. 2016. Water transparency and epilimnetic temperatures affect thermal stratification patterns across small Arctic lakes of southwest Greenland. <i>Limnology and Oceanography</i> , doi: 10.1002/lno.10314			1	0
Northington, Robert	Journal Article	Submitted	Northington, R.M., and J.E. Saros. Factors controlling methane concentrations in Arctic lakes of southwestern Greenland. In Review, <i>PLOS One</i>			0	0
Northington, Robert	Journal Article	Submitted	Anderson, N.J., J.E. Saros, J.E. Bullard, S.M.P. Cahoon, S. McGowan, E.A. Bagshaw, C. Barry, R. Bindler, B.T. Burpee, R.A. Fowler, M. Giles, L. Hamerlik, A. Law, S.H. Mernild, R.M. Northington, C.L. Osburn, S. Pla-Rabes, E. Post, J. Telling, E. Whiteford, M. Yallop, and J.C. Yde. The Arctic in the 21st century: Changing biogeochemical linkages across a glacial landscape of Greenland. In Review, <i>BioScience</i>			2	0
Northington, Robert	Journal Article	Submitted	Saros, J.E., R.M. Northington, D. Anderson, and N.J. Anderson. A whole-lake experiment confirms a small centric diatom species as an indicator of changing lake thermal structure. In Review, <i>Limnology and Oceanography Letters</i>			0	0
Northington, Robert	Book Chapter	Submitted	Hershey, A.E., R.M. Northington, J.C. Finlay, and B.J. Peterson. Stable isotopes in food web ecology. In Hauer, R., and G.A. Lamberti (eds.), <i>Methods in Stream Ecology</i> , 3rd Edition. In Review			0	0
Northington, Robert	Proceedings	Submitted	Northington, R.M., J.E. Bullard, and J. Telling. The role of the Greenland Ice Sheet in modulating the effects of climate change in the ice-free regions of Greenland. In Review, <i>EOS</i>			0	0
Norton, Stephen	Journal Article	Published	Kopáček, J., Hejzlar, J., Kana, J., Norton, S., and Stuchlík, E., 2015, Effects of acidic deposition on in-lake phosphorus availability: A lesson from lakes recovering from acidification. <i>Environ. Sc. Tech.</i> , 49, 2895-2903	Yes	Basic	0	0
Norton, Stephen	Journal Article	Published	Norton, S. A., Kopáček, J., Jacobson, G. L., and Navratil, T., 2015, A comparative study of long-term Hg and Pb sediment archives. <i>Environ. Chem.</i> http://dx.doi.org/10.1071/EN15114 .	Yes	Basic	0	0
Norton, Stephen	Journal Article	Published	Norton, S. A., Pierret, M-C, Kopáček, J., Perry, R., and Handley, M., 2016, Long-term evolution of leaching and lake sediment sequestration of rare earth elements from two deglaciated mountain watersheds. <i>J. Paleolim.</i> 55, #3, 209-222	Yes	Basic	1	0
Norton, Stephen	Abstract	Published	Norton, S., Amirbahman, A., Bacon, L., Fitzgibbon, K., Pavri, F., and Williams, S., 2016, A Social Science-Physical Science Collaboration to Evaluate the Potential for Water Quality Decline and Enhance Lake Stewardship in Maine – Part 1: Physicochemical Indicators. Maine Annual Water and sustainability solutions Conference, Augusta, Maine		Applied	1	0

Norton, Stephen	Abstract	Published	Gruselle, M-C, Fernandez, I. J., Simon, K. S., Norton, S. A., and Mineau, M. M., 2015, Fate of N Tracer Addition in a New England Watershed with a 25-Year History of Experimental N addition. Soil Science Society of America. Annual meeting, Minneapolis, MN		Basic	0	0
Norton, Stephen	Abstract	Published	Norton, S. A., Fernandez, I., Olsen, A., Negrich, K., Salvino, C., 2015, Al, REEs, P, and DOC linkages in changing pH environments. Acid Rain 2015, Rochester, NY	Yes	Basic	2	0
Norton, Stephen	Abstract	Published	Jacobson, G. L., Norton, S. A., Grimm, E., 2015, Lund University, Lake Tulane, Florida – Controls on mercury in a 60,000 year sediment record		Basic	0	0
Norton, Stephen	Abstract	Published	Ragnoli, E., O'Brien, N., O'Donncha, F., Short, J. W., Kolar, H. R., Norton, S. A., 2015, Modelling circulation of Cl in Lake George, NY, USA with hydrodynamic and water quality Models: The International Water Association, Symposium on Lake and Reservoir Management, Pembroke, VA		Applied	0	0
Peterson, Michael	Journal Article	Published	Tranquille C.A., Walker V.A., Hernlund E., Egenvall A., Roepstorff L., Peterson M.L., Murray R.C., 2015, Effect of superficial harrowing on surface properties of sand with rubber and waxed-sand with fibre riding arena surfaces: a preliminary study., Vet J. 2015 Jan;203(1):59-64. Epub 2014 Oct 27 doi: 10.1016/j.tvjl.2014.10.027 .	Yes	Applied	1	0
Peterson, Michael	Journal Article	Published	Kate Lewis, Alison J. Northrop, Glen M. Crook, John Mather, Jaime H. Martin, Danielle Holt, Hilary M. Clayton, Lars Roepstorff, Michael 'Mick' L. Peterson, Sarah J. Hobbs, "Comparison of equipment used to measure shear properties in equine arena surfaces", Biosystems Engineering, Vol. 137, September 2015, Pp 43–54	Yes	Applied	1	0
Peterson, Michael	Proceedings	Accepted	Analytical Methods to Determine Chemical Changes in High-Oil Paraffin Binders used in Granular Composites, Advances in Functional Materials (Conference 2015), AFM 2015 http://afm2016.functionalmaterials.org/	Yes	Basic	0	0
Roscoe, Paul B	Book Chapter	Published	Participant Observation. In Vocabulary for the Study of Religion. Robert Segal and Kochu von Stuckrat, eds. Leiden: Brill	Yes		0	0
Roscoe, Paul B	Book Chapter	Published	2016 War and the Food Quest in Small-Scale Societies: Settlement Pattern Formation in Contact-Era New Guinea. In The Archaeology of Food and Warfare: Food Insecurity in Prehistory, Amber M. Vanderwarker and Gregory D. Wilson, eds. Pp.13-39. New York and Philadelphia: Springer	Yes	Basic	0	0
Roscoe, Paul B	Book Chapter	Accepted	n.d. Positivism. In The Wiley-Blackwell International Encyclopedia of Anthropology, Michelle McFadden, ed. In press	Yes		0	0
Roscoe, Paul B	Book Chapter	Submitted	The Fortunes of Foragers in Colonial and Post-Colonial New Guinea. In Hunter-Gatherers in a Changing World, Victoria Reyes Garcia and Aili Pyhälä, eds. Springer	Yes	Basic	0	0
Roscoe, Paul B	Other	Published	2015 Review of How Climate Change Comes to Matter: The Communal Life of Facts, 2014, by Candis Callison. Durham and London: Duke University Press. Journal of International and Global Studies 7:119-121		Applied	0	0
Roscoe, Paul B	Other	Published	2015 Review of Leviathans at the Gold Mine: Creating Indigenous and Corporate Actors in Papua New Guinea, 2014, by Alex Golub. Durham and London: Duke University Press.		Applied	0	0

Journal of International and Global Studies 7:127-129								
Sandweiss, Dan	Book	Under Contract	Prieto, O.G. and D.H. Sandweiss, editors, under contract: Maritime Communities of the Ancient Andes. University of Florida Press	Yes	Basic	0	0	
Sandweiss, Dan	Journal Article	Published	Sandweiss, D.H., 2015, Comentario 2: Con lo mi'nimo: los debates sobre el poblamiento de Ame'rica del Sur (de Luis Borrero). Intersecciones en Antropologi'a 16:19-21	Yes	Basic	0	0	
Sandweiss, Dan	Book	Accepted	Barnes, M. and D.H. Sandweiss, editors, 2016, Andean Past 12. Orono, ME: University of Maine Digital Commons/Department of Anthropology	Yes	Basic	0	0	
Sandweiss, Dan	Journal Article	Published	Sandweiss, D.H. and D.A. Reid, 2015, Negotiated Subjugation: Maritime Trade and the Incorporation of Chincha into the Inca Empire. In Journal of Island and Coastal Archaeology online ahead of print DOI: 10.1080/15564894.2015.1105885	Yes	Basic	0	0	
Sandweiss, Dan	Journal Article	Published	Rademaker, K., G. Hodgins, K. Moore, S. Zarrillo, C. Miller, G.R.M. Bromley, P. Leach, D. Reid, W. Ye'pez A'lvarez, and D.H. Sandweiss, 2016, Cuncacha Rockshelter, a Key Site for Understanding Colonization of the High Andes. Reply to Capriles et al. Current Anthropology 57:101-103	Yes	Basic	0	0	
Sandweiss, Dan	Journal Article	Accepted	Reitz, E.J., H. McInnis, D.H. Sandweiss, and S.D. deFrance, in press, Variations in Human Adaptations during the Terminal Pleistocene and Early Holocene at Quebrada Jaguay (QJ-280) and the Ring Site, Southern Peru'. Journal of Island and Coastal Archaeology	Yes	Basic	0	0	
Sandweiss, Dan	Journal Article	Accepted	Reitz, E.J., H. McInnis, D.H. Sandweiss, and S.D. deFrance, in press, Terminal Pleistocene and early Holocene fishing strategies at Quebrada Jaguay and the Ring Site, southern Peru'. JASREP (Journal of Archaeological Science Reports)	Yes	Basic	0	0	
Sandweiss, Dan	Book Chapter	Accepted	Sandweiss, D.H., in press, Climate, Catastrophe and Culture in the Ancient Americas: the case of the Pacific Coast. In UNESCO HEADS (Human Evolution: Adaptations, Dispersals and Social Developments) 5 World Heritage Papers, ed. by N. Sanz	Yes	Basic	0	0	
Sandweiss, Dan	Book Chapter	Accepted	Sandweiss, D.H., in press, Zooarchaeology in the 21st Century: Comments on the Contributions. In Climate Change and Past Human Responses: An Archaeozoological Perspective, ed. by G. Monks. Vertebrate Paleobiology and Paleoanthropology Series. New York	Yes	Basic	0	0	
Sandweiss, Dan	Book Chapter	Accepted	Sandweiss, D.H., in press Maritime aspects of early Andean civilizations. In Oce'anides: Antiquity, ed. by P. de Souza. Paris: Editions Picard	Yes	Basic	0	0	
Sandweiss, Dan	Other	Published	Sandweiss, D.H., C.F.T. Andrus, F. Chai, A.R. Kelley, K.A. Maasch, and E.J. Reitz, 2016, Re: ENSO Variability and Archaeological Proxies (Comment on Rustic et al. 2015, Dynamical excitation of the tropical Pacific Ocean and ENSO variability by Little Ice Age cooling, Science 350:1537-1541). Science e-Letters http://science.sciencemag.org/content/350/6267/1537.e-letter		Basic	0	0	
Sandweiss, Dan	Other	Published	Sandweiss, D.H., 2015, Review of Ancient Central Andes, by Jeffrey Quilter. Latin American Antiquity 26:577-578		Basic	0	0	
Sandweiss, Dan	Other	Published	Sandweiss, D.H., 2015, Oscillations: What effect does the weather have on the development of human culture? Phi Kappa Phi Forum Winter 2015:8-13		Basic	0	0	

Saros, Jasmine	Journal Article	Published	Saros, J.E., Osburn, C.L., Northington, R.M., Birkel, S.D., Auger, J.D., Stedmon, C.A. & N.J. Anderson. 2015. Recent decrease in DOC concentrations in arctic lakes of southwest Greenland. <i>Geophysical Research Letters</i> 42: 6703-6709, doi: 10.1002/2015GL065075	Yes	Basic	1	0
Saros, Jasmine	Journal Article	Published	Rose, K.C., Williamson, C.E., Kissman, C.E.H. & J.E. Saros. 2015. Does allochthony in lakes change across an elevation gradient? <i>Ecology</i> 96: 3281-3291	Yes	Basic	0	0
Saros, Jasmine	Journal Article	Published	Wigdahl-Perry, C.R., Saros, J.E., Fritz, S.C. & C.T. Hess. 2015. Investigating potential effects of zooplankton grazing on diatom-inferred drought reconstructions. <i>Hydrobiologia</i> , DOI 10.1007/s10750-015-2529-1	Yes	Basic	1	0
Saros, Jasmine	Journal Article	Published	Burpee, B.T., Saros, J.E., Northington, R.M. & K.S. Simon. 2016. Microbial nutrient limitation in arctic lakes in a permafrost landscape of southwest Greenland. <i>Biogeosciences</i> 13: 365-374	Yes	Basic	1	0
Saros, Jasmine	Journal Article	Published	Strock, K.E., Saros, J.E., Nelson, S.J., Birkel, S.D., Kahl, J.S. & W.H. McDowell. 2016. Extreme weather years drive episodic changes in lake chemistry: Implications for recovery from sulfate deposition and long-term trends in dissolved organic carbon. <i>Biogeochemistry</i> 127: 353-365	Yes	Basic	1	0
Saros, Jasmine	Journal Article	Published	Malik, H.I. & J.E. Saros. 2016. Effects of temperature, light, and nutrients on five <i>Cyclotella</i> sensu lato taxa assessed with in-situ experiments in arctic lakes. <i>Journal of Plankton Research</i> , doi:10.1093/plankt/fbw002	Yes	Basic	1	0
Saros, Jasmine	Journal Article	Published	Wigdahl-Perry, C. R., Saros, J. E., Schmitz, J., Calcote, R., Rusak, J., Anderson, D. & S. Hotchkiss. 2016. Response of temperate lakes to drought: a paleolimnological perspective on the landscape position concept using diatom-based reconstructions. <i>Journal of Paleolimnology</i> 55: 339-356	Yes	Basic	1	0
Saros, Jasmine	Journal Article	Published	Stone, J.R., Saros, J.E. & G.T. Pederson. 2016. Coherent late Holocene climate-driven shifts in the structure of three Rocky Mountain lakes. <i>The Holocene</i> , DOI: 10.1177/0959683616632886	Yes	Basic	0	0
Saros, Jasmine	Journal Article	Published	Hobbs, W.O., Lafrancois, B.M., Stottleyer, R., Toczydlowski, D., Engstrom, D.R., Edlund, M.B., Almendinger, J.E., Strock, K.E., VanderMeulen, D., Elias, J.E. & J.E. Saros. 2016. Nitrogen deposition to lakes in national parks of the western Great Lakes region: isotopic signatures, watershed retention, and algal shifts. <i>Global Biogeochemical Cycles</i> , DOI: 10.1002/2015GB005228	Yes	Basic	0	0
Saros, Jasmine	Journal Article	Published	Boeff, K.A., Strock, K.E. & J.E. Saros. 2016. Evaluating planktonic diatom response to climate change across three lakes with differing morphometry. <i>Journal of Paleolimnology</i> , DOI 10.1007/s10933-016-9889-z	Yes	Basic	1	0
Saros, Jasmine	Journal Article	Published	Williams, J.J., Beutel, M., Nurse, A., Moore, B., Hampton, S.E. & J.E. Saros. 2016. Phytoplankton responses to nitrogen enrichment in Pacific Northwest, USA mountain lakes. <i>Hydrobiologia</i> , DOI 10.1007/s10750-016-2758-y	Yes	Basic	1	0
Saros, Jasmine	Journal Article	Published	Saros, J.E., Northington, R.M., Osburn, C.L., Burpee, B.T. & N.J. Anderson. 2016. Thermal stratification in small arctic lakes of southwest Greenland affected by water transparency and epilimnetic temperatures. <i>Limnology & Oceanography</i> , doi: 10.1002/lno.10314	Yes	Basic	1	0

Schauffler, Molly	Proceedings	Published	Zoellick, B., Schauffler, M., Flubacher, M., Weatherbee, R., Webber, H., 2016. Data Literacy: Assessing Student Understanding of Variability in Data. Paper presented at the annual Meeting of the National Association for Research in Science Teaching, April 14-17, 2016, Baltimore, MD	Yes	Pedagogical	0	0
Sorg, Marcella	Journal Article	Submitted	Sorg, Marcella H., D. Leann Long, Marie Abate, James A. Kaplan, James C. Kraner, Allen R. Mock, Margaret Greenwald, Thomas A. Andrew, Steven Shapiro, Jamie A. Wren (2016 submitted) Variability among opioids in apparent co-intoxicant additive effects in opioid-related deaths. Submitted for review to Academic Forensic Pathology.	Yes	Applied	0	0
Sorg, Marcella	Journal Article	Accepted	Sorg, Marcella H., Margaret Greenwald, Jamie A. Wren. (forthcoming, 2016) Patterns of drug-induced mortality in Maine, 2015 Update. Submitted for review to Maine Policy Review.		Applied	0	0
Sorg, Marcella	Book Chapter	Accepted	Crist, T, MH Sorg (forthcoming 2016) Autopsy and colonial experience with mass fatality in New France during the winter of 1604-1605. In K Nystrom, Ed. The Bioarchaeology of Dissection and Autopsy in the United States. Springer	Yes	Basic	0	0
Sorg, Marcella	Other	Accepted	Sorg, Marcella H. and William D. Haglund (forthcoming, 2016) Foreword in E.M.J. Schotsmans, N. Marquez-Grant and S. Forbes (Eds.) Taphonomy of Human Remains: Forensic Analysis of the Dead and Depositional Environment. New York: Wiley-Blackwell		Applied	0	0
Zaro, Gregory D	Journal Article	Published	Herndon, K.E., G. Zaro, B.A. Houk, D. Sandrock, A. Booher, E. Vasquez (2015). Investigating urban form and kingship: Preliminary Results of the 2014 Chan Chich Archaeological Project. Research Reports in Belizean Archaeology 12:339-346	Yes		4	0
Zaro, Gregory D	Journal Article	Published	Houk, B.A. and G. Zaro (2015). Lithic production and domestic economy in an ancient Maya neighborhood at Chan Chich, Belize. Research Reports in Belizean Archaeology 12:127-134	Yes		0	0
Zaro, Gregory D	Other	Submitted	Zaro, G. (2016). Review of: Light and Shadow: Isolation and Interaction in the Shala Valley of Northern Albania, by M.L. Galaty, O. Lafe, W.E. Lee, and Z. Tafilica (eds). UCLA Cotsen Institute of Archaeology Press, 274 pp. American Journal of Archaeology 120(3): in press			0	0

PRESENTATIONS: INTERNATIONAL/NATIONAL/REGIONAL/STATE/LOCAL

Name	Date	Scope	Description	GS	US
Belknap, Daniel F.	10/18/15	State	Belknap, D.F. and Kelley, J.T., 2015, Geology of the nearshore and coastal Presumpscot Formation from high resolution seismic profiling and vibracores: 2nd Symposium on the Presumpscot Formation, Portland, ME, October 18, 2015. http://umaine.edu/presumpscot-symposium/2015-symposium-proceedings/	0	0
Birkel, Sean	12/16/2015	International	Reanalysis Context for Ice Cores Recovered from Mt. Hunter, Denali National Park, USA. This poster reports an effort to use reanalysis to facilitate the interpretation of events registered in ice cores. https://agu.confex.com/agu/fm15/webprogram/Paper86621.html	0	0

Borns Jr., Harold W.		State	Acadia Senior College -special gathering		
Borns Jr., Harold W.		State	Rotary Club, Waterville, ME		
Borns Jr., Harold W.		State	Kiwanis Club, Bangor, ME		
Borns Jr., Harold W.		State	Appalachian Mountain Club: Down East Chapter		
Borns Jr., Harold W.		State	Eagle Hill Institute, Steuben, ME		
Borns Jr., Harold W.		State	Key Note Speaker; Dedication of the Tom and Nancy Harrigan Earth History Museum, Milo, ME		
Chai, Fei	09/2015	Regional	An oral presentation at the 57th Annual Eastern Pacific Ocean Conference (EPOCE), South Lake Tahoe, California.	0	0
Chai, Fei	10/2015	International	A keynote lecture for PARE (Population, Activities, Resources, and Environment) at Hokkaido University, Sapporo, Japan.	0	0
Chai, Fei	10/2015	International	Three oral presentations at the PICES (North Pacific Marine Science Organization) 24th Annual Meeting, Qingdao, China.	0	0
Chai, Fei	11/2015	International	An invited talk in a workshop on developing blue economy during the World Ocean Week (WOW) in Xiamen, China.	0	0
Chai, Fei	11/2015	International	An invited talk in a workshop on ocean acidification in IAEA in Monaco.	0	0
Chai, Fei	12/2015	International	An invited talk at the Second Institute of Oceanography (SIO)/State Oceanic Administration (SOA) in Hangzhou, China	0	0
Chai, Fei	02/2016	International	An invited talk at the IOCCG Working Group (Ocean Color Applications for Biogeochemical, Ecosystem and Climate Modeling) in New Orleans, USA	0	0
Chai, Fei	02/2016	International	One lead oral presentation, and several co-authored oral and poster presentations at the Ocean Sciences Meeting 2016, New Orleans, USA	0	0
Chai, Fei	04/2016	International	An invited talk at the Ocean Acidification Workshop in Eastern Normal University, Shanghai, China.	0	0
Chai, Fei	05/2016	International	An invited talk on ocean acidification at the GOA-ON 3rd Workshop in Hobart, Australia.	0	0
Chai, Fei	05/2016	International	An oral presentation on carbon cycle modeling at the Oceans in High CO2 World Conference, Hobart, Australia	0	0
Chai, Fei	05/2016	International	A keynote talk on ecosystem modeling at the International Symposium on Fisheries Oceanography, Shanghai Ocean University, Shanghai, China	0	0
Chawathe, Sudarshan S			Toward a Domain-Specific Language for Patterns in Ice-Core Data.	0	0
Denton, George	October, 2015	International	Southern Hemisphere climate change during the last glacial cycle. Lecture presented at the annual science meeting of the Comer Family Foundation	0	0
Denton, George	November, 2015	International	Distinguished Career Lecture given at the annual Geological Society of America meeting in Baltimore, Maryland.	0	0

Enderlin, Ellyn		International	Submarine Melting of Icebergs in Sermilik Fjord, Southeast Greenland, Based on Satellite Remote Sensing and Hydrographic Observations	0	0
Enderlin, Ellyn		International	High-resolution force balance analyses of tidewater glacier dynamics	0	0
Fernandez, Ivan	March 29, 2016		Patel, Kaizad, Corianne Tatariw, Ivan J. Fernandez, Jean MacRae, and Tsutomu Ohno. "Nutrient Dynamics in a Changing Climate: How Does a Decreasing Snowpack Influence Soil Biogeochemistry?"	2	0
Fernandez, Ivan	March 2, 2016		Maine's Climate: What Are the Right Questions Now?	0	0
Fernandez, Ivan	Dec. 17, 2015	Other/Special	The End of Climate Change	0	0
Fernandez, Ivan	2015	International	Using Fluorescence Spectroscopy to Link Changes in Soil Chemistry with Stream Dissolved Organic Matter	1	0
Fernandez, Ivan	2015	International	Effect of Snow Removal on Soil Biogeochemistry	2	0
Fernandez, Ivan	2015	International	Declining Acidic Deposition Begins Reversal of Forest-Soil Acidification in the Northeastern U.S. and Eastern Canada	0	0
Fernandez, Ivan	2015	International	The Effect of Long Term Nitrogen Deposition on the Structure and Function of Soil Microbial Communities	1	0
Fernandez, Ivan	2015	International	Fate of 15N Tracer Additions in a New England Watershed	0	0
Fernandez, Ivan	2015		Multidecadal Response in Soil Carbon, Nitrogen, and Mercury to the Mt. Desert Island Fire of 1947 Using Paired Watersheds in Acadia National Park, Maine.	1	0
Fernandez, Ivan	2015	International	Does Chronic N Enrichment Enhance Soil Microbial P Limitation? : Evidence from Several Long-Term Studies in the Eastern US	1	2
Fernandez, Ivan	2015	International	The Forest's Perception of Multi-Air Pollutant Stressors in the 21st Century	0	0
Fernandez, Ivan	2015	International	Declining Acidic Deposition in the Northeastern U.S. and Eastern Canada	0	0
Fernandez, Ivan	2015	International	Al, REEs, P, and DOC Linkages in a Changing pH Environment	2	0
Fernandez, Ivan	2015	Regional	Seaweeds and Soil Health – The United Nations International Year of Soils	0	0
Fernandez, Ivan	2015	State	UMaine, Soils, and Climate Change	0	0
Fernandez, Ivan	2015	State	Maine's Climate Future	0	0
Fernandez, Ivan	2015	Regional	What the Data Tells Us	0	0
Gill, Jacquelyn	8/13/2015	International	Disequilibrium vegetation dynamics in response to climate change: Lessons from the late glacial no-analog communities https://eco.confex.com/eco/2015/webprogram/Paper56026.html	0	0
Gill, Jacquelyn	9/20/2015	Regional	Top-up and bottom-down controls on climate-vegetation interactions http://www.uwpcc.washington.edu/event.jsp?id=1341&action=ViewObject&object=event&forward=no	0	0
Gill, Jacquelyn	11/20/2015	National	Climate change in the classroom: getting past denial	0	0

Gill, Jacquelyn	1/12/2016	Local	The past is not even past: a 2.5 million year perspective on community assembly	0	0
Gill, Jacquelyn	3/8/2016	Local	How to build a novel ecosystem in three easy steps	0	0
Gill, Jacquelyn	3/17/2016		Disequilibrium dynamics in temperate forests following extinction and abrupt climate change	0	0
Hall, Brenda	Sept/ 2015	International	Timing of the last deglaciation in the western Ross Sea region, Antarctica	3	0
Hall, Brenda	March 2016	International	The end of the last ice age in the Southern Hemisphere	0	1
Hall, Brenda	January 2016	National	History of the Antarctic ice sheet during the last glaciation and last termination	0	0
Hall, Brenda	Sept. 2015	International	Deglaciation of Cordillera Darwin during Heinrich Stadial I	0	0
Hamilton, Gordon	8/20/2015	International	Recent changes in the Norske Øer Ice Barrier, Northeast Greenland	1	0
Hamilton, Gordon	9/11/2015	State	Recent progress in understanding Greenland's coupled ice sheet-atmosphere-ocean system	0	0
Hamilton, Gordon	12/12/2015	International	Overview of observational programs on Greenland's outlet glaciers	0	0
Hamilton, Gordon	1/26/2016	International	Glacier-ocean interactions in the Arctic	0	0
Hamilton, Gordon	2/2/2016	International	Overview of international activities on Greenland ice-ocean interactions	0	0
Hamilton, Gordon	2/18/2016	Regional	Greenland: Climate change and sea level rise	0	0
Isenhour, Cynthia	March 2016	State	Talking Trash: The Sustainability Problem Hiding in Plain Sight.	0	0
Isenhour, Cynthia	November 2016	International	Power in Numbers: On Accounting for Climate Change and the Reproduction of International Advantage	0	0
Isenhour, Cynthia	October 2016	International	When Gestures of Change Demand Policy Support.	0	0
Isenhour, Cynthia	May 2016	State	Measuring and Modeling the Value and Potential of Maine's Reuse Economies	0	0
Jain, Shaleen	18 Sept. 2015	International	Jain, S. and N. Dhakal, Seasonality of extreme precipitation events in a changing climate: A nonparametric statistical approach and critical considerations for climate change studies.	0	0
Jain, Shaleen	13 Nov/ 2015	International	Jain, S., and M. Beyene, Delineation of commingled climate and urbanization influences and identification of thresholds in lake-watershed systems: A tentative framework and case studies on local to regional scales.	1	0
Jain, Shaleen	20 August 2015	International	Kim, J.-S., and S. Jain, Wintertime High Flow Regime in Northern Maine, USA : A Hydroclimatic Diagnostic Study. http://www.cripe.ca/proceedings/cripe-workshop18.html	0	0
Jain, Shaleen	6 June 2016	State	Jain, S., Integrating Hydroclimatic Knowledge to Inform Engineering Design and Decision-making: Some Examples from the Northeast.	0	0
Jain, Shaleen	17 Dec. 2015	International	T. Wahl, S. Jain, J. Bender, S. D. Meyers, and M. Luther, Increasing risk of compound flooding from storm surge and rainfall for major US coastal cities	0	0
Jain, Shaleen	14 January 2016	International	Dhakal, N., and S. Jain, Daily Precipitation Extremes over Eastern United States: Variability and Change Stemming from North Atlantic Tropical Cyclones	0	0

Jain, Shaleen	27 May 2016	National	Kim, J.-S., S. Jain, J.-M. Yuk, Y.-I Moon, Sensitivity of flow metrics to climate variability and extremes in Korea.	0	0
Kelley, Alice	4/8/16	National	Combining GPR and Archeological Excavations at Los Morteros: Looking “Inside” a Complex Preceramic Coastal Peruvian Site http://www.saa.org/Portals/0/SAA/MEETINGS/2016%20Abstracts/1_L.pdf	0	0
Kelley, Joseph	October, 2015	International	Chandler, E.A., Kelley, J.T. and Belknap, D.F., 2015. Sedimentation accumulation patterns in the Damariscotta Estuary. GSA Annual Meeting Program, p. 190.	1	0
Kelley, Joseph	March, 2016	Regional	Sedimentation patterns in the Damariscotta River Estuary doi:10.1130/abs/2016NE-272497	1	0
Kelley, Joseph	April 1, 2016	State	Sediment accumulation patterns in the Damariscotta River as related to Maine Aquaculture	1	0
Kelley, Joseph	August 18, 2016	Local	Geology of the Gulf of Maine	0	0
Kreutz, Karl	July 13 2015	National	Earth Systems Thinking: An InTeGrate Module That Can Be Used In Any Course	0	0
Kreutz, Karl	March 7 2016	International	Potential impact of volcanic aerosols on the position of the ITCZ and Southern Hemisphere westerlies over the past 2000 years	0	0
Kreutz, Karl	Feb. 11 2016	International	Challenges and Opportunities for Developing Robust Annually Resolved Paleoenvironmental Reconstructions from the Oceans	0	0
Kurbatov, Andrei	Spring 2016	International	Bohleber, P., N. Spaulding, P. Mayewski, A. Kurbatov, H. Hoffmann, T. Erhardt, H. Fischer, A. More, C. Loveluck, M. Luongo, J. Kabala, and M. McCormick (2016). Linking two thousand years of European historical records with environmental change recorded in a high Alpine ice core. In: Geophysical Research Abstracts. Vol. 18. EGU General Assembly, pp. EGU2016– 14903.	0	0
Kurbatov, Andrei	Spring 2016	International	N. Spaulding, P. Mayewski, S. B. Sneed, M. Handley, D. Introne, and A. Kurbatov. Glacial-interglacial variability in paired surface ice and ice core records from the Allan Hills Blue Ice Area, Antarctica. In International Partnerships in Ice Core Sciences Second Open Science Conference 7 - 11 March 2016 Hobart, Australia., 2016.	0	0
Kurbatov, Andrei	Spring 2016	International	N. Spaulding, P. Bohleber, S. Sneed, P. Mayewski, M. McCormick, A. Kurbatov, and D. Wagenbach. What’s in a signal? examining ultra-high resolution LA-ICP-MS signals for the reconstruction of European climate. In International Partnerships in Ice Core Sciences Second Open Science Conference 7 - 11 March 2016 Hobart, Australia., 2016.	0	0
Kurbatov, Andrei	Summer 2015	International	Dunbar, N., N. A. Iverson, A. Kurbatov, W. McIntosh, D. Kalteyer, B. G. Koffman, and M. Yates (2015). Antarctic tephra research: source volcanoes, blue ice sites, and ice cores. In: SCAR Kickstart meeting for working group on Antarctic Volcanism: Catania, Italy.	0	0
Kurbatov, Andrei	Fall 2015	International	Iverson, N. A., N. W. Dunbar, A. Kurbatov, D. Kalteyer, M. Yates, W. McIntosh, M. Sigl, J. R. McConnell, and N. Pearce (2015). Linking the Antarctic tephra record across the continent and beyond. In: American Geophysical Union Fall Meeting 2015, Volume V51F-3107. https://agu.confex.com/agu/fm15/meetingapp.cgi/Paper/76151 .	1	0
Maasch, Kirk	3/18/16	Regional	Foot Steps of the Ancient Great Glacier of North America: A Long Lost Document of a Revolution in 19th Century Geological Theory	0	0

Maasch, Kirk	11/23/15	Regional	Northern New England Climate: Past, Present, and Future	0	0
Maasch, Kirk	4/14/16	State	Atmospheric Circulation Influences on West Greenland Precipitation	1	0
Mayewski, Paul	2 June		European climate change	0	0
Mayewski, Paul	26 June	Regional	Climate Education Workshop	0	0
Mayewski, Paul	10 July	International	Arctic climate change	0	0
Mayewski, Paul	13 July	International	18th century climate	0	0
Mayewski, Paul	15 July	Regional	18th century climate	0	0
Mayewski, Paul	24 July	Regional	Tidesmart Steveo Radio	0	0
Mayewski, Paul	15 August	International	Chilean researchers	0	0
Mayewski, Paul	20 August	Regional	Climate instability	0	0
Mayewski, Paul	2 Oct	International	Westwind Expedition	0	0
Mayewski, Paul	23 Oct	International	Southern Ocean climate change	0	0
Mayewski, Paul	30 Oct	International	Falkland Islands climate change	0	0
Mayewski, Paul	11 Nov	International	Advances on ice cores	0	0
Mayewski, Paul	26 Nov	International	Climate change in Central America	0	0
Mayewski, Paul	27 Nov	International	Climate tools - Climate change in Central America	0	0
Mayewski, Paul	10 Dec	International	Colle Gnifetti and climate change in Europe	0	0
Mayewski, Paul	17 Dec	International	Bangor Daily News interview re COP21 Climate Talks	0	0
Mayewski, Paul	18 Dec	International	TV WCSH6 interview for “207” with Rob Caldwell	0	0
Mayewski, Paul	2 Feb	International	Society for American Archaeology (SSA) - “Timing is Everything”, invited talk and video broadcast	0	0
Mayewski, Paul	18 Feb	Regional	Climate change	0	0
Mayewski, Paul	6 April	International	Ice core advances and archaeology	0	0
Mayewski, Paul	19 April	International	Hans Oeschger Medal Lecture	0	0
Mayewski, Paul	26 April	Regional	Climate change	0	0
Mayewski, Paul	15 June	State	Climate change	0	0
McGill, Brian	February 2016	International	Getting serious about a top-down view of community assembly (John Muir lecture)	0	0
McGill, Brian	August 2015	International	S. Kathleen Lyons and 30 others including McGill, Brian (2015) – “Species associations of plant and	0	0

			mammal communities from deep time to the recent”		
McGill, Brian	August 2015	International	Brian J. McGill - Solving informatics challenges to advance plant ecology: A vision for the next 100 years – Ecological Society of America, Baltimore	0	0
McGill, Brian	August 2015	International	Brian J. Enquist and 22 others including McGill, Brian (2015) – “The macroecology of botanical diversity: History, new insights and the central informatics barriers” – Ecological Society of America, Baltimore	0	0
McGill, Brian	August 2015	International	Benoit Parmentier, Brian McGill and 9 others (2015) “Comparison of methods for the production of high resolution global daily climate layers for species modeling” – Ecological Society of America, Baltimore	0	0
McGill, Brian	August 2015	International	Anne E. Magurran, Maria Dornelas, Nicholas Gotelli, Brian J. McGill and Faye Moyes (2015) “Temporal turnover in marine assemblages in a rapidly changing world”– Ecological Society of America, Baltimore	0	0
McGill, Brian	August 2015	International	Kathryn Miller, Brian Mitchell and Brian McGill (2015) – “Using the Forest Service Climate Change Tree Atlas and National Land Cover Data to predict changes in forest composition in Northeastern National Parks” – Ecological Society of America, Baltimore	1	0
McGill, Brian	August 2015	International	Brian J. McGill (2015) – “Why scaling up is harder than you think” – IGNITE session - Ecological Society of America, Baltimore	0	0
Northington, Robert	11/04/2015		Greenland ecosystems as sentinels for enhanced climate change in the Arctic	0	0
Northington, Robert	04/14/2016	Local	J.E. Saros and R.M. Northington. Quantifying the role of lakes in the arctic carbon cycle. Harold W. Borns Symposium, University of Maine Climate Change Institute, April 2016.	0	0
Northington, Robert	5/22/2016	International	H.S. Greig, K.A. Capps, J. Gill, R.M. Northington, T. Parr, and A. Klemmer. EXPERIMENTAL EVIDENCE THAT HEMLOCK DECLINE CHANGES THE ROLE OF DETRITAL SUBSIDIES IN FRESHWATER FOOD WEBS. Society for Freshwater Science Annual Meeting (Sacramento, CA), May 2016.	0	0
Northington, Robert	06/09/2016	International	R.M. Northington and J. E. Saros. EXPERIMENTAL MANIPULATION OF LAKE MIXING DEPTH ALTERS PHYTOPLANKTON COMMUNITIES AND BIOMASS IN AN ARCTIC LAKE IN SOUTHWESTERN GREENLAND. Association for the Sciences of Limnology and Oceanography (Santa Fe, NM), June 2016.	0	0
Peterson, Michael	November 15, 2015	International	Surface materials and construction to suit health and performance of horses, Bonn http://www.agpferd.com/equine-surfaces-2015/	0	0
Peterson, Michael	March 25, 2015	State	Hooves and Tracks, Biological Adaptation and Engineering Design for Safety and Performance	0	0
Roscoe, Paul B	4/7/2016	International	On Losing one's Head in New Guinea: Head Rituals among New Guinea Hunter-Gatherers and Fisher-Foragers. In the session, "Skull Cults" amongst Hunter-Gatherers?" organized by Richard Schulting.	0	0
Roscoe, Paul B	10/21/2015		Fission and fusion in contact-era New Guinea.	0	0
Sandweiss, Dan	9/22/15	Local	Sandweiss D.H., Tracking El Niño through Archaeology	0	0
Sandweiss, Dan	10/14/15	International	Sandweiss, D.H., Nature’s Naughty Child: El Nin~o and Cultural Change in Ancient Peru.	0	0
Sandweiss, Dan	01/07/16	International	Sandweiss, D.H., Nature’s Naughty Child: El Nin~o in Peruvian Prehistory.	0	0

Sandweiss, Dan	04/06/16	International	Reitz, E.J. and D.H. Sandweiss, Climate Change on the North Coast of Perú.	0	0
Sandweiss, Dan	04/07/16	International	Sandweiss, D.H. and C.F.T. Andrus, The Reitz Stuff: A Faunal Perspective on El Niño from Coastal Peru.	0	0
Sandweiss, Dan	04/07/16	International	A. St. Amand, D.H. Sandweiss, and A. Kelley, Impacts of Population Resettlement Due to Sea Level Rise on Archaeological Resources: A Case Study.	1	0
Sandweiss, Dan	04/08/16	International	Kelley, A., A.C. Mauricio, D.H. Sandweiss, J. Kelley, and D. Belknap, Combining GPR and Archeological Excavations at Los Morteros: Looking “Inside” a Complex Preceramic Coastal Peruvian Site.	0	0
Saros, Jasmine	July 2015	International	Malik, H.I & J.E. Saros. Deciphering the mechanisms behind the climate driven changes in the relative abundances of diatom Cyclotella.	1	0
Saros, Jasmine	March 2016	State	Warner, K.A. & J.E. Saros. Investigating the response of Maine’s drinking water resources to extreme precipitation events.	1	0
Saros, Jasmine	April 2016	Local	Warner, K.A., J.E. Saros, & M.F. Teisl. Investigating the response of Maine’s drinking water resources to extreme precipitation events.	1	0
Saros, Jasmine	June 2016	International	R.M. Northington and J. E. Saros. EXPERIMENTAL MANIPULATION OF LAKE MIXING DEPTH ALTERS PHYTOPLANKTON COMMUNITIES AND BIOMASS IN AN ARCTIC LAKE IN SOUTHWESTERN GREENLAND.	0	0
Saros, Jasmine	June 2016	International	Saros, J.E., B.T. Burpee, K. Slemmons & K. Warner. Temporal and spatial variability in the effects of nitrogen subsidies in glacial meltwater on alpine aquatic ecosystems.	2	0
Saros, Jasmine	April 2016	Local	Saros, J.E. & R.M. Northington. Rapid changes in the role of lakes in the arctic carbon cycle.	0	0
Saros, Jasmine	April 2016	Local	Tugend, C. & J.E. Saros: Effects of Geese on Nutrient and Carbon Inputs To Arctic Lakes in Southwest Greenland	1	0
Saros, Jasmine	April 2016	Local	Fowler, R.A. & J.E. Saros. Elevated dust inputs to SW Greenland lakes: effects on surface water dissolved organic carbon concentration and quality.	1	0
Saros, Jasmine	April 2016	Local	Burpee, B. & J.E. Saros: Do Nitrogen Subsidies in Glacier Meltwater Modify the Response of Alpine Lakes to Abrupt Warming?	1	0
Saros, Jasmine	April 2016	Local	Theodore. N, J. E. Saros, K. E. Strock, W. Gawley, K. Boeff, S. Wiggin, S Reischauer & A. Thine. Epilimnion Thickness of Lakes in Acadia National Park: Biological Implications in a Changing Climate.	1	0
Saros, Jasmine	March 2016	State	Theodore. N, J. E. Saros, K. E. Strock, W. Gawley, K. Boeff, S. Wiggin, S Reischauer & A. Thine. Drivers of Declining Epilimnion Thickness in Acadia National Park and Implications for Phytoplankton.	3	0
Saros, Jasmine	April 2016	Regional	Theodore. N, J. E. Saros, W. Gawley, K. Boeff, S. Wiggin, S Reischauer & A. Thine. Jordan Pond Buoy Project.	2	0
Sorg, Marcella	July, 2015	Local	Sorg, Marcella H. (2015, July) Drug Abuse and Overdose with a focus on Portland and Cumberland County. Portland Public Health Department Drug Abuse Task Force and the public, Portland City Hall, Portland ME (invited)	0	0
Sorg, Marcella	August, 2015	State	Sorg, Marcella H. (2015, August) Drug Deaths, Particularly Heroin and Fentanyl. Maine Governor’s Drug	0	0

			Summit. August, 2015; Augusta ME (invited)		
Sorg, Marcella	August, 2015	National	O’Roak, Jonah* and Marcella H. Sorg* (2015, August) An interesting cold case. New England Seminar in Forensic Sciences. Colby College, August, 2015, Waterville, ME (invited)	0	0
Sorg, Marcella	August, 2015	National	Sorg, Marcella H.* and Margaret Greenwald* (2015, August) Tracking Drug Deaths in the Medical Examiner Setting. New England Seminar in Forensic Sciences, Colby College, August, 2015, Waterville ME. (invited)	0	0
Sorg, Marcella	August, 2015	National	Greenwald, Margaret* and Marcella H. Sorg* (2015, August) Outdoor scenes: Combining Anthropology and Forensic Pathology. New England Seminar in Forensic Sciences. Colby College, August 2015, Waterville ME (invited)	0	0
Sorg, Marcella	September, 2015	State	Sorg, Marcella H. (2015, September) Substance Abuse in Maine. Hanley Physician Leadership Academy, Brunswick, ME (invited)	0	0
Sorg, Marcella	November, 2015	State	Sorg, Marcella H. (2015, November) Preliminary Analysis of Law Enforcement-Related Indicators of Heroin and Opioid Abuse and Trafficking. Governor’s Anti-Heroin and Opiate Task Force, Office of the U.S. Attorney, Portland ME (invited)	0	0
Sorg, Marcella	December, 2015	State	Sorg, Marcella H. and Jonah C. O’Roak (2015, December) Cold case homicide: Woodburn Case. Maine State Policy Evidence Response Team Training. Maine Criminal Justice Academy, Vassalboro, ME. (invited)	0	0
Sorg, Marcella	March, 2016	State	Sorg, Marcella H. (2016, March) Decomposition, Insects & Scavengers: A Practical Approach. Maine State Policy Evidence Response Team Training. Maine Criminal Justice Academy, Vassalboro, ME. (invited)	0	0
Zaro, Gregory D	November 2015	International	Celhar, M., G. Zaro, and D. Vujevic (2015). Nadin-Gradina: Razvoj Grada. Poster presented at Antiquitatis Sollemnia Antidoron Mate Suic, Zagreb-Zadar, Croatia, November 3-7.	0	0
Zaro, Gregory D	April 2016	National	Zaro, G., M. Celhar, D. Vujevic, and K. Nystrom (2016). Nadin-Gradina and the process of urbanization in the eastern Adriatic. Paper to be presented at the 81st Annual Meeting of the Society for American Archaeology, Orlando, FL, April 8.	0	0
Zaro, Gregory D	April 2016	Local	Bovie, Marissa, G. Zaro, A. Kelley, D. Belknap, M. Yates, M. Celhar, and D. Vujevic (2016). Compositional, Textural, and Chronological Evaluation of Mortar at the Nadin-Gradina Archaeological Site, Croatia	0	1

CONFERENCES/SYMPOSIA/MEETINGS ATTENDED: INTERNATIONAL/NATIONAL/REGIONAL/STATE/LOCAL

Name	Date	Scope	Conference	Location	GS	US
Belknap, Daniel F.	07/13/15	State	State of Maine's Beaches Conference http://www.seagrant.umaine.edu/maine-beaches-conference/2015/agenda	Southern Maine Community College, South Portland, ME	0	0

Belknap, Daniel F.	October 10, 2015	State	2nd Symposium on the Presumpscot Formation, advances in Geotechnical, Geologic and Construction Practice http://umaine.edu/presumpscot-symposium/2015-symposium-proceedings/	Univ. Southern Maine, Portland, ME	0	0
Chawathe, Sudarshan S	April 14-15, 2016.		Borns Symposium		1	0
Denton, George	October, 2015	International	Annual Comer Family Foundation	Comer Farm, Soldiers Grove, Wisconsin	3	0
Denton, George	November, 2015	International	Geological Society of America Annual meeting	Baltimore, Maryland	0	0
Enderlin, Ellyn	08/17-08/21/15	International	Int. Glac. Soc.	Cambridge, UK	0	0
Enderlin, Ellyn	12/14-12/18/15	International	American Geophysical Union Fall Meeting	San Francisco, CA, USA	0	0
Hall, Brenda	September 2015	International	Comer Abrupt Climate Change Meeting	Soldiers Grove, Wisconsin	2	0
Hall, Brenda	September 2015	International	22nd Annual West Antarctic Ice Sheet Meeting	Loveland, CO	2	0
Hamilton, Gordon	August 2015	International	International Symposium on Ice-Ocean Interactions	Cambridge, UK	0	0
Hamilton, Gordon	December 2015	International	International Workshop on Greenland Ice Sheet-Ocean Observing Systems (GrIOOS)	San Francisco, Calif.	2	0
Hamilton, Gordon	January 2016	International	International Arctic Science Committee Workshop on Arctic Glaciology	Benasque, Spain	0	0
Hamilton, Gordon	February 2016	International	World Meteorological Office Program on Climate and Cryosphere annual meeting	Copenhagen, Denmark	0	0
Kelley, Alice	11/1/15-11/4/15	National	Geological Society of America http://community.geosociety.org/gsa2015/home	Baltimore, Maryland	0	0
Kelley, Alice	4/6/16-4/10/16	National	Society for American Archaeology http://www.saa.org/Portals/0/SAA/MEETINGS/2016	Orlando, Florida	1	0
Kelley, Alice	4/14/16	State	2016 Maine Sea Grant Research Symposium http://www.seagrant.umaine.edu/research/symposium	Orono, Maine	0	0
Kelley, Joseph	10/23/15	International	Geological Society of America annual meeting		1	0
Kreutz, Karl	July 13-16 2015	National	Earth Educators Rendezvous	Boulder, CO	0	0
Kreutz, Karl	Dec. 11-15 2015	International	AGU Fall meeting	San Francisco, CA	0	0
Kreutz, Karl	March 6-10 2016	International	International Partnership in Ice Core Sciences (IPICS) Second Open Science Conference	Hobart, Australia	0	0
Kreutz, Karl	June 19-21 2015	National	InTeGrate Workshop	Northfields MN (Carleton College)	0	0
Kreutz, Karl	Sept. 22-23 2015	National	WAIS Divide/SPICE Workshop	La Jolla, CA	0	0

Maasch, Kirk	4/14/16	State	Borns Symposium	Orono, ME	6	0
McGill, Brian	August 2015	International	Ecological Society of America	Baltimore, MD	1	0
Norton, Stephen	Fall 2016	International	Acid Rain, 8th Int. Conf.	Rochester, NY	0	0
Norton, Stephen	April 2016	State	Maine Water Conference	Augusta, Maine	1	0
Norton, Stephen	April 2016	Regional	New England Association of Environmental Biologists	Rockland, Maine	0	0
Roscoe, Paul B	October 2015	International	Wenner-Gren Workshop, Fission-Fusion Dynamics in Primate Species	Valladolid, Mexico.	0	0
Roscoe, Paul B	April 2016		2016 Annual Meeting of the Society for American Archaeology	Orlando, Florida	0	0
Sandweiss, Dan	7/10/15	State	Maine Chapter of the Fulbright Association Event	Maine Maritime Academy, Castine ME	0	0
Sandweiss, Dan	8/2/15 to 8/5/15	National	Phi Kappa Phi Partnering for Success Workshop	Snowbird Resort, Snowbird UT	0	0
Sandweiss, Dan	9/30/15 to 10/1/15	National	Phi Kappa Phi site visit	Hillsdale College, Hillsdale MI	0	0
Sandweiss, Dan	10/14/15 to 10/15/15	International	Humboldt Forum "On Thin Ice: Facing Environment and Climate Change in Ethnological Museums"	Ethnological Museum, Berlin, Germany	0	0
Sandweiss, Dan	10/29/15	State	Maine Chapter of the Fulbright Association Event	Bowdoin College, Brunswick ME	0	0
Sandweiss, Dan	10/31/15	Regional	Peabody Advisory Committee Meeting	RS Peabody Museum, Phillips Academy, Andover MA	0	0
Sandweiss, Dan	11/11/15 to 11/15/15	National	Society for American Archaeology Board Meeting	Albuquerque NM	0	0
Sandweiss, Dan	12/4/15	National	Phi Kappa Phi site visit	Pontificia Universidad Católica de Puerto Rico, Ponce PR	0	0
Sandweiss, Dan	12/13/15	National	Institute of Andean Research Annual Board Meeting	MIT, Cambridge MA	0	0
Sandweiss, Dan	1/7/16	International	American Institute of Archaeology Annual Meeting	San Francisco CA	0	0
Sandweiss, Dan	1/8/16 to 1/9/16	International	Institute of Andean Studies Annual Meeting	University of California Berkeley, Berkeley CA	0	0
Sandweiss, Dan	2/12/16	National	Phi Kappa Phi site visit	Caldwell University, Caldwell NJ	0	0
Sandweiss, Dan	3/1/16	National	Phi Kappa Phi Chapter Installation	Hillsdale College, Hillsdale MI	0	0
Sandweiss, Dan	3/10/16 to 3/12/16	National	Phi Kappa Phi Spring Board Meeting	Baton Rouge LA	0	0
Sandweiss, Dan	4/5/16 to 4/10/16	International	Society for American Archaeology Board Meeting and Annual Meeting	Orlando FL	1	0
Sandweiss, Dan	4/29/16	National	Phi Kappa Phi site visit	Southern Virginia University, Buena Vista VA	0	0

Sandweiss, Dan	5/6/16	Regional	Peabody Advisory Committee Meeting	RS Peabody Museum, Phillips Academy, Andover MA	0	0
Sandweiss, Dan	5/13/16	National	Widener University Presidential Inauguration	Widener University, Chester PA	0	0
Sandweiss, Dan	5/26/16	National	SPIA Board Meeting	Washington DC	0	0
Sorg, Marcella	August, 2015	State	Governor's Drug Summit	Augusta, ME	0	0
Sorg, Marcella	August, 2015	National	New England Seminar in Forensic Sciences	Waterville, ME	0	2
Sorg, Marcella	February, 2016	National	American Academy of Forensic Sciences	Las Vegas, NV	0	0
Sorg, Marcella	January, 2016	National	NIST Organization of Scientific Area Committees	Leesburg, VA	0	0
Zaro, Gregory D	April 2016	National	Society for American Archaeology	Orlando	0	0

RESEARCH EXPEDITIONS & FIELD TRIPS

Name	Date	Description	GS	US
Belknap, Daniel F	July, 2015	8 day trips aboard R/V Mud Queen mapping the Damariscotta Estuary with Olex-Wassp multibeam sonar. Part of NOAA-SeaNet project with Joe Kelley. MS Student Emily Chandler thesis, Robin Arnold MS student and undergraduate Eliza Kane field assistants on several days.	2	1
Belknap, Daniel F	08/20/15	1 day trip aboard R/V Mud Queen mapping the Saco River Estuary with Olex-Wassp multibeam sonar. Part of NOAA-SeaNet project with Joe Kelley. MS Student Emily Chandler thesis/project responsibilities.	1	0
Belknap, Daniel F	May-April, 2016	Bimonthly field work at NOAA-Maine Sea Grant-supported Invasive Green Crab project localities in Walpole, Damariscotta, and Harpswell at established salt marsh and tidal flat monitoring sites.	0	0
Borns Jr., Harold W.		Eagle Hill Institute, Steuben, Me. - Eastern Maine. Glacial Geology		
Borns Jr., Harold W.		Maine Audubon Society - Eastern Maine Glacial Geology		
Borns Jr., Harold W.		Marine-Based Ice Sheet on Continental Shelf, Western Ireland, in cooperation with the Geological Survey of Ireland - a continuing project		
Borns Jr., Harold W.		With Prof. Brenda Hall; surface exposure dating of the Pineo Moraine and Delta Complex that preceded the Bolling Warm Interval in Maine (This is the first geological record found of this hemispheric - wide climate event related to the Laurentide Ice Sheet.).		
Borns Jr., Harold W.		mbedding Maine's Ice Age Trail - Down East, Map and Guide geological history in the curriculum of the public schools in Washington and Hancock Counties, ME		
Borns Jr., Harold W.		Completing work on CCI's Virtual Polar Resource Center (checking and enlarging the data base, and developing a "search engine").		
Denton, George	Jan. – Feb., 2015	Glacial geologic field work and moraine chronology in the Southern Alps of New Zealand	1	0

Hall, Brenda	Summer 2015	Geologic field work in Maine, including in Acadia National Park, on Pineo Ridge (Cherryfield), and at Eagle Hill.	0	1
Hall, Brenda	March 2016	Geologic field work in the Falkland Islands	0	0
Hamilton, Gordon	July 2015	Glaciological research in Southeast Greenland	0	0
Hamilton, Gordon	Oct./Nov. 2015	Glaciological research in West Antarctica	1	0
Hamilton, Gordon	May 2015	Glaciological research in Southeast Greenland	0	0
Isenhour, Cynthia	March 2016	Maine Science Festival- Designed and Presented Exhibit on Waste Recovery	0	3
Kelley, Joseph	October 28, 2016	Field trip to the Delmarva Coast	0	0
Kreutz, Karl	May 1-29 2016	Glaciological research on Eclipse Icefield, Yukon Territories, Canada	3	2
Mayewski, Paul	29 Sept - 5 Nov	Westwind Expedition to South Georgia, Southern Ocean 2000 miles in sailboat, ascend South Georgia ice palteau, collect ice core	2	0
Northington, Robert	June to July 2015	Kangerlussuaq, Greenland	2	0
Northington, Robert	08/27/2015	Schoodic Experience for new biology undergraduates	0	150
Saros, Jasmine	July 1-19, 2015	Fieldwork in Kangerlussuaq, southwest Greenland	2	0
Zaro, Gregory D	May-July, 2015	Nadia-Gradina Archaeological Project, Croatia	1	11
Zaro, Gregory D	May-July 2016	Nadia-Gradina Archaeological Project, Croatia	2	7

OTHER INDICATORS

Name	Description
Belknap, Daniel F.	Frequent requests by e-mail and phone to answer research-related questions by professionals and general public.
Denton, George	According to Google Scholar, my publications on the subject of climate change have an H-index of 69, an i10-index of 153, and an all citations index of 16,477.
Koons, Peter	Several invited Keynotes at International meetings to present this theory
Sandweiss, Dan	I was invited to edit a submission to the Proceedings of the National Academy of Sciences (initial and revised submissions). I was an invited speaker in the Presidential Plenary Session at the Archaeological Institute of America Annual meeting and, when the President was unable to attend due to health issues, asked to chair the session. I was invited to organize and chair the Presidential Opening Forum on Climate Change and Archaeology at the Society for American Archaeology Annual Meeting and also co-authored a presentation in this forum.
Sorg, Marcella	Book contract, CRC Press, 2015: Sorg MH, WD Haglund & KA Marden. Forensic Taphonomy: Postmortem Fate of Human Remains, 2nd edition. Invited by the Maine Office of Attorney General and the Governor's Office to continue providing epidemiological research and statistics on drug deaths to policy makers in Maine on a quarterly basis.

Zaro, Gregory D My research has caught the attention of graduate students from the University of Chicago and UCLA/Oxford; two such students will participate in the field project during the summer 2016 season.

MEDIA PRESENTATIONS CREATED

Name	Type	Description	GS	US
Birkel, Sean	Website	Climate Reanalyzer, an interactive website for visualizing climate and weather data. http://cci-reanalyzer.org	1	0
Birkel, Sean	Website	Environmental Change Model (ECM), an interactive website for visualizing high-resolution climate reconstructions (or projections) for selected time intervals ranging from the Last Glacial maximum to 2100 AD. ECM output includes temperature, precipitation, snow/ice mass balance, and biomes. http://cci-reanalyzer/ECM	0	0
Birkel, Sean	Website	Maine State Climate Office website (in progress). The primary purpose of this website is to provide access to daily and monthly climate datasets for Maine. Weather station data extracted from the Global Historical Climatology Network (GHCN) are updated daily and made available through an interactive plot interface. http://pamola.um.maine.edu/MaineClimate/	0	0
Enderlin, Ellyn	webinar	USAPECS webinar on Outreach from Afar, featuring the University of Maine Follow-A-Researcher Program https://vimeo.com/165873221	2	0
Enderlin, Ellyn	webinar	USAPECS webinar on Building Bridges and Designing Activities with Teachers to encourage more K-12 outreach by polar early-career scientists https://vimeo.com/167751679	0	0
Hall, Brenda	website	Our research group maintains a website that features our activities. http://umaine.edu/earthclimate/faculty-staff/faculty-and-staff/brenda-hall/glacial-geology-and-geochronology-research-group/	1	0

SERVICE – TO PROFESSION/DEPARTMENT/COLLEGE/UNIVERSITY SYSTEM/STATE GOVERNMENT AGENCIES/ GENERAL PUBLIC & LOCAL COMMUNITIES/PRE-K-12 EDUCATION

To Profession:

Name	Type	Description
Belknap, Daniel F.	Advisory Board	Wells National Estuarine Research Reserve, Laudholm Farm, Wells, ME. Member of Reserve Management Authority. Quarterly meetings and frequent e-mail interactions on policy and management.
Belknap, Daniel F.	Advisory Board	Chairman of Research Advisory Committee, Wells National Estuarine Research Reserve, Wells, ME. Annual

		meetings with Research Director and seven other prominent regional scientist to provide advice on research directions.
Belknap, Daniel F.	Advisory Board	Search Committee member, Wells National Estuarine Research Reserve, selection of new Research Director, Nov., 2015 - Jan., 2016
Belknap, Daniel F.	General/Other	Review of manuscripts for papers and books: 1 Textbook 8 individual papers in Geological Society of America Field Trip book 5 Journal reviews (including 2 reviews of revisions)
Belknap, Daniel F.	General/Other	Review of 2 proposals for NSF-EAR
Chai, Fei	Advisory Board	International Advisory Committee for the State Key Lab at the Xiamen University, China
Chai, Fei	Editorial Board	Biogeosciences.
Chai, Fei	Editorial Board	Acta Oceanologica Sinica.
Chai, Fei	Program Committee Member	The in situ iron studies (ISIS) Consortium
Chai, Fei	Editorial Board	Journal of Oceanography
Chai, Fei	Advisory Board	serve on NERACOOS Board and attending the annual meeting
Chawathe, Sudarshan S	Professional Association Committee	IEEE Intellectual Property Committee.
Chawathe, Sudarshan S	General/Other	Standards-setting committee for Java exam at Excelsior College.
Chawathe, Sudarshan S	Grant Review Board Member	NIH grant review panel.
Chawathe, Sudarshan S	Discussant	Scheme (language) Requests for Implementations.
Chawathe, Sudarshan S	General/Other	Scheme (language) Working Group 2 for developing the "R7RS-large" specification.
Denton, George	Advisory Board	Comer Family Foundation
Enderlin, Ellyn	Professional Association Officer	United States national committee co-chair for the Association of Polar Early Career Scientists (USAPECS).
Enderlin, Ellyn	Professional Association Committee	Board member for the Association of Polar Early Career Scientists US National Committee (USAPECS).
Enderlin, Ellyn	Professional Association Committee	Early-career representative on the Ice Sheet Mass Balance and Sea Level (ISMASS) Steering Committee
Enderlin, Ellyn	Editorial Board	Review editor for Frontiers in Cryospheric Sciences.
Enderlin, Ellyn	Program Committee Member	Cryosphere Focus Group representative for the American Geophysical Union Fall Meeting Planning Committee
Enderlin, Ellyn	Conference Section Chair	Co-convenor of poster and oral presentations on ice-ocean interactions at the American Geophysical Union Fall Meeting.
Enderlin, Ellyn	Conference Section Chair	Co-convenor of oral presentations on surface mass balance at the American Geophysical Union Fall Meeting.
Fernandez, Ivan	General/Other	Member – Planning Committee for Acadia National Park Science Symposium (2013 - 2016)
Fernandez, Ivan	General/Other	Member - State of Maine Board of Certification for Geologists and Soil Scientists (1993 – present)

Fernandez, Ivan	General/Other	University of Maine Representative to the USDA Northeast Climate Hub
Fernandez, Ivan	General/Other	Chartered Member, Clean Air Scientific Advisory Committee, US Environmental Protection Agency, Science Advisory Board. Washington, DC. 2015-2018.
Fernandez, Ivan	Panel Chair	Chair of the Secondary NAAQS Review Panel for Oxides of Nitrogen and Sulfur, US EPA Clean Air Scientific Advisory Committee, US EPA, Washington DC. 2015-2018.
Fernandez, Ivan	Advisory Board	External Science Advisor, Hubbard Brook Ecosystem Study, New Hampshire. 2013-2016, reappointed 2016-2019..
Fernandez, Ivan	General/Other	Invited Participant – Acadia National Park Climate Change Scenario Planning Workshop. Schoodic Education and Research Center, Acadia National Park, Maine.
Fernandez, Ivan	General/Other	Invited participant – US Department of Homeland Security Regional Resiliency Assessment Program (RRAP) meeting on critical infrastructure – Region I Electric Energy Resilience. Portland, Maine. May 12, 2016.
Fernandez, Ivan	General/Other	Focus Group Member - CarbonScapes Tool Development - USDA. 2016
Fernandez, Ivan	General/Other	Invited Participant – Envision Maine’ Planning Meeting for ‘Conversations on Maine’s Future’. Portland, Maine. 9/11/2015.
Fernandez, Ivan	General/Other	Invited Participant – Acadia National Park Strategic Planning Workshop, Acadia National Park Headquarters, Bar Harbor, Maine. September 8-10, 2015.
Gill, Jacquelyn	Professional Association Officer	Vice President of Communications, International Biogeography Society Meeting
Gill, Jacquelyn	Professional Association Officer	Paleoecology Section Secretary, Ecological Society of America
Gill, Jacquelyn	Editorial Board	Ecography Subject Editor
Gill, Jacquelyn	Editorial Board	Journal of Ecology Associate Editor
Gill, Jacquelyn	Editorial Board	Open Quaternary: Founding editor of a new open access peer-reviewed journal
Gill, Jacquelyn	Curatorial Activities	Supervising the organization, identification, and cataloging of the Biology Department's skull collection.
Hall, Brenda	General/Other	Reviewer for approximately 1-2 papers per month for various scientific journals, most recently Nature Communications.
Hall, Brenda	General/Other	Reviewer for 6-10 grant proposals per year from the National Science Foundation, the National Geographic Society, and American Philosophical Society.
Hall, Brenda	Advisory Board	Participant in review of redesign and construction of primary US Antarctic research station.
Hall, Brenda	General/Other	United States Representative for the Geosciences to the Scientific Committee on Antarctic Research (SCAR)
Hamilton, Gordon	Advisory Board	NASA: Operation IceBridge advisory board
Hamilton, Gordon	Panel Chair	US CLIVAR working group on Greenland Ice Sheet - Ocean Interactions
Hamilton, Gordon	Editorial Board	Frontiers of Earth Science (Cryosphere)
Hamilton, Gordon	Panel Chair	US Interagency Arctic Policy Research Committee

Hamilton, Gordon	Conference Chair/Co-Chair	International Workshop on Greenland Ice-Ocean Observing System (GrIOOS), San Francisco, Calif., December 2015
Hooke, Roger	General/Other	Served as referee on 10 papers submitted for publication in International journals, 2 in Anthrocene, 3 in the Journal of Glaciology, and 1 each in The Cryosphere, Journal of Geophysical Research, Quaternary Science Reviews, Environmental Science, and EOS
Isenhour, Cynthia	Advisory Board	Society for Economic Anthropology
Isenhour, Cynthia	Conference Chair/Co-Chair	International Conference of the Sustainable Consumption Research and Action Initiative
Kelley, Alice	Advisory Board	Member: Society for American Archaeology's Climate Change Strategies Task Force
Kelley, Alice	Advisory Board	Organizing Team Member: IHOPE (Integrated History and Future of People on Earth) Threats to Global Heritage
Kelley, Joseph	Editorial Board	Journal of Coastal Research
Kelley, Joseph	Professional Association Committee	Joint Technical Committee Geological Society of America
Kreutz, Karl	Panel Chair	U.S. Ice Core Working Group
Kreutz, Karl	Advisory Board	Ice Drilling Program Office
Kreutz, Karl	Editorial Board	Scientific Reports (Nature Publishing Group)
Kreutz, Karl	Advisory Board	Maine Audubon Board of Trustees
Kurbatov, Andrei	Advisory Board	Ice core working group
Maasch, Kirk	Program Committee Member	University Corporation for Atmospheric Research, Member's Nominating Committee
Maasch, Kirk	Program Committee Member	University Corporation for Atmospheric Research, Membership Committee
Mayewski, Paul	Advisory Board	Member, Environmental Sustainability Committee, Boston Museum of Science (2014-present)
Mayewski, Paul	Advisory Board	Advisory Board, Maine North Atlantic Development Office (2014-present)
Mayewski, Paul	Advisory Board	Advisory Board, World Ocean Observatory (W2O) (2014-present)
Mayewski, Paul	Advisory Board	Advisory Board, Marine Environmental Research Institute (MERI) Center for Marine Studies (2009-present)
Mayewski, Paul	Advisory Board	Committee of Visitor, National Science Foundation, Polar Programs, Antarctica
McGill, Brian	Editorship	Editor in Chief of journal Global Ecology and Biogeography (ranked 10th/145 ecology journals 1/46 physical geography journals)
McGill, Brian	Editorial Board	Frontiers in Ecology & Environment
McGill, Brian	General/Other	One of 3 co-bloggers on leading blog in academic ecology. Reached 1,000,000th page view this year. Many postings receive 1000+ readers on topics as diverse as surviving your comprehensive exam to what is wrong with academic publishing.
McGill, Brian	Grant Review Board Member	NASA Biodiversity grant panel June 2016

McGill, Brian	Conference Section Chair	“Going Macro: Is Scaling Up All the Same?” – ESA Ignite Session (August 2015) co-organizer with Margaret Kosmala
McGill, Brian	Conference Section Chair	“Understanding Temporal Trends of Biodiversity” – ESA Symposium (August 2015) co-organizer with Nick Gotelli, Anne Magurran and Maria Dornelas
Northington, Robert	General/Other	Reviewer for multiple scientific journals
Norton, Stephen	Editorial Board	Environmental Monitoring and Assessment Journal
Peterson, Michael	Advisory Board	Jockey Club, Welfare and Safety of the Racehorse, Surfaces Committee
Roscoe, Paul B	General/Other	External Reviewer, PhD candidacy of Tobias Schwoerer, Department of Anthropology, University of Luzern, Luzern, Switzerland.
Sandweiss, Dan	Professional Association Officer	Regional Vice President (Northeast), Phi Kappa Phi National Honor Society (elected office)
Sandweiss, Dan	Professional Association Officer	Board of Directors, Phi Kappa Phi National Honor Society (elected office)
Sandweiss, Dan	Professional Association Officer	Board of Directors, Society for American Archaeology (elected office)
Sandweiss, Dan	Advisory Board	Chair, RS Peabody Museum of Archaeology Advisory Committee
Sandweiss, Dan	Advisory Board	Vice President, Maine Chapter of the Fulbright Association
Sandweiss, Dan	Editorship	Founding Editor, Andean Past (Cornell Latin American Studies Program transitioning to University of Maine)
Sandweiss, Dan	Editorship	Joint Editor for Archaeology and Patrimony, Chungará Revista de Antropología Chilena (bilingual)
Sandweiss, Dan	Editorial Board	Editorial Board Member, Latin American Antiquity (published by the Society for American Archaeology)
Sandweiss, Dan	Editorial Board	Editorial Board Member, Journal of Island and Coastal Archaeology (Taylor and Francis)
Sandweiss, Dan	Editorial Board	Editorial Board Member, Boletín de Arqueología PUCP (published by the Pontificia Universidad Católica del Perú)
Sandweiss, Dan	Program Committee Member	Organizing Committee, Society for American Archaeology's Third Conferencia Intercontinental (Oaxaca, Mexico, August 2016)
Sandweiss, Dan	Professional Association Committee	Chair, Society for American Archaeology Task Force on Climate Change
Sandweiss, Dan	Professional Association Committee	Board liaison to following Society for American Archaeology groups: International Government Affairs Committee, Government Affairs Committee, Committee on Climate Change Strategies and Archaeological Resources, Island and Coastal Archaeology Interest Group, Prehistoric Mines and Quarries Interest Group, Geoarchaeology Interest Group, Academic Tenure & Promotions Task Force
Sandweiss, Dan	General/Other	I operate an Andean Studies email information distribution list with over 1000 members
Sandweiss, Dan	General/Other	Review letter for Promotion to Professor for Scott Fitzpatrick, University of Oregon
Sandweiss, Dan	General/Other	Review letter for Promotion to Professor for Christine Conlee, Texas State University
Sandweiss, Dan	General/Other	Review letter for tenure and promotion for César Méndez, Universidad de Chile

Sandweiss, Dan	General/Other	Review for appointment as External Faculty Member for Kevin Vaughn, Anthropology Department, UCLA
Saros, Jasmine	Editorial Board	Associate editor of Hydrobiologia, handled 15 manuscripts
Saros, Jasmine	Conference Chair/Co-Chair	Past Global Changes Aquatic Transitions workshop, Orono, April 2016
Saros, Jasmine	Conference Chair/Co-Chair	Greenland Synthesis workshop, SERC, May 2016
Sorg, Marcella	Professional Association Committee	Vice-Chair, Crime Scene/Medico-legal Death Investigation Subcommittee, Organization of Scientific Area Committees, National Institute of Standards efforts to develop professional standards for all of the forensic sciences nationally.
Zaro, Gregory D	Award Committee Member	Borns Symposium Awards committee
Zaro, Gregory D	College/University Program Review	Anthropology Program Reviewer, Adelphi University
Zaro, Gregory D	Professional Association Committee	Phi Kappa Phi National Honors Society, UMaine Chapter Executive Committee member
Zaro, Gregory D	Professional Association Officer	Phi Kappa Phi National Honors Society, UMaine Chapter Past President
Zaro, Gregory D	Professional Association Committee	Maine Fulbright Association Board Member
Zaro, Gregory D	Professional Association Officer	Maine Fulbright Association Chapter Treasurer

To Department:

Name	Description
Belknap, Daniel F	Member - SECS Peer Review Committee Acting Chair - SECS Peer Review Committee
Chawathe, Sudarshan S	Committees of the School of Computing and Information Science (SCIS), University of Maine. * Curriculum * CS graduate * Labs * Web and Marketing * CS PEER I am also vice-coordinator for assessment and accreditation for the BS CS program.
Denton, George	Policy Advisory Committee
Enderlin, Ellyn	Climate Change Institute Science Day presenter
Fastook, James L	Cirriculum, Graduate and Peer Committees
Fernandez, Ivan	-Peer Committee: Climate Change Institute -Peer Committee: School of Forest Resources

	<ul style="list-style-type: none"> -Member - Steering Committee: Climate Change Institute A2C2 IGERT -Member - Recruiting Committee: Climate Change Institute A2C2 IGERT -Graduate Faculty -Building Manager, Potato Storage Building
Gill, Jacquelyn	<p>SBE Speakers Committee</p> <p>Search Committee (Applied Plant Physiologist)</p> <p>Supervising the organization and cataloging of the Biology skull collection (e.g., tracking down permits, identification, etc.).</p>
Hall, Brenda	<p>Service on the following committees:</p> <p>Peer Review Committee - SECS</p> <p>Peer Review Committee - CCI</p> <p>Graduate Committee - SECS</p> <p>Graduate Committee - CCI</p> <p>Ad Hoc Curriculum Reform Committee - SECS</p>
Hamilton, Gordon	<p>Chair, Peer review committee (Climate Change Institute)</p> <p>Co-Chair, ad hoc Website committee (Climate Change Institute)</p>
Hooke, Roger	<p>Taught one 2-credit course (ERS 552) in Fall'14</p> <p>Taught one 1-credit seminar course in Fall'14</p> <p>Was available for consultation with graduate students</p> <p>All of the above was pro bono</p>
Isenhour, Cynthia	<p>Graduate Coordinator (2013 – current): As graduate coordinator I am responsible for responding to all prospective student inquiries, organizing and disseminating graduate program applications, scheduling and leading graduate admissions committee meetings and working with current graduate students to ensure they are meeting their requirements and are in compliance with Graduate School and departmental policy. In the fall of 2014 I worked with my colleagues to author a departmental handbook for our graduate students. I also submit all nominations for graduate school awards (we've had a major award for the past three years!) and work with faculty who wish be appointed/reappointed as Graduate School Faculty.</p>
Jain, Shaleen	<p>Graduate Studies Coordinator, 2014 - present</p> <p>Chair, Hydraulics Faculty Search Committee, 2015 - 2016</p>
Kelley, Alice	<p>School of Earth and Climate Sciences Golden Undergraduate Coordinator</p>
Kreutz, Karl	<p>CCI Graduate Coordinator</p> <p>CCI Graduate Board Representative</p> <p>CCI graduate committee, chair</p> <p>SECS strategic planning committee</p> <p>CCI Churchill Fund committee</p>
Kurbatov, Andrei	<p>One of the organizers of Climate Change Institute Lecture series</p>
Maasch, Kirk	<p>CCI Policy Advisory Committee</p> <p>Joint CCI/SECS Peer Review Committee</p>
Mayewski, Paul	<p>Director, Climate Change Institute</p>
McGill, Brian	<p>SBE Peer Committee</p> <p>SBE Plant Physiology search committee</p>

Norton, Stephen	mentoring of graduate student research
Roscoe, Paul B	Policy Advisory Committee Chaired three Peer Review Committees
Sandweiss, Dan	For Climate Change Institute: Organizer, Ice-age Breaker Event Organizer, Borns Symposium Co-chair, Churchill Exploration Fund Selection Committee Member, Policy Advisory Committee Member, CCI Service Award Committee 2 guest lectures in Ant 317 (February 15 and 17, 2016) 1 guest lecture in Ant 493 (March 29, 2016) For Anthropology Department: Chair, AA Search Committee Member, Zaro Post Tenure Review Committee Member, MA in Anthropology Planning Committee Member, Anthropology Awards Committee
Saros, Jasmine	Member of SBE Peer Review Committee
Sorg, Marcella	Service lectures as needed in biological anthropology and bioarchaeology. Maintain human osteology laboratory, including curation of human skeletal material involving students.
Zaro, Gregory D	Graduate Committee member: CCI and Anthropology

To College:

Name	Description
Belknap, Daniel F	Boat Safety Committee member
Isenhour, Cynthia	Human Dimensions of Climate Change Film Series (Spring 2014, 2015, 2016): Each spring Jen Bonnet (Fogler Library) and I organize a film series centered on the human dimensions of climate change to promote our new undergraduate major. The series features a recent film every Tuesday for three weeks, just after spring break. We also invite a faculty member to lead the discussion for each film. The series has been a great success, drawing between 30 and 50 audience members to each showing.
Jain, Shaleen	Member, College of Engineering Graduate Fellowship Selection Committee (2014 - present)
Kelley, Alice	Natural Sciences, Forestry, and Agriculture Undergraduate Curriculum Committee Member
Koons, Peter	Faculty Awards Committee Geddes Simpson Award Committee
Kreutz, Karl	Center for Undergraduate Research Advisory Board NCURA Steering Committee

	Graduate School Strategic Plan Financial Stability subcommittee
Sandweiss, Dan	Member, SPIA (School of Policy and International Affairs) Advisory Board (ex officio) Member, CLAS Awards Committee Participated in CLAS panel on teaching large courses (February 3, 2016)
Sorg, Marcella	Post-tenure review committee for Jonathan Rubin
Zaro, Gregory D	Chair search committee for Department of Art and Department of Sociology CLAS Dean tenure and promotion advisory committee

To University:

Name	Description
Belknap, Daniel F	Cooperating Curator, Hudson Museum
Chawathe, Sudarshan S	Faculty Senate. Member of senate and of the senate's library committee. 9/2006–present. University Club, University of Maine Member, Executive Committee. (Vice-president, 2008--2009; President 2009--2010)
Fernandez, Ivan	University of Maine Representative to the National Park Service North Atlantic Coastal Cooperative Ecosystem Studies Unit (2005-present) Member Project Advisory Team: Signs of the Seasons: A Maine Phenology Project Founding Member - Data Science and Engineering Advisory committee (2016-present) Geddes W. Simpson Lecture Selection Committee, College of Natural Sciences, Forestry and Agriculture (2016-2019) Member – Review Committee for the Irving Chair of Forest Ecosystem Management. (2015) Office of Research and Sponsored Programs Process Improvement Task Force (2015-2016)
Gill, Jacquelyn	Geddes W. Simpson Lecture Committee Women, Gender, and Sexuality Studies Advisory Board
Hall, Brenda	Faculty Research Funds Grants Committee
Hamilton, Gordon	Institutional Representative to the University of the Arctic
Isenhour, Cynthia	-Graduate School Board (2013 - current): As the AEP PHD program’s representative to the graduate board I attend monthly meetings and review all submitted materials including course proposals and modification, suggested graduate school policy and strategic plans. After each meeting I compile notes for graduate students and faculty in the department and report any actionable items at each faculty meeting. Student Research Competition, Volunteer Judge (Spring 2014, 2015, 2016): Each year since joining the faculty I have volunteered to help judge student research competitions including the CUGR Academic and Creative Activities Showcase, The Grad Expo and now this year the combined Graduate and Undergraduate Research Symposium.

Jain, Shaleen	Graduate School Executive Committee (2015 - present) Co-chair, University Teaching Council (2014 - 2015) Member, UMaine Data Science and Engineering Executive Committee (2016 - present) New Faculty Mentor, ADVANCE Rising Ride Center Faculty Mentorship Program (2014 - present) Invited Panelist, CAREER Proposal Writing Workshop, ADVANCE Rising Ride Center (2015, 2016)
Kelley, Alice	Member, Cultural Affairs Committee Cooperating Coordinator, Hudson Museum
Kelley, Joseph	Provosts Advisory Committee on Promotion and Tenure
Maasch, Kirk	UMaine Academic Representative to University Corporation for Atmospheric Research (UCAR) Member, Hudson Museum Advisory Board
Mayewski, Paul	Member VPR Director's committee Member VPR University Research Council
Sandweiss, Dan	Chief Cooperating Curator, Hudson Museum Board of Cooperating Curators Member, IGERT Internship Committee Member, Executive Committee, University of Maine Chapter of Phi Kappa Phi
Saros, Jasmine	Associate Director, Climate Change Institute Director, Sawyer Water Research Laboratory Member, Gender & Teaching Evaluation Committee Member, Rising Tide 5-year Celebration Organizing Committee
Zaro, Gregory D	Rising Tide Center steering committee for Department Chair Professional Development Day Hudson Museum Cooperating Curator and Archaeology Day presenter

To State Legislature:

Name	Description
Isenhour, Cynthia	Our interdisciplinary Materials Management Research Group, funded by the Mitchell Center for Sustainability Solutions, has engaged in an extensive stakeholder engagement process. Over the past year we have drawn together more than 200 stakeholders to discuss the state and future of Maine's materials and waste management systems. Stakeholders engaged in this process not only include private businesses (waste haulers, landfill operators), public representatives (municipal and tribal representatives, regulators), and civil society organizations (environmental groups, citizen activist groups) – but they also include legislators serving on the Joint Standing Committee on Environment and Natural Resources. By gathering such a diverse group to identify areas of significant consensus and to survey their support for a suite of different policy options, our research team has worked closely with the committee to provide data-informed decision support. This work has helped to inform LD1587 A Bill to Update Maine's Solid Waste Management Laws, which passed out of committee in March 2016 for consideration by the Maine State Legislature. While the bill did not get a vote it is likely to be reintroduced next session. If successful it would create a new product stewardship program for small batteries, establish a food waste hierarchy, extend the timeline for the achievement of recovery goals, shift waste reduction goals to per capita measures, establish funding for recovery grant programs, provide authority for the DEP to impose municipal solid waste disposal fees and direct the DEP to implement pilot food scrap composting projects.
Sandweiss, Dan	Vice President, Maine Chapter of the Fulbright Association

To State Government Agencies:

Name	Description
Fernandez, Ivan	Maine State Board of Certification for Geologists and Soil Scientists – Augusta, Maine (1992 to present) Ongoing collaboration with Maine CDC, Maine DACF, Maine DEP and others
Sorg, Marcella	Responding to requests for data and interpretation of data regarding drug abuse, particularly drug related mortality: --Office of Substance Abuse --Office of Attorney General --Office of the Governor --Maine Drug Enforcement Agency Provide training in forensic science to the Maine State Police Evidence Response Team

To General Public/Local Community:

Name	Description
Birkel, Sean	I gave four invited public lectures as Maine State Climatologist during AY 2016: 1) The Changing Climate of Baxter State Park. Friends of Baxter State Park Annual Meeting, Augusta, ME, April 2016. 2) Maine's Climate: Baxter State Park. Baxter State Park Annual Staff Meeting, Millinocket, ME, October 2015. 3) Maine's Climate: Past, Present, and Future. Hancock County Democrats, Ellsworth, ME, September 2015. 4) Maine's Climate: Past, Present, and Future. Orgonon Nature Program, Rangeley, ME, July 2015.
Fernandez, Ivan	I continue to participate in, and represent the University in, climate change adaptation initiatives in Maine.
Gill, Jacquelyn	Filed in First Peoples, a PBS documentary. Blogging for The Contemplative Mammoth, Twitter account with >9400 followers. iSWOOP program to communicate science in Acadia National Park
Isenhour, Cynthia	Maine Science Festival - Public Engagement Participant (2016)
Koons, Peter	Advise local lakes association. On Board of Friends of Messalonskee
Kreutz, Karl	Tim Godaire, Climate Ride article in the BDN, August 12, 2015 Interview with Minnesota Public Radio Climate Cast, August 13, 2015, "Glacial Retreat" Asa Adams 4th grade river sampling, lab tour, and science project, Sept. 20-27 2015 (Sara class) Bangor High School STEM program talk and interaction, Oct. 15 (Cary James and John Cangelosi) Asa Adams 4th grade river sampling, lab tour, and science project, Nov. 5 2015 (Allyson class) ERS Open house – Nov. 9 2015 Interview with Ralston Valley High School in Arvada, Colorado, Nov. 17 2015 Recommendation for Greg Zielinski, Bangor YMCA, Nov. 19, 2015

	Participation in Rice University diversity study, Jan. 31 2015
Kurbatov, Andrei	One of the developers of 10green (http://www.10green.org) and ClimateFutures (http://www.climatefutures.net/) projects.
Norton, Stephen	Talk to Penobscot Bay Stewards Field Trip for Camden Conservancy
Roscoe, Paul B	Public presentation of Exploring New Guinea Art to the Valladolid English Library, Valladolid, Mexico, October 2015
Schauffler, Molly	Advisory boards for Maine Community Foundation and Signs of the Seasons Citizen Science Project.
Sorg, Marcella	Responding to requests for data and interpretation of data regarding drug abuse, particularly drug related mortality: --Community overdose prevention (e.g., Portland Public Health) --Law enforcement (e.g., Maine Drug Enforcement Agency, local police departments)

To Pre-K - 12 Education:

Name	Description
Chawathe, Sudarshan S	2015--present. Chair of the judging panel, Intel Science Talent Search. 12/1999--present. Intel Science Talent Search. Judge 2000--present; evaluator 1999--2000. Judging the week-long Science Talent Institute and evaluating entries for the Science Service's Intel Science Talent Search (formerly, the Westinghouse Competition). 10/2006--present. "Classbooks": A Web-based data management system for tracking student reading and outcomes, currently used in a 1st grade class at the Newport Elementary School (RSU 19).
Enderlin, Ellyn	Judge of 8th-grade science fair presentations at the Etna-Dixmont school. Guest speaker at Ellsworth High School (grades 9 & 12), the Etna-Dixmont school (grade 7), and the Challenger Center in Bangor. I also hosted a "station" at the Climate Change Institute Science Day.
Fernandez, Ivan	As noted elsewhere, we have developed K-12 curriculum materials on Nitrogen in Watersheds used by high school science teachers and students in 3 states. I have also been directly involved with Old Town High School teachers and students with their implementation of these programs. This past year we carried out a new initiative on snowmelt working with multiple high schools and teachers throughout Maine.
Gill, Jacquelyn	Undergraduates led an activity for CCI's Climate Science Day Student Hamley helped develop UMaine/4H's Follow a Researcher program
Hall, Brenda	Correspondence with K-12 students on issues concerning Antarctica, climate change, and being a geologist.
Hamilton, Gordon	Mentor for the Schoodic Institute's "Maine Snowpack Learning Project" Mentor for NSF's PolarTREC program
Isenhour, Cynthia	Maine Science Festival - Public Engagement Participant (2016)
Kreutz, Karl	Stillwater Montessori School, Passport to the World Camp, Antarctic Science, June 27, 2013

Sandweiss, Dan	Lecture to Bangor High School STEM Academy students
Schauffler, Molly	Support to science teachers in the midcoast area and collaboration with other science educators in Maine. Development of data literacy teaching resources for online dissemination through Tuva Labs, Inc., professional development for science teachers.
Sorg, Marcella	Presentation to students from Blue Hill High School Teen Science Cafe, NSF funded.

Service – Manuscripts/Proposal Reviewed

Name	Manuscripts	Proposals	Description
Belknap, Daniel F.	13	2	NSF-EAR Geomorphology proposal NSF-EAR Sedimentology Proposal Textbook review - Barrier Islands, R.A. Davis, Pineapple Press Field Trip Book - 8 individual chapters, Geological Society of America, 06-21-15 Journal Article Review - J. Marine Sci. and Engr., 07-06-15 Journal Article Review - Marine Geophysical Reviews 11-20-15 Journal Article Review - J. Environmental & Engineering Geophysics, 02-03-16 Journal Article Review - Marine Geology, 04-15-16 plus review of revision
Denton, George	6	5	Papers in refereed journals and proposals from government and private foundations
Enderlin, Ellyn	6	20	I've reviewed manuscripts for The Cryosphere, Geophysical Research Letters, and the Journal of Geophysical Research. I also served on a NASA review panel and performed mail-in reviews for the NSF and European Research Council.
Fastook, James L	3	1	Icarus: Lava Heating and Loading of Ice Sheets on Early Mars: Predictions for Meltwater Generation, Groundwater Recharge, and Resulting Landforms JGR: Enhancement of Volcanism and Geothermal Heat Flux by Ice-Age Cycling: A Stress Modeling Study NSF Proposal: Holocene Deglaciation of the Western Ross Embayment: Constraints from East Antarctic Outlet Glaciers Science: Holocene deceleration of the Greenland Ice Sheet
Fernandez, Ivan			I periodically review manuscripts for a wide range of journals in natural and environmental sciences as well as proposals for the National Science Foundation, the US Department of Agriculture and the US Environmental Protection Agency.
Gill, Jacquelyn	18	4	Manuscripts reviewed for PLOS ONE, The Holocene, Biology Letters, Nature Communications, Science, Nature Climate Change, Global Environmental Biology, and Global Change Biology External reviewer for NSF proposals (PIRE, DDIG).
Hall, Brenda	12	8	I regularly review papers and proposals for respected journals and granting agencies.

Hamilton, Gordon	8	3	<p>Manuscript reviews for Nature (1), Nature Geoscience (1), Journal of Glaciology (2), The Cryosphere (1), Geophysical Research Letters (1), Frontiers of Earth Science (1), Journal of Geophysical Research (1)</p> <p>Proposal reviews for NSF (1), NASA (1), UK NERC (1)</p>
Hooke, Roger	8	4	<p>7 Manuscripts submitted to professional journals</p> <p>1 Manuscript in advance of submission</p> <p>2 proposals for NSF</p> <p>1 proposal for NERC (British equivalent of NSF)</p> <p>1 proposal for International Foundation for Science</p>
Isenhour, Cynthia	7		Human Ecology, Anthropology Quarterly, American Anthropologist, Journal of Cleaner Production, Local Environment, American Anthropologist Book Reviews.
Jain, Shaleen	4		AGU and AMS Journals
Kelley, Alice	1	1	<p>Manuscript: Review of article on pre-European canal system on the North Coast of Peru.</p> <p>Proposal: Review of NSF proposal for archaeological work on the north coast of Peru</p>
Kelley, Joseph	4	2	Netherland Organization for Scientific Research, Sea Grant, National Science Foundation proposals, Paper reviews for Geo-Marine Letters, Marine Geology, Geological Society of America, Geomorphology
Koons, Peter			<p>I generally review 3 proposal for NSF Tectonics each 6 month round as well as proposals from NSF Geochemistry and Petrology, Geomorphology and Surface Dynamics, Geophysics.</p> <p>During the past year I reviewed manuscripts from Nature, Nature Geoscience and Science.</p>
Kreutz, Karl	15	6	<p>NSF PLR-Antarctic Earth Science program, Review of Jackson et al., “COLLABORATIVE RESEARCH: Perchlorate: A new biogeochemical tool to study deposition and biogeochemical processing of atmospheric salts, and Paleoclimate/ecological environments”</p> <p>NSF PLR – Antarctic Glaciology, Review of Rupper et al. “Bayesian quantification of Antarctic surface mass balance”</p> <p>AGS – GEO/ATM – Paleoclimate Program, Review of McConnell and Arienzo “Evaluating linkages between atmospheric carbon dioxide and Southern Hemisphere dust emissions, chemistry, transport during the past 2,000”</p> <p>NSF PLR – Arctic Natural Sciences, Review of White “The East GRIP ice core and the Northeast Greenland ice stream”</p> <p>AGS – GEO/ATM – Paleoclimate Program, Review of Kirby “Tracking the Far Western United States Precipitation Dipole Over the Past 3000 Years”</p> <p>For NSF PLR – Arctic Natural Science, Review of Cziezo et al. “Collaborative research: Retrieving single aerosol particle properties from ice cores”</p> <p>>15 manuscripts handled as editor for Scientific Reports</p>
Kurbatov, Andrei			All are relevant to paleoclimate or volcanism.
McGill, Brian	20		<p>Peer reviewed ~20 articles including for Science, Nature, PNAS</p> <p>Responsible for initial assessment of ~400 manuscripts submitted to GEB</p>
Northington, Robert	4	20	<p>Over the past year, I have served as a manuscript reviewer for the journals Hydrobiologia and Limnology and Oceanography.</p> <p>I also served as a grant review panelist for the National Science Foundation.</p>

Roscoe, Paul B	6	1	American Ethnologist (Article MS) Ecology and Society (Article MS) Journal of Archaeological Method and Theory (Article MS) Left Coast Press (Climate Change Book MS) Oceania (Article MS) PLOS ONE (Article MS) NSF Archaeology Directorate (Funding proposal)
Sandweiss, Dan	30	12	Manuscripts: American Association for the Advancement of Science (Symposium proposals): 11 Geoarchaeology: 1 The Holocene: 1 Journal of Anthropological Archaeology: 1 JASREP (Journal of Archaeological Science Reports): 3 Journal of Social Archaeology: 1 Latin American Antiquity: 3 PaleoAmerica: 1 PLoS ONE: 1 Proceedings of the National Academy of Sciences: 2 Quaternary International: 1 Quaternary Research: 1 Quaternary Science Reviews: 1 Routledge book: 1 University Press of Florida book: 1 Grants: American Philosophical Society Lewis & Clark Fund: 4 FONDECYT (Chilean National Science Foundation): 1 Fulbright Senior Specialist Program: 1 Louisiana Board of Regents Support Fund R&D Program: 1 National Endowment for the Humanities: 1 National Geographic Society: 3 OSF (Polish National Science Foundation): 1
Saros, Jasmine	12	2	Reviewed manuscripts for 11 different journals, including Journal of Phycology, Ecology, Geophysical Research Letters, and Global Change Biology. Reviewed proposals for the NSF Arctic Program.
Zaro, Gregory D	1	2	NSF, Journal of World Prehistory

Service – Television/Radio/Newspaper Interviews

Name	Description
Birkel, Sean	Newspaper 1) Working Waterfront, newspaper of the Island Institute, Rockland, ME: Changing climate and water temperatures in the North Atlantic (12/10/2015)

	2) Lewiston Sun Journal, Lewiston, ME: Climate warming and the spread of vector borne disease in Maine (4/7/2016).
	Television
	1) ABC 7 News, Bangor, ME: Impacts of the warm winter of 2015-2016 (3/3/2016).
Chai, Fei	3
Enderlin, Ellyn	I've provided professional opinions for a number of science news articles by The Weather Channel.
Fernandez, Ivan	I have provided input to several news stories on climate change in Maine. Invited guest on several Maine Public Radio 'Maine Calling' dealing with climate.
Gill, Jacquelyn	Rolling Stone, Slate, WABI, Nature, Marie Claire, Science
Hamilton, Gordon	January 18, 2016: National Public Radio (http://www.pri.org/stories/2016-01-18/greenland-climate-change-mystery-clues-written-water-and-stone) January 19, 2016: National Public Radio (http://www.pri.org/stories/2016-01-19/looking-small-big-answers-greenland)
Isenhour, Cynthia	March 2016 "Talking Trash" University of Maine December 2015 "Urban vs. Rural: Who Has a Smaller Carbon Footprint" The Take Away, Public Radio September 2015 "Climate Change Becomes a Matter of Mental Health" Portland Press Herald July 2015 "Researchers Explore the Problem of Materials Management in Maine" University of Maine
Jain, Shaleen	WIRED Magazine (2015) Los Angeles Times (2015)
Kreutz, Karl	Canadian National Park Service
Mayewski, Paul	15 July – Channel 7 News interview - Castine, Maine 24 July – Tidesmart Steveo Radio interview – Portland, Maine 15 August – Media interview with Chilean film crew 17 Dec – Bangor Daily News interview re COP21 Climate Talks 18 Dec – TV WCSH6 interview for "207" with Rob Caldwell 18 Feb – WERU Climate change interview
Sandweiss, Dan	I was flown to Washington DC to interview for a segment on the Discovery Science Channel show "What on Earth". The segment appeared this past spring. I interviewed with Hakai Magazine for an article focused on my work: http://www.hakaimagazine.com/article-long/civilizing-power-nature I interviewed with Science News for story on an early site in Chile: https://www.sciencenews.org/article/people-roamed-tip-south-america-18500-years-ago
Sorg, Marcella	Responding to requests for data and interpretation of data regarding drug abuse, particularly drug related mortality: --Media outlets (e.g., Bangor Daily News, Portland Press Herald, New York Times)

SPECIAL PUBLIC SERVICE RECOGNITION/AWARDS/HONORS RECEIVED

Denton, George	Distinguished Career Award, 2015, Geological Society of America
Mayewski, Paul	European Geophysical Union Hans Oeschger Medal for Climate (Past, Present and Future) (2016) Ocean Exemplar (Special Citizen of the Ocean) designated by the World Ocean Observatory (2015)
Roscoe, Paul B	Distinguished Maine Professor

Other: (e.g. special contacts)

Name	Description
Fernandez, Ivan	<p>I continue to be involved in state-level activities regarding climate change adaptation across multiple natural resource based sectors of the Maine economy. This is a continuation of my involvement in the Maine Climate Change Stakeholder Adaptation Process.</p> <p>The Bear Brook Watershed in Maine project has its own web site: http://www.umaine.edu/bbwm/ with real-time stream monitoring in collaboration with the US Geological Survey:</p> <p>http://waterdata.usgs.gov/me/nwis/uv/?site_no=01022294&PARAMeter_cd=00065,00060</p> <p>and is also a participant in the emerging Smart Forests initiative: http://smartforests.org/</p>
Hamilton, Gordon	External PhD committee member for Benjamin Walker, Dartmouth College
Hooke, Roger	Edited English in one paper by a Chinese geoscientist
Sorg, Marcella	Providing data and interpretation of data regarding Maine state drug abuse, especially drug related mortality for: --U.S. Drug Enforcement Agency --U.S. High Intensity Drug Trafficking Association --Office of National Drug Control Policy (White House)

The Arkansas River Glacial Lake Outburst Flood Problem: Geomorphological Evidence and Modeling with HEC-RAS

Xavier Allègre¹, Roger LeB. Hooke^{1, 2}

1. School of Earth and Climate Sciences, University of Maine.
2. Climate Change Institute, University of Maine.

Abstract: During the late Pleistocene glaciers extended across the Arkansas River valley, Colorado, damming the river and forming a lake. Flood boulders on terraces downstream from the lake suggest at least two flood events. We propose to model these floods to learn more about water depth downstream of the dam breach, and thus possibly reduce future disasters elsewhere.

Setting:

Keenan Lee (Lee 2008) was one the first (with Scott, 1975) to find evidence for glacial lake outburst floods in the Arkansas River valley, Colorado, during the Pleistocene.

Flood landforms are features of these catastrophic events. Landslides (namely Kobe, Mt Massive and Empire Gulch landslides) also occurred at the same time as the floods, owing to a reversed hydraulic gradient. Lakes impounded behind the glacial dam did not cut clear shorelines, but ice rafted boulders dropped from icebergs, both in the lake basin and clustered on shore, are the testimony to the previous extent of these lakes.

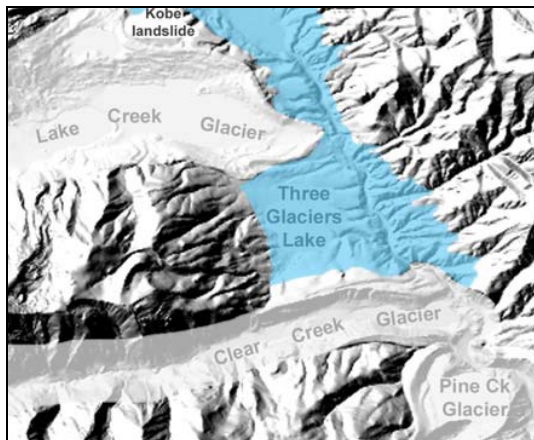


Fig. 1. Geographical settings: Three glaciers lake impounded by a glacial dam formed by northern Clear Creek and southern Pine Creek glaciers during Pleistocene, figure taken from (Lee 2008).

The origin of this debris that provides a way to reconstruct the extent of the glacial lakes is the same as that of boulders that we find now downstream: The Sawatch Range, hosted glaciers flowing from the west; these glaciers

crossed the Arkansas River and slammed into the Mosquito Range on the east side of the valley. These ice rafted boulders give evidence of the extent of water at the moments of the outburst floods, but this evidence does not constrain the depths of the floods sufficiently well.

Objectives:

HEC-RAS is an open-source software developed by the USGS that can be used to reconstruct these floods. It has been used by Jürgen Herget (2005) to constrain Pleistocene ice-dammed lake outburst floods in the Altai Mountains, Siberia. Our goals are similar to his and we will try to follow a similar methodology to model the water depth downstream from the dam breach. We primarily need to incorporate cross-sections, with a chosen spacing, from a map of the Arkansas River valley into the software, starting downstream and proceeding upstream. Initially we will use Brugger et al.'s (2010) estimates of discharge.

Bibliography:

Brugger, K. et al. (2010). Discharge estimates for a glacial outburst Paleoflood on the Upper Arkansas River, Colorado, from an ice dam failure model, GSA poster.

Herget, J., 2005. Reconstruction of Pleistocene ice-dammed lake outburst floods in the Altai Mountains, Siberia: GSA Spec Pap., 386 118pp.

Lee, K. (2008). Three glaciers flood Arkansas River, Colorado. Unpub ms dated 8/21/2008.

Scott, G.R., 1975, Reconnaissance geologic map of the Buena Vista Quadrangle, Chaffee and Park Counties, Colorado: USGS Miscel Field Studies Map MF-657, scale 1:62,500.

Atmospheric Circulation Influences on West Greenland Precipitation

Jeffrey D. Auger¹, Sean D. Birkel¹, Kirk A. Maasch^{1,2}, Keah C. Schuenemann³, Paul A. Mayewski^{1,2}

1. *Climate Change Institute, University of Maine.*

2. *School of Earth and Climate Sciences, University of Maine.*

3. *Earth and Atmospheric Sciences, Metropolitan State University of Denver.*

Abstract: This preliminary study uses the 56-year Japanese Meteorological Agency Reanalysis to examine the influence of North Atlantic teleconnections on precipitation over West Greenland.

Recent decades have brought significant warming and glacier retreat to West Greenland. By understanding changes in atmospheric circulation that deliver heat and moisture to the region, we may gain valuable insight into future climate and sea-level rise. Two centerpiece patterns over the North Atlantic Basin, the Atlantic Multidecadal Oscillation (AMO) and North Atlantic Oscillation (NAO), play a major role in global climate (Parker et al., 2007). The impact of the NAO and AMO on West Greenland remains less well understood. Here, we present results from a preliminary examination of these North Atlantic teleconnections using JRA-55 (Kobayashi et al., 2015), a state-of-the-art reanalysis model spanning 1958-present.

The AMO defines the fluctuation (~70 year period) of average sea surface temperature (SST) in the North Atlantic Basin from 0-70 N, whereas the NAO defines synoptic modes of atmospheric circulation arising from the sea level pressure difference between the Azores High (AH; measured at Lisbon, Portugal) and Icelandic Low (IL; measured at Reykjavik, Iceland). These climate patterns are linked on decade timescales such that cool SSTs (-AMO) facilitate +NAO like patterns and warm SSTs (+AMO) facilitate -NAO like patterns.

The signal of West Greenland precipitation from JRA-55 shows that moisture delivery to the region increased by ~8% during the most recent transition from AMO-cool to AMO-warm (Fig. 1). The NAO shows a different story on the annual timescale. Years with totals of extreme high precipitation (1983, 1996, 2005, and 2012) show high-pressure blocking events thereby weakening the pressure gradient between the IL and AH. Moreover, the IL is weaker when compared to the four years with extreme low precipitation (1958, 1974, 1992, and 2009), showing a relatively deeper IL. A deeper IL is due to dominantly zonal flow bringing moisture eastward to Europe rather than to West Greenland. Although precipitation in West Greenland does not correlate well with the NAO index, the link between the extreme precipitation years and the NAO does

point to synoptic patterns that influence precipitation in this region.

In summary, our results thus far suggest that the influences from the AMO and NAO on West Greenland precipitation are complex. The AMO warm phase does show a minimal increase of precipitation with respect to the previous AMO-cool phase. A link with NAO exists, but only during extreme years of precipitation. Although we cannot fully explain West Greenland precipitation with just the AMO and NAO, it is clear by default that other variables such as location of moisture flux sources and synoptic blocking patterns in the North Atlantic domain are potentially relevant.

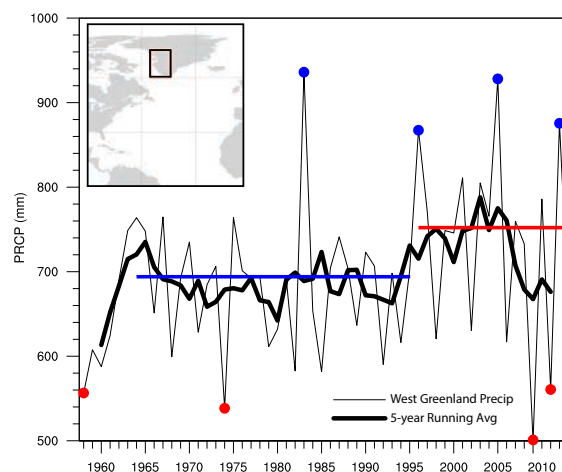


Fig. 1. West Greenland (upper left corner) precipitation registered in the JRA-55 record, 1958-2013 (thin, black line) with a 5-year running average (thick, black line). Red (blue) dots show 4 years of minimum (maximum) precipitation. Red and blue lines show average total annual precipitation during the AMO warm and cool phases, respectively.

Acknowledgements: This work is supported by NSF award PLR-1417640 (GreenTrACS) to Sean Birkel.

Bibliography:

Kobayashi, S., [and others], The JRA-55 Reanalysis: General Specifications and Basic Characteristics. *J. Met. Soc. Japan* 93 (2015): 440.

Parker, D. [and others], Decadal to multidecadal variability and the climate change background. *J. Geophys. Res.* 112 (2007): D18115.

Investigating Ecological Values of Rockweed Habitat to Intertidal Invertebrates along the Maine Coast

Amy M. Baron^{1,2}, Amanda Klemmer^{1,3}, and Brian J. Olsen^{2,3}

1. Ecology and Environmental Sciences, University of Maine.

2. Climate Change Institute, University of Maine.

3. School of Biology and Ecology, University of Maine.

Abstract: Rockweed (*Ascophyllum nodosum*) provides many essential ecological services to the Maine intertidal ecosystem, including habitat for many species. However, increasing commercial rockweed harvesting may affect populations of marine invertebrates. Here we attempt to investigate a connection between invertebrate community structure and rockweed in Maine.

Rockweed (*Ascophyllum nodosum*), a perennial brown macro-algae, creates complex structure and provide many essential ecological services to the intertidal ecosystem, including habitat for many ecologically and economically important species (Larsen 2012). As a primary producer, rockweed supports many secondary consumer populations. The 3-dimensional structure of rockweed canopy provides settlement, refuge, and foraging sites and significantly enhances diversity and abundance of invertebrate species (Schmidt et al. 2011). While some invertebrates graze upon rockweed, others receive protection against heat, sunlight, desiccation, and predation from it at low tide.

Despite their ecological services, rockweed in has been commercially harvested for the production of alginates, fertilizers, and animal feed. Because many species of intertidal invertebrates use rockweed as their habitats, commercial harvesting potentially affects invertebrate diversity and abundance, which in turn could impact populations of fishes and coastal birds that rely on these invertebrates as their food source.

The present study will assess the ecological importance of rockweed-dominated areas and describe invertebrate diversity and abundance in rockweed habitat along the Maine coast. Rockweed and invertebrate surveys will be conducted during low tide in summers and winters 2016-2018, at designated rockweed-dominated sites along the entire coast of Maine. At each survey site, invertebrates will be sampled within quadrats along transects perpendicular to the shore, starting at the highest rockweed location to where there is a clear transition from rockweed to different algal

species or no algal species present. Invertebrates will be identified and counted.



Fig. 1. Invertebrates among rockweed

Not only will the results of this study provide a better understanding of ecological significance of rockweed-dominated areas to invertebrates as their habitat but will also help organizations to establish a better management plan and regulations regarding rockweed harvesting, in order to minimize impacts to invertebrate habitat, as well as nursery and refuge for fishes, and foraging habitat for many bird species.

Acknowledgements: Maine Coastal Island National Wildlife Refuge, US Fish and Wildlife Service.

Bibliography:

Larsen, P. F. "The macroinvertebrate fauna of Rockweed (*Ascophyllum nodosum*)-dominated low-energy rocky shores of the Northern Gulf of Maine." *Journal of Coastal Research* 28, no. 1 (2010): 36-42.

Schmidt, Allison L., Marta Coll, Tamara N. Romanuk, and Heike K. Lotze. "Ecosystem structure and services in eelgrass *Zostera marina* and rockweed *Ascophyllum nodosum* habitats." (2011).

Spatial Characterization of Maine's Lobster Fishery in a Changing Climate

Samuel L. Belknap III^{1,2}, George LaPointe³, Nick Battista⁴, Rebecca Clark-Uchenna⁴

1. *Department of Anthropology, University of Maine.*
2. *Climate Change Institute, University of Maine.*
3. *George LaPointe Consulting LLC, Hallowell, Maine.*
4. *Island Institute, Rockland, Maine.*

Abstract: In 2010, President Obama's Executive Order 13547 established the National Ocean Policy. As part of this policy, responsibility for Marine Spatial Planning was delegated to regional planning bodies (RPB's). The Northeast Regional Ocean Council (NROC) is the organization responsible for the New England's ocean plan, and has characterized other fisheries with GIS maps of fishing activity. Similar information does not exist for the New England lobster fishery. We undertook this project to demonstrate how external climate impacts and behavioral change within the lobster fishery intersect with the regional ocean plan, for the purpose of informing NROC.

Understanding how New England's ocean waters are used by the lobster fishery is difficult because of the limited and varied mapping that has taken place. Regional ocean planning has recognized the importance of the lobster fishery and the need for the best possible spatial characterization information available. To aid in the ocean planning process and to provide information about how the lobster fishery uses the ocean, we documented changes in Maine lobster fishing practices over the last 15 to 20 years.

Lobstermen from all Maine lobster management zones were interviewed for their perspectives on how they fish throughout the year, how lobster fishing has changed in the last 15 to 20 years, how they approach new ocean uses and ocean planning, and how they adapt to increased effort in their fishing areas. 25 lobstermen were interviewed from December 2015 to February 2016.

While the specific responses varied slightly by location along the coast, major themes did emerge. To summarize, lobstermen:

- are most concerned about future ocean uses that could restrict how they adapt to changing conditions in the environment and lobster fishery. Their business model requires mobility and flexibility; anything that reduces these is a major concern to lobstermen. They:
- are concerned about increases in effort and about new fishermen moving into their areas. A key component of how someone coming into a traditional lobstering area is perceived

and treated is the degree to which they try to fit in.

- have seen lobster fishing expand spatially; this has occurred because the area in which lobsters are found has expanded rather than simply shifting away from traditional areas.
- don't use traps to hold bottom as was done traditionally. This is because lobsters are available in more areas and because lobstermen want to fish as many traps as possible efficiently rather than using traps to hold bottom.

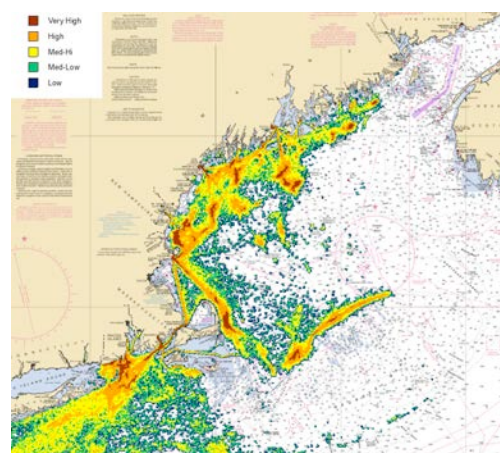


Fig. 1. NROC GIS map of herring fishing activity. Data from Vessel Monitoring Systems (VMS). Lobster fishery has no such data.

Acknowledgements: This research is supported by the Island Institute, The University of Maine Graduate School, and by the men and women of Maine's lobster fishery.

An Interactive Educational Experience Designed to Facilitate Understanding of Three-Dimensional Spatial Relationships within Archaeological Excavations

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Abstract: Spatial relationships are of essential importance when attempting to interpret an archaeological site. However, popular depictions of archaeology are often reduced to a focus on materials themselves with minimal attention to their context. This project is intended to encourage awareness of space in archaeology and the relationships that can be associated with it, utilizing touch-based tablet technology to bring the excavation experience to a general audience.

When visiting a museum or reading a book about materials recovered from archaeological sites, it can be challenging to conceptualize their original three-dimensional (3D) context or its importance. The excavation experience itself can put the participant in that three-dimensional space, a space in which concepts such as superposition and spatial clustering can be seen and interacted with. Keeping in mind that a real-world excavation experience cannot always be accessible, this project, titled “Arti-Finder,” was initiated to bring a reasonable facsimile of that experience to a general audience.

Early development was focused around the Oculus Rift head-mounted display and Leap Motion infrared hand-tracker. These peripherals work in conjunction with one another, allowing the participant’s head motion as well as his or her hands to be tracked in real time. A virtual environment was created in the Unity3D game engine, alongside models of some major lithic artifact classes (based on 3D laser scans of real-world materials) as well as a “virtual trowel” that could be picked up in-game using the Leap Motion and used to “dig” in the designated excavation area.

However, a number of issues discouraged forward movement with the virtual reality version of the project; the most prominent of these involved limitations within the then-current Leap Motion software development kit (SDK). The development focus was subsequently shifted to the iOS platform, though many elements of the original version were retained.

Via an orthographic camera view, the user is positioned above an archaeological excavation

and can simulate digging through five visually distinct layers of dirt by dragging his or her finger across the screen. Eight artifacts are spawned each time the application restarts; their three-dimensional locations and rotation are randomized every time. When uncovered, they are collected and placed in a bucket using a tap-and-drag interaction.

When all of the artifacts are collected, the application returns a series of points that represent the original locations of all eight objects. When tapped, each point returns its corresponding spatial information alongside the name of the artifact that it represents. The post-excavation summary is currently only available in the orthographic view, but will eventually be represented in 3D, with the ability for that representation to be manipulated by the user.

Future development will include a build for the Android platform, as well as improved 3D representation and identification of spatial clusters and other meaningful associations. Another area of interest is the inclusion of haptic feedback, making it possible for the user to “feel” in-application interactions such as digging. A consumer-ready build of Arti-Finder will hopefully be available on the Apple App Store and Google Play at some point within 2016.

Acknowledgements: Appreciation is extended to the Virtual Environment and Multimodal Interaction Lab, Department of Anthropology, Climate Change Institute, and School of Computing and Information Science, all at the University of Maine, as well as to early users who have provided feedback, including, but not limited to, participants at the Central Lincoln County Teen Science Café and the 2016 Maine Science Festival.

Seasonal Analysis of Two Major Archaeological Sites in Eastern Maine Using Mollusk and Faunal Remains

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Abstract: Utilizing the pioneering work of David Sanger, Arthur Spiess and others, two archaeological sites in Eastern Maine will be analyzed using oxygen isotopic patterns to determine seasonal indicators of the season of occupation at the sites. Determining the season of occupation of a site provides crucial information as to the types of activities that took place (e.g., ritual, spiritual, or domestic) and availability of food resources. It has been hypothesized that the first site, Holmes Point West in Machiasport, Maine, was occupied by the Passamaquoddy Tribe during the summer months, while the second site, Jones Cove in West Gouldsboro, Maine, was occupied by a Native group during the winter months. Faunal remains, especially fish, and mollusks previously excavated will be analyzed and the results will be used as the determining factors of the season of occupation for each site.

Background:

As Maine has very acidic soil, preservation of faunal remains in an archaeological site within the state is unlikely unless shell is present on the site. Calcium carbonate within a shell acts as a neutralizer within the soil and allows the preservation of organic materials, e.g. faunal remains. It is because of this presence of shell that the Holmes Point West and Jones Cove sites exist. These two sites are designated as 'shell middens', which are piles of discarded materials that were no longer utilized or no longer served a purpose to the Native Americans occupying the area. These shell middens provide a wealth of information and have preserved a piece of ancestral Native American culture that otherwise may not have survived.

Holmes Point West is a shell midden located in Machiasport, Maine and is culturally relevant to the Passamaquoddy Tribe. Dr. Brian S. Robinson has worked in conjunction with the Passamaquoddy Tribe to excavate the site and recover information from the Tribe's ancestral way of life.

Jones Cove is a shell midden located in West Gouldsboro, Maine. The initial excavation of the site took place in 1928 and was led by Dr. Warren K. Moorehead. It is undetermined which native tribes occupied the site but they are believed to be an Algonquin language-speaking culture.

Purpose:

I will be looking for oxygen isotopic patterns through analysis of faunal remains, especially fish, and mollusks previously excavated from the two sites. These patterns will indicate whether the sites were of summer or winter occupation. This analysis will help to fill in cultural gaps by providing evidence and insights to help characterize past ways of life.

Methods:

I plan to use the methodologies, sectioning and analysis techniques, set forth by David Sanger and Arthur Spiess for my thesis research involving seasonality analysis.

Acknowledgements:

Funding from the UMaine Anthropology MAPI Project directed by Dr. Brian S. Robinson and Dr. Lisa K Neuman.

Graduate Assistantship through Dr. Nicholas A. Giudice, Director of the VEMI Lab at UMaine.

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Topographic Fabric and Bedrock Weakness Distribution in Glacial Erosion Models

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Abstract: Displacement along active fault systems in southeast Alaska damages bedrock, increasing fracture density and decreasing cohesive strength. These changes in material strength properties affect erosion rates and may be responsible for unusually high sedimentation rates in the Gulf of Alaska. We estimate local weakening at the outcrop scale with field observations. At the orogen scale, we estimate the range and magnitude of weakening caused by tectonic strain using Elevation Variance Analysis (EVA). Further work will focus on improving erosion models by introducing more nuanced bedrock cohesion strengths based on EVA results.

Southeastern Alaska is an area known for active glaciation caused by high precipitation and temperate climate (Birkel 2016). Convergent and strike-slip faulting along the Aleutian Megathrust and Fairweather Fault systems causes relatively frequent high magnitude displacement. The amount of bedrock damage, related to fault displacement, creates variations in cohesive strength across two orders of magnitude (Roy et al. 2015).

I measured fracture density and orientation on recently deglaciated bedrock outcrops near the Fairweather Fault system and near the Juneau Icefield. Field observations show that near faults with high displacements (the Fairweather Fault region), bedrock cohesion varies across two orders of magnitude in fault zones up to 2 km across. Outside the active fault zone (the Juneau Icefield), weakening is less pronounced and occurs in smaller regions. This pattern supports our assumption that the range in cohesive strength is due to tectonically controlled processes.

EVA measures elevation variance between a specific point on a digital elevation model and every point a set radius away. The magnitude and orientation of this variation yields information about controls on topography.

EVA results (Fig.1) for the study areas show that the Fairweather Fault region has high magnitude anisotropy with orientation trends that reflect tectonically controlled topography. In contrast, the Juneau Icefield region has low magnitude anisotropy without orientation indicating tectonic control. Using more complex cohesion estimates

based on these results in erosion models may increase the accuracy of outputs.

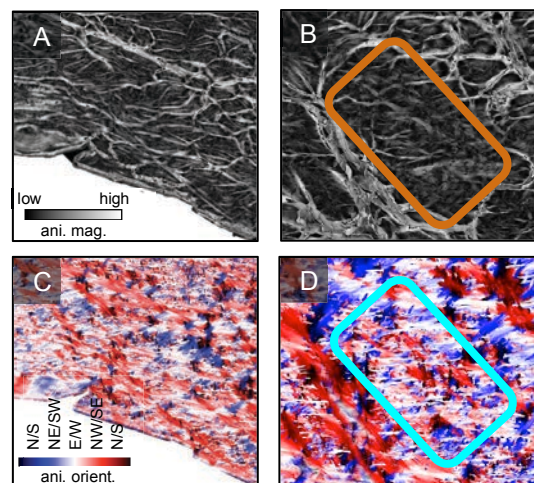


Fig. 1. Anisotropy magnitude (top) and orientation (bottom). Fairweather Fault region (A, C) shows high magnitude and strong NW-SE trends in red. Juneau Icefield region (outlined in the middle of images B, D) shows low magnitude and no trends.

Acknowledgements: Research funded by the Dan and Betty Churchill Fund for Exploration, the Juneau Icefield Research Program, and NSF Grant 1250130 to P. Koons, B. Hallet, and S. Birkel.

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Compositional, Textural, and Chronological Evaluation of Mortar at the Nadin-Gradina Archaeological Site, Croatia

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Abstract: The Nadin-Gradina Archaeological site in Croatia reflects an occupational history from the Iron Age to the later Middle Ages (ca. 400 BCE -1700 CE). This relatively continuous record provides insight into human interactions within the landscape for thousands of years. This study investigates potential changes in the composition and texture of mortar from the site, in order to construct a chronological system of changes in building technology through time.

Project Goals:

The roughly 2500 year span of occupation at Nadin-Gradina has resulted in various building styles and materials, revealed during excavation, and includes a decrease in quality between the Late Antique and Middle Ages, as exhibited by lack of carefully cut stone, reused materials, and coarsening of mortar materials. Archaeological excavation of these mortar materials took place near the summit of the hill fort and was composed of five units placed across the site (Figure 1).



Fig. 1. Location of excavation pits at Nadin-Gradina.

Samples were analyzed using an optical scanning electron microscope (SEM) and energy dispersive x-ray analysis (EDAX). Textural properties of the material were analyzed using sedimentological grain size measurements of the aggregate present in the mortar samples. Seven mortar samples were collected from wall surfaces in units B,C, and D, and ten samples were taken from the standing Ottoman walls.

Results:

The proportion of CaCO_3 matrix to aggregate and the sand and gravel portions of the aggregate were compared across three main cultural

phases: Early Roman, Late Roman/Antique, and Ottoman periods (Figure 2). The Early Roman and Late Roman/Antique samples have comparable CaCO_3 averages, 58% and 49% respectively, while the Ottoman samples averaged 77% CaCO_3 .

Matrix Proportion and Aggregate Proportions for Mortar Samples Nadin, Croatia

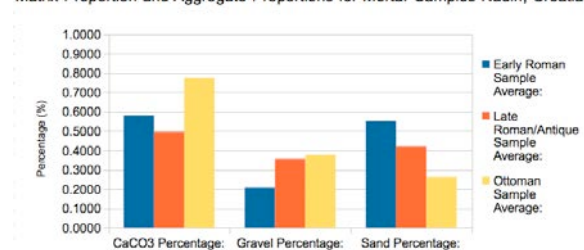


Fig. 2. Matrix and Aggregate Proportions for samples.

Future Work:

Variation in composition does exist between the mortar samples of cultural phases at Nadin-Gradina, however, the variation between values is not distinct enough to show a drastic change in building methods, particularly between the Early Roman and Late Roman/Antique periods. Future research will seek to use these same techniques to compare the textural and compositional differences between floor or fresco plaster of these same periods, as well as potential structural differences between mortars of varying matrix and aggregate proportions.

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Deciphering the Terrestrial Response to Stadial Conditions in the North Atlantic

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ABSTRACT: During the last glacial-interglacial transition, pronounced climatic disturbances now known as Heinrich Stadials interrupted the pattern of progressive warming. In the tropics and southern mid latitudes, Heinrich Stadials are increasingly associated with rapid warming and deglaciation, potentially linked to a dynamic interplay between Earth's wind belts and ITCZ and the tropical Pacific Ocean. In contrast, the effect of these events on the Northern Hemisphere climate is less clearly defined. By one model, stadials are characterised by an abrupt return to almost full-glacial conditions, particularly in the North Atlantic, resulting in regrowth of ice sheets and glaciers. An alternative view invokes boreal warming and deglaciation during stadials, despite apparently cold conditions in the North Atlantic Ocean itself. To explore this problem of the manifestation of stadials, we are building a glacial record for the British Isles constrained with cosmogenic ¹⁰Be surface-exposure dating. Our new data set, consisting of 19 ages, aligns with the second model, suggesting that Heinrich Stadials were characterised by extensive deglaciation and, thus, warming.

Project Goals:

We seek to understand how stadial events in the North Atlantic basin were manifested on land and, specifically, how these abrupt climate perturbations impacted the cryosphere. The North Atlantic is widely held as a key component – if not the driver – of abrupt climate change yet accounts of how this region behaved during the late-glacial period are conflicting, with strong arguments both for and against stadial cooling and renewed ice growth. Our investigation focuses on the Scottish Highlands, where exquisitely preserved glacial landforms afford the opportunity to reconstruct stadial cryospheric behaviour as a proxy for atmospheric temperature immediately adjacent the North Atlantic Ocean. Our field site is An Teallach (“the Forge”), a massif in NW Scotland where the bedrock is suitable for cosmogenic ¹⁰Be surface-exposure dating. During the 2015 field season, we collected 40 samples from glacial moraines and thus far have measured 20 to provide a preliminary picture of glacier-climate evolution between the last glacial maximum (LGM: ~20,000 years ago) and the latter part of the late-glacial period.

Initial Results:

Twenty ¹⁰Be ages show (i) that the last British Ice Sheet had retreated from its LGM margins on the outer continental shelf to within the cirques of An Teallach by ~15.5 Ka and (ii) that a subsequent, short-lived regrowth of ice peaked at ~13.1 Ka. Together, these data suggest both that the majority of the ice sheet was deglaciated during Heinrich Stadial 1 (18.3–14.7 Ka) and that there is no evidence for renewed glaciation during Heinrich Stadial 0 (12.9–11.6 Ka). Viewed in a global context, our data set suggests that the cryospheric response in NW Scotland to stadial conditions was similar to that of the tropics and of southern mid latitudes.

Acknowledgements: This work was funded by a grant to G. Bromley from the UMaine Faculty Research Fund and was made possible by the Dundonnell Estate.

Do Nitrogen Subsidies in Glacier Meltwater Modify the Response of Alpine Lakes to Abrupt Warming?

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Abstract: Rapid climate warming in alpine regions of the northern hemisphere has enhanced glacial meltwater inputs to alpine lakes over the past century. Glacier meltwater in the Beartooth Mountains contains high nitrate concentrations. Nitrate enrichment may decrease coherence of historic algal community changes within and across lake chain systems.

Alpine glaciers are sensitive to small changes in air temperature and glacier meltwater inputs to lakes have increased over the past 100 years because of rapid alpine warming. Alpine glacier meltwater can contain high nitrate concentrations that increase primary productivity and decrease phytoplankton species richness in glacially fed (GF) lakes (Slemmons and Saros 2012). In a GF lake chain in the Beartooth Mountain region of Montana, sediment records indicate that nitrate enrichment of the headwater (Jasper Lake) started ~1000 ya (Slemmons et al 2015). In 2015, we conducted an expedition that determined nitrate concentrations are elevated in other GF lake chain systems across the Beartooth region compared to snow fed (SF) lakes (Figure 1). This area is therefore ideal to study regional-scale effects of climate warming on GF lakes with elevated nitrate.

Coherence describes the degree of temporal variability of lake responses across a landscape to a regional-scale driver, such as warming. In this study, the response variable is algal community change, which is an important ecological indicator of broader environmental transition. Evidence suggests changes in energy inputs to lakes (i.e., irradiance) increase coherence, whereas material inputs (i.e., nutrients) decrease it (Vogt et al 2011). Glacial nitrogen enrichment is a material input. Therefore, GF (high nitrate) lakes likely have less coherence than SF lakes. We pose two questions: 1. Does glacial nitrate enrichment decrease coherence of past algal community shifts in affected lakes in response to abrupt climate warming? 2. Do lakes within the same chain have greater coherence of past algal community changes than lakes between chains?

To address these questions, we will measure algal community change over time using diatom fossils and phytoplankton pigment remains. Almost 50% of Earth's freshwater supply comes from glaciers in alpine regions experiencing rapid warming. Therefore, understanding the coherence of GF lake ecological responses to temperature is important to water security in the 21st century. This research is also timely because Rocky Mountain alpine glaciers are predicted to disappear in the next few decades.

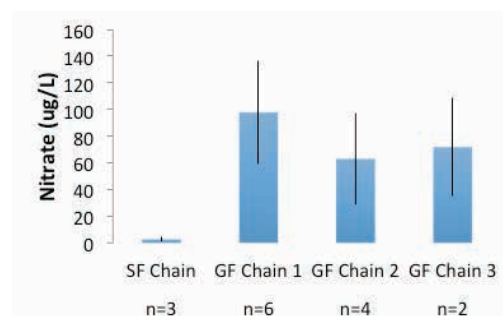


Fig. 1. Average nitrate concentrations of Beartooth Mountain lake chain systems. SF = snow fed, GF = glacially fed, n indicates the number of lakes. Error bars indicate \pm SD.

Acknowledgements:

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Toward a Domain-Specific Language for Patterns in Ice-Core Data

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Abstract: We describe a language for expressing simple patterns in time series data derived from ice-cores and similar sources. Such patterns use simpler features mapped to tokens by an earlier phase of analysis. In turn, they allow more complex features to be expressed and analyzed.

Introduction. Technological improvements in analysis of ice cores (such as laser ablation) are yielding datasets that are orders of magnitude larger than before. Effectively using these datasets requires tools that are qualitatively different from those that suffice for smaller datasets. Ongoing work in the *P301* project is developing tools to partly automate tasks, such as pattern matching and inference, that are likely to assist in scientific discovery, as part of a larger effort to address this problem. Here, we address a small component of this effort, viz., the specification and detection of simple patterns in time series datasets. In particular, we define a small, embedded domain-specific language for specifying patterns. These patterns are intermediate constructs that build on simpler constructs such as tokens derived from the original datasets. In turn, patterns are used to express more complex constructs.

Benefits. Such layering of concepts has the significant benefit of enabling efficient implementation that would be unlikely to result from a direct implementation of complex constructs. A well-defined pattern language enables precise and concise specification of data characteristics being studied. Further, the patterns specified in this manner, and the constructs they enable, provide a documentation of scientific conventions and procedures. For brevity, the sequel describes only a very simple example of the realization of some of these ideas.

Tokens. Following prior work, we tokenize the time series for a single measure (e.g., SO₄) into tokens representing peaks, valleys, increases, decreases, or flats within predefined windows. A (simple) token such as P.CO₂ represents a peak (P) in the CO₂ series. A compound token such as P.CO₂|D.SO₄|F.d18O denotes the

concurrent (within token resolution) peak in CO₂, decrease in SO₄, and flat in d18O.

Patterns. The core of our pattern language is, essentially, a regular-expression language over strings over the alphabet of compound tokens. For example, consider this pattern from Nathan Dunn's thesis (expressed in his notation): SO₄^Δ ~ d18O / : [5, 10]. Using the SRE flavor of regular expressions, we may write:

(: "P.SO4" (** 4 9 any) "I.d180")

Another, more complex, example from the thesis is { Fe^Δ ~ (O₂ / \cap CO₂) : [1,2] } ~ d18O / : [5,10], which we may express as:

(: "P.Fe" (** 0 1 any) (and "I.O2" "D.CO2") (** 4 9 any) "I.d180")

Implementation. The above use of a token-like syntax, such as P.CO₂, may be mapped to the regular expression language by viewing it as short-hand for a very verbose expression of the form

(or "P.CO2.|I.Fe|...|..." "P.CO2|P.Fe|...|..." ...)

assuming a setup with four time series. Mapping our pattern language to regular expressions, which have been studied extensively in both theoretical and practical contexts, allows us to use any of several mature and optimized libraries for the computationally intensive task of matching the patterns to large datasets. For instance the very large or-expression may be mapped to an efficient implementation of character sets.

Acknowledgements. Supported in part by US NSF grant EAR-1027960. Work benefited from earlier joint work with Nathan Dunn, reported in his honors thesis (U. Maine, 2015), and from interactions with the P301 group.

Niche Evolution Across a Gradient of Ecological Specialization

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Abstract: Elucidating factors that determine species' ranges is a central question in ecology and evolutionary biology. A species range is broadly defined as it's niche, a set of biotic and abiotic conditions in which a species can persist. Species that specialize on a narrow set of resources may be better able to outcompete rivals for those resources. However, this competitive advantage may come at a cost over the long-term, whereby specialists have a reduced ability to adapt to a changing environment. Hence, specialists are often thought to be more vulnerable to rapid environmental change. We know a species' niche can vary over space and time, yet factors that determine niche breadth, or degree of specialization, remain poorly explored. We will determine if niche breadth is correlated across niche axes to determine how niche evolution is constrained.

Introduction:

Ecological specialization is often synonymous with narrow niche breadth, resulting from trade-offs between competitive ability and adaptive capacity (MacArthur 1972, Futuyma 2001). Specialization is often a key concept in predicting adaptive response of populations to fluctuating environments (Levins 1968), and is associated with recent population declines (Correll 2015). However, a species niche breadth can be defined along multiple dimensions, or niche axes (Hutchinson 1957), and most species are likely specialist on some axes and generalist on others (Poisot et al. 2011). Yet, specialization is rarely quantified across several ecological niche axes, and the degree to which niche breadth is correlated among niche axes has received little attention (Bonetti and Wiens 2004).

We will explore factors that facilitate or constrain niche evolution by quantifying niche breadth across morphological, physiological, behavioral, and habitat-specific traits. This information will help elucidate if niche evolution is constrained by endogenous (narrow niche breadth across multiple traits) or exogenous (limited by narrowest environmental axes) factors

Tidal marshes provide an ideal system to explore factors that constrain niche evolution. They are highly productive, yet high salinity and daily tidal inundation pose a barrier to colonization. Six species of Emberizid sparrows have colonized tidal marsh habitats at different time scales (and thus show variation in the degree of

specialization within tidal marsh habitats). These species also show convergence in a suite of traits to deal with the unique adaptive challenges. Tidal marshes further possess a gradient in salinity and tidal influence that varies systematically with distance upriver. Thus, traits measured across this gradient may reflect associations between habitat characteristics and organismal ability to both occupy a wide array of environments (i.e., generalism) and possess adaptations for specific environmental challenges (i.e., specialism). This information will help elucidate if niche evolution is constrained by endogenous (narrow niche across multiple traits) or exogenous (limited by narrowest axes) factors.

Acknowledgements: Funding for my research has been provided by the U.S. Fish & Wildlife Service and the University of Maine.

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Conditions for Collective Action and Cooperation to Enhance Adaptation to Abrupt Climate Change in Chile's Territorial Use Rights in Fisheries Policy

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Abstract: Fisheries policy often assumes fishers act within homogenous social, economic, and ecological situations which reinforces poverty, excludes fishers from the political process, and makes them vulnerable to abrupt climate change (ACC) impacts. Chile's management policy, TURFs, offers a solution to this by devolving some rights and responsibilities to fishers, yet the policy continues to have disparate outcomes. This research examines the conditions under which fishers act collectively and sustain cooperation to enhance adaptation to ACC.

Project Goals:

This project examines the conditions under which small-scale fishers in Chile's Territorial User Rights in Fisheries (TURFs) act collectively to form and sustain local institutions to enhance adaptation to Abrupt Climate Change in Chile's coastal zone. Chile faces ACC impacts that may cause marine ecosystem regime shifts and irrevocably harm the gastropod *Concholepas concholepas* (*loco*) on which fishers depend as a primary source of income.



Fig. 1. Fishers in Caldera process *piure*, a tunicate.

Chile is home to over 90,000 small-scale fishers who are given access rights and form local institutions that design management plans with the state.¹ Rights-based co-management of marine resources intends to ensure social, ecological, and economic vitality of Chile's coastal communities.

However, the policy has had disparate outcomes; some TURFs succeed while others struggle and fail. Fisheries policy often assumes fishers act within a homogenous geographical and socioeconomic space which can make

fishers vulnerable to climate change.² Thus it is essential to understand under what conditions fishers make decisions and cooperate in order to create policy that is adaptive and supports diverse epistemologies, patterns of behavior, and sociocultural norms.



Figure 2. Fishers repair boats in Estaquilla.

This research is in its preliminary phases, but aims to use mixed methods to look at three TURFs with varied outcomes; operating, operating in doubt, and failed, to examine; the factors that contribute to institutional formation and sustained cooperation, fishers' perceptions of resilience and adaptation, and fishers' adaptive strategies to cope with ACC impacts.

Acknowledgements: Advisor, Dr. Christine Beitzl. NSF Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423.

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²Tanner et al. "Livelihood resilience in the face of climate change", *Nature Clim. Change* 5 (2015): 23-26.



Using Diverse Proxies to Study Climate Change at Nevada Coropuna Volcano, Peru

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Abstract: Nevada Coropuna in southern Peru is a high elevation volcanic complex with one of the largest tropical glacier masses on Earth. It is a critical water source for >100,000 people, who are also at risk from a variety of hazards from future volcanic eruptions. We are conducting a multi-proxy study of the climate history at Coropuna by examining modern-day changes in ice extents, century-scale changes in climate using cores of lake sediments, and millennial-scale changes by identifying ice-contact lava flow deposits. Integration of information from these studies will provide constraints on climate across a broad-range of time-scales to help better understand the processes that control climate in this part of Peru.

The Coropuna volcanic complex in southern Peru has a unique range of climate proxy records, including long-lived ice, lake sediment records, and ice-contact volcanic deposits. In June 2015 we began a collaborative study at Coropuna in conjunction with the Peruvian volcano observatory (OVI) to catalogue the variety of proxies that record climate around the complex. We are presently focusing on studies of each of these three areas to investigate changes in climate for this high-altitude, tropical location.

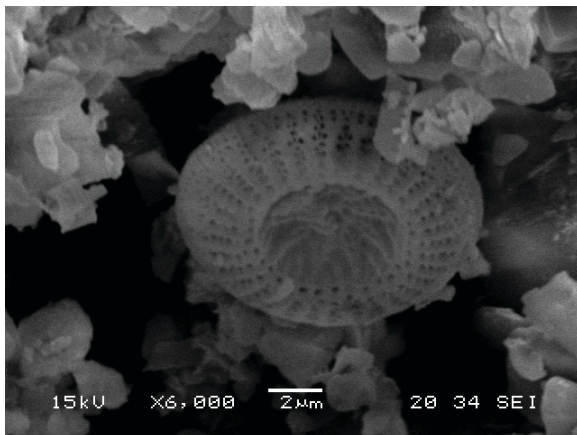


Fig. 1. Diatom in layer of volcanic ash deposited in Lago Pallarcocha at the western end of the Coropuna volcanic complex.

At the decadal time-scale, we have used the Landsat archive to identify changes in ice extent at the complex for 30+ years. See presentation by Kochtitzky et al (this symposium) for details. This study shows that ice loss is apparently slower than many previous estimates. Its short time-scale provides a high resolution base for understanding processes that inform longer term changes.

We also collected two lake sediment cores from Lago Pallarcocha, which is a small high altitude lake located at the western end of the volcanic complex. The cores were subsampled at 0.5 cm increments in the field, and both cores contain a distinctive layer of volcanic ash that has been correlated with the 1600 AD Huaynaputina eruption from southern Peru. Assuming constant sedimentation rates, this means that the 20+cm cores likely record deposition in the lake for the past 2000 yrs. We are conducting detailed diatom population surveys through the core, sediment size analysis measurements, Loss-on-Ignition measurements, and identification of mineralogical variation throughout one of the cores. Preliminary results show possible changes in lake circulation regimes as well as changes related to deposition of the ash layer.

We also have begun a longer-term study to identify volcanic deposits formed by glaciovolcanic eruptions. Several lava flows on the western flank have textural characteristics indicating the presence of ice when lava flows were emplaced. Once ages are obtained from these lavas we will be able to document significant changes (expansions of several kms) in the Coropuna ice over time-scales of 10,000+ years.

Our studies will have important implications for present-day climate adaptation planning, understanding ancient societal climate adaptation, and improve plans for future volcanic hazards.

Acknowledgements: This project is funded by Dickinson College and the Churchill Fund.

What is Driving Range Expansion of Vector Deer Ticks in Maine, USA -- Climate, Hosts, Habitat, or Human Behavior?

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Abstract: In 2014 Maine had the highest incidence of Lyme disease among US states (88 cases per 100,000). Incidence is higher in mid-coast counties and higher yet on off-shore Maine islands. Lyme and other tick-borne illnesses (anaplasmosis, babesiosis) are correlated with deer tick abundance. On a univariate basis, deer tick abundance is correlated with warm winters, wet summers, deer, invasive plants (such as Japanese barberry), and human behavior, manifested as resistance to tick control strategies and clashing values over resource management. Models will explain relative contribution of climate, hosts, habitat, and humans and inform adaptation.

Project goals

The goals of the research are to predict the range expansion of the deer tick in Maine through 2050, and inform adaptation and resilience to the threat of vector-borne disease through informed policy-making.

Lyme borreliosis and other tick-borne diseases are spreading in both North America and Europe, following contemporary climate warming and northward range expansion of vector *Ixodes* ticks¹. Lyme disease cases in Maine have risen

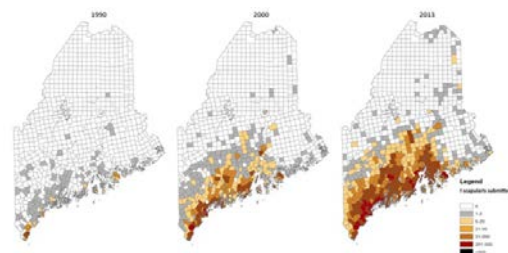
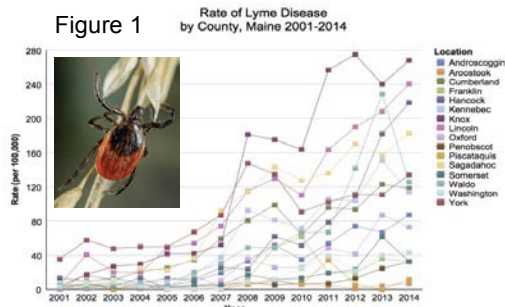


Figure 2. Range expansion of the deer tick



dramatically (Fig. 1) since the first case in 1983. In 2014 Lyme incidence in Maine was greater than in any other state (88 per 100,000 people), still greater in the mid-coast counties (268/100K) and astronomically high on some off-shore islands (up to 2,693/100K). Lyme is correlated with temporal statewide range expansion of the vector deer tick, *Ixodes scapularis*².

Tick-borne human and veterinary illness is tied to white-tailed deer density, habitat, and human behavior. Research objectives are to 1) use a Bayesian hierarchical spatiotemporal model to determine relative contributions of climate, hosts, and habitat 2) use weather forecasting models to predict future tick abundance, and 3) through an island case study, ascertain attitudes toward tick control.

Initial Results

Deer tick abundance is correlated with warm winters and wet summers. Warmer winters allow completion of the tick life cycle at higher latitudes, and rain events rescue nymphal ticks in summer from desiccation.

Acknowledgements: This research is supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423. Any opinions, findings, conclusions or recommendations expressed are those of the authors and do not necessarily reflect the views of the NSF.

¹ Parham P et al. 2014 Theme issue: Climate change and vector-borne diseases of humans. *Philosophical Transactions of the Royal Society B* 370(1665)

² Rand P et al. 2007 Passive surveillance in Maine, an area emergent for tick-borne diseases. *Journal of Medical Entomology* 44:1118–1129

Estimating Freshwater Fluxes from Ice Mélange in Glacial Fjords

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Abstract: Icebergs calved from marine-terminating glaciers account for nearly half of the recent mass loss from the Greenland Ice Sheet. These icebergs act as a distributed source of freshwater as they traverse fjords. Despite their potentially significant freshwater contribution to fjords, their meltwater fluxes are unconstrained by observations. Here we show preliminary meltwater flux estimates derived from repeat satellite remotely sensed images for two major Greenland fjords.

Iceberg discharge from the Greenland Ice Sheet has increased over the last two decades, likely in response to increased surface and submarine melting driven by warming air and ocean temperatures¹. Although a portion of the freshwater stored in the icebergs is exported to surrounding ocean basins, a potentially large fraction of the iceberg meltwater is released as the icebergs traverse Greenland's kilometers-long fjords. An increase in iceberg meltwater fluxes to glacial fjords due to an increase in iceberg abundance or warmer water temperatures may influence fjord stratification and circulation. Thus, in order to understand ice-ocean interactions in glacial fjords, it is imperative that spatio-temporal variations in iceberg freshwater fluxes are quantified. We expand upon our earlier analysis of iceberg melt rates obtained from repeat stereo satellite images to estimate freshwater fluxes from the ice mélange (i.e., matrix of icebergs, bergy bits, and sea ice) in Sermilik and Ilulissat fjords in East and West Greenland, respectively.

iceberg size and surface elevation within the portion of the mélange area covered by the DEM and the full mélange area measured in near-contemporaneous Landsat images (Fig. 1) to estimate the submerged area of the mélange. The freshwater flux from the mélange is then calculated as product of the submerged area and the averaged iceberg melt rate, which is obtained using a DEM-differencing approach².

We find that the freshwater flux from ice mélange may exceed the surface meltwater flux over the entire glacier area for most of the year. However, we also find that freshwater fluxes vary considerably with changes in submarine melt rates and the submerged iceberg area over weekly to inter-annual time scales. Based on these results, we suggest that models of glacial fjords must take iceberg melting into account. Further, we recommend that glacier submarine melt rates are interpreted with extreme caution if inferred from hydrographic observations collected down-fjord of icebergs.

Acknowledgements: This project is funded by NSF award ANS1417480 to E. M. Enderlin.

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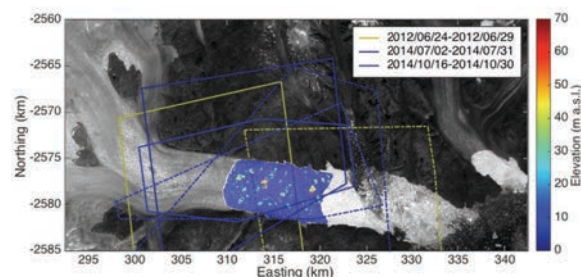


Fig. 1. High-resolution DEM overlay on a Landsat image of Helheim Glacier/Sermilik Fjord. Colored lines outline DEM footprints for each date pair.

For each fjord, we construct repeat high-resolution digital elevation models (DEMs) from stereo satellite images. We use observations of

Whole-Watershed Experimental Acidification Validates Regional Evidence for Initial Forest Soil Recovery in the Northeastern U.S. and Canada

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Abstract: Significant declines in atmospheric sulfur and nitrogen deposition have resulted from changes in policy and technology that reduced emissions from fossil fuels. Evidence in Europe and the U.S. is demonstrating an emergent recovery of surface waters from acidification, but evidence has been absent for recovery in soils. This year a collaboration of long-term research sites in eastern Canada and the northeastern U.S. reported the first evidence of soil recovery. In addition, the long-term watershed manipulation study at the Bear Brook Watershed in Maine (BBWM) provided experimental support for the interpretation of the empirical regional results.

Policy changes such as the U.S. Clean Air Act, and improvements in technology, have resulted in dramatic declines in atmospheric deposition of acidifying pollutants. For example, in Acadia National Park, sulfur deposition has declined 70% and inorganic nitrogen deposition has declined 37% since 1980 (1). This has resulted in improvements in surface water quality in the affected regions (2). To determine whether there was evidence of recovery in soils, participants in the Northeastern Soil Monitoring Cooperative evaluated soil data from 27 forested watersheds in eastern Canada and the northeastern U.S. with a history of soil resampling (3). Significant trends were reported for decreases in the concentrations of exchangeable aluminum in the O horizon, and increases in pH in the O and B

horizons. One site in the network, BBWM, also includes a paired whole-watershed acidification experiment that allowed the researchers to test what a lack of recovery would look like. Figure 2 shows soil aluminum concentration changes over time for all sites together, as well as the reference and experimentally acidified watersheds at BBWM. For both forest types in the experimentally acidified watershed, there was no evidence for declines in exchangeable aluminum. However, the reference watershed conformed to regional trends, providing experimental support for empirical evidence of a linkage between soil recovery and declines in acid deposition.

Acknowledgements: This research is supported by the Maine Agricultural and Forest Experiment Station and the National Science Foundation.

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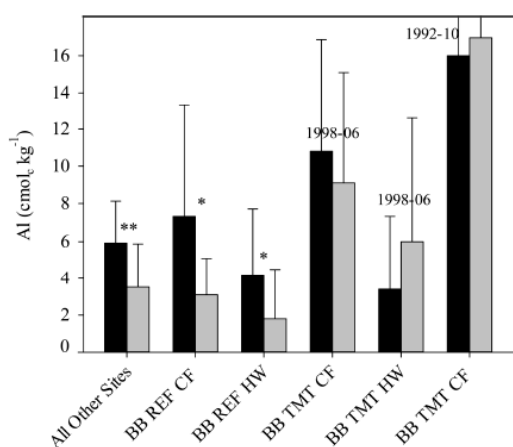


Fig. 2. Mean exch. Al concentrations in O horizons for initial (black) and final (gray) collections for resampling studies at Bear Brook (BB) and all 27 regional sites. HW=hardwoods, CF=conifer forest, REF=reference watershed, TMT=treatment watershed. From Lawrence et al. (2015).

Elevated Dust Inputs to SW Greenland Lakes: Effects on Surface Water Dissolved Organic Carbon Concentration and Quality

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Abstract: Recent declines in dissolved organic carbon (DOC) concentration of southwest Greenland lakes have important implications for lake ecosystem function. Increases in regional glacial outburst flooding, concurrent with the observed changes in DOC, are likely magnifying proglacial dust activity and extent. It is well-known that iron (Fe) oxides, which are present in proglacial dust, can bind to humic DOC and precipitate from the water column, effectively reducing DOC concentration. We performed experiments to explore the effects of dust addition to lake water DOC concentration and quality.

Saros et al. (2015) discovered that DOC concentration in a group of study lakes in SW Greenland has declined by 14-55% in the period between 2001-2003 and 2011-2014. This shift in DOC may be an indicator of broader climate-mediated trends that are affecting lake catchments and is important for lake ecosystem function (Williamson et al. 2009)

Between the periods of 1979-2000 and 2007-2012, surface air temperatures in Greenland increased by almost 3° C (Mayewski et al. 2014). This surge in temperature is likely a key driver of the increased frequency of glacial outburst flooding from the Russell Glacier. The glacial till left behind after floodwater recession is easily deflated, and can be transported long distances as dust. Dust in this region is known to contain Fe, which can bind to some fractions of humic DOC, flocculating and then precipitating from the water column.

We performed experiments to determine how dust additions to lake water impact DOC concentration and quality. We added dust to filtered water from three lakes, and incubated the treatments in ultraviolet (UV)-exposed conditions and in the dark. DOC concentrations increased in UV-exposed conditions, regardless of dust addition, indicating an additional source of DOC production, i.e. microbial. Absorbance at 254 nm decreased in UV-exposed conditions (Figure 1), signifying a decrease in DOC aromaticity, which indicates a shift in source of DOC from terrestrially-derived to microbially-derived.

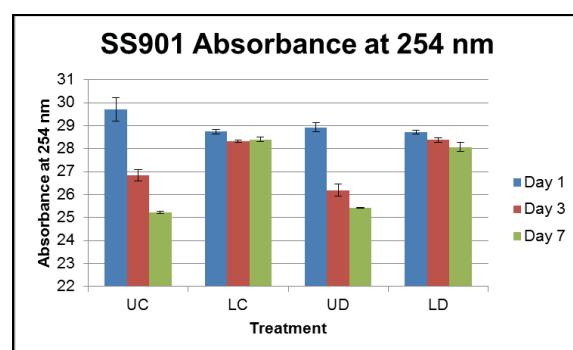


Figure 1. Absorbance at 254 nm of dust treatments and controls throughout experiment.

Acknowledgements: This research was supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423.

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Testing for Biotic Feedbacks in Tidal-marsh Community Stability in the Face of Sea-level Rise

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Abstract: The persistence of insectivorous birds in tidal marshes is unlikely in the face of rapid sea-level rise. It is unclear, however, how their loss will influence the broader tidal-marsh ecosystem. In the summers of 2014 and 2015, we conducted predator-removal experiments in Northeastern US tidal marshes to test if the exclusion of avian predators would result in measurable changes in lower levels of the food web. Birds are considered important top predators in marsh food webs, and we report the changes in both invertebrate abundance and plant biomass as measures of direct and indirect effects.

Introduction:

Tidal-marsh songbirds face an imminent threat of extinction this century with sea-level rise (Hodgman et al. 2015). The effects of losing these species from the marshes are unclear. Food webs shape the structure of ecological communities through direct and indirect interactions. The loss of an invertebrate predator, like these birds, can trickle down to the plant community by influencing when and where herbivores forage and the magnitude of herbivory damage to the plant. Further, the ability of tidal marshes to maintain elevation in the face of sea-level rise is partially determined by the production of plant biomass (Donnelly & Bertness, 2001). Removing avian predators from this system may therefore alter plant biomass through indirect species interactions (a trophic cascade) and affect the resiliency of tidal marshes to climate change. To test the impact of the sparrow's absence in local food webs, we constructed avian exclosures in eight tidal-marsh systems along the Northeastern US coast. We measured temporal changes to invertebrate communities after excluding avian predators. For evidence of trophic cascades, we measured vegetation biomass.

Preliminary results show that exclosure plots have higher biomass than paired control plots (Figure 1: p value < 0.05), and investigations into changes to the invertebrate community are ongoing.

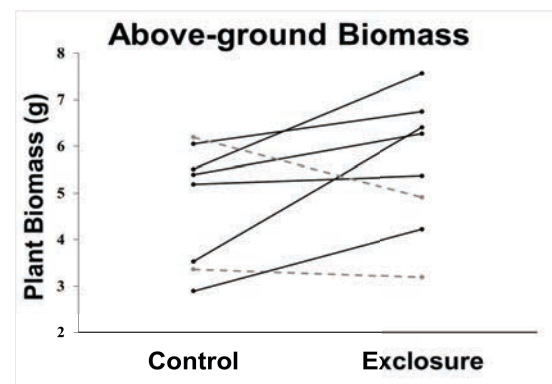


Figure 1. Above-ground plant biomass (ash-free dry mass) collected at eight tidal marshes across the Northeastern US. Lines connect values gathered at predator exclusion and control plots for the same sites. Biomass was higher (black solid lines) in the exclusion plots for six of the sites and lower (gray dashed lines) in two.

Acknowledgements: Funding for my research has been provided by the U.S. Fish & Wildlife Service and the University of Maine.

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Developing a Validated Long-term Satellite-based Albedo Record in the Central Alaska Range

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Abstract: Mountain glaciers around the world, particularly in Alaska, are experiencing significant surface mass loss from rapid climatic shifts and constitute a large proportion of the cryosphere's contribution to sea level rise. In-situ albedo measurements from our 2013 field season on the Kahiltna Glacier (Denali National Park, AK) validate the use of satellite-derived albedo values. We examine the relationships between surface albedo and glacier mass balance.

Surfaces with high reflectance values within the cryosphere such as seasonal snowpack, glacial snow and ice, and sea ice play a vital role in the global climate system and in the energy budgets of the world's glaciers. Changes in reflectance may induce feedbacks resulting in fluctuations of glacier mass balance. My objective is to understand glacier response to climate forcing by using surface albedo as a proxy for mass balance.

To understand the relationship between surface albedo and mass balance, we used an ASD, Inc. FieldSpec4 Standard Resolution spectroradiometer to measure incoming solar radiation, outgoing surface reflectance and optical grain size on the Kahiltna Glacier and at the Kahiltna Base Camp for seven days during our 2013 field season in Denali National Park.

We derive surface albedo using the Moderate Resolution Imaging Spectroradiometer (MODIS) MCD43A3 Albedo Product, a 16-day composite with 500-meter resolution. Comparisons are made between ASD FieldSpec4 ground measurements and MCD43A3 imagery to assess the ability of MODIS to capture the variability of surface albedo across the glacier surface. The MCD43A3 albedo product performs well at Kahiltna Base Camp, but low biases in MODIS albedo appear to occur along the Kahiltna Glacier due to the snow-free valley walls being captured in the 500m MODIS footprint. Incorporating Landsat imagery will strengthen our interpretations and has the potential to produce a long-term validated satellite albedo record for

steep and mountainous terrain. Once validation is complete, we will compare the satellite-derived albedo record to the Denali Ice Core accumulation rate, aerosol records, and glacier mass balance data.

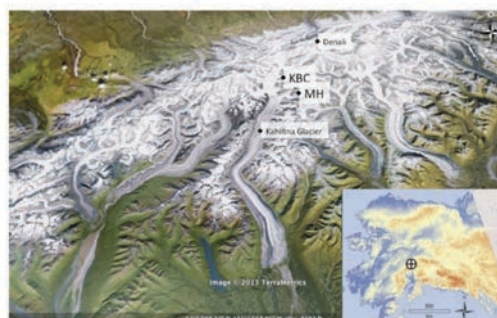


Fig. 1. Google Earth image of study locations: Kahiltna Base Camp (KBC- 2105 masl), and Mount Hunter (MH- 3910 masl). Kahiltna Glacier and Mount McKinley (Denali) also noted. Insert map (from Campbell et al., 2012) shows the Central Alaska Range (circle-plus symbol) on a DEM of Alaska (red is high elevation).

Acknowledgements: Funding from US National Science Foundation- Office of Polar Programs award 1203838 to K. Kreutz. Logistical support provided by: Denali National Park, Talkeetna Air Taxi, and CPS Polar Services.

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A 1908-1995 Major Soluble Ion Record of Dust and Anthropogenic Pollutants from Inilchek Glacier, Tien Shan

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Abstract: High-resolution major soluble ion records from Inilchek Glacier provide proxy records for dust storm activity and anthropogenic activities throughout the 20th century.

High-resolution major soluble ion records (Na^+ , K^+ , Mg^{2+} , Ca^{2+} , Cl^- , NO_3^- and SO_4^{2-}) covering the period 1908-1995 AD from the Inilchek Glacier, Tien Shan, Kyrgyzstan provide detailed 20th century climatic and environmental proxies. Chemical concentrations, EOF analyses and non-crustal excess calculations were used to identify natural and potential anthropogenic inputs. Dust proxy species (e.g. Ca^{2+}) reveal declining decadal trends, likely reflecting regional dust storm activity in central Asia post 1950, that has been associated with coupled atmospheric circulation variability and human activities [1,2]. Comparison between Ca^{2+} and ERA-interim climate reanalysis data indicates a strong relationship to spring surface pressure patterns in northwest China and the position and potential strength of the Siberian High. Non-crustal contributions (excess) estimates of NO_3^- , SO_4^{2-} , K^+ , and Cl^- concentrations suggest discernable anthropogenic inputs began between the 1950s-1970s and increased into the mid-1980s and early 1990s. Excess trends coincide with Former Soviet Union (FSU) consumption, production and emission of fossil fuels and fertilizers, reflecting the rapid growth of agriculture and industry, as well as economic declines in the mid-late 1980s/early 1990s. Excess- Cl^- trends reflect timings that coincide with the construction of the Pavlodar Chemical Plant and the military production of Cl_2 in Kazakhstan. NOAA HYSPLIT back-trajectory frequency analysis suggests the Fergana Valley (located in Kazakhstan, Uzbekistan and Kyrgyzstan) to be a major pollutant source.

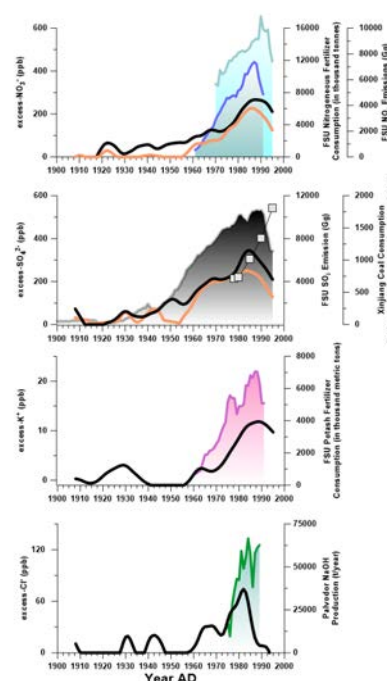


Figure 1. Comparison between Inilchek excess-ion concentrations (lines) and consumption, production and emission data from the FSU (gradients) and western China (squares).

Acknowledgements:

NSF ATM-0754644 NSF, P2C2-1401899 and NSF A2C2 IGERT DGE-1144423.

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How Do Land-Use and Seabirds Explain the Chemical Characteristics of Soil and Tussac Grass (*Poa flabellata*) in the Falkland Islands?

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Abstract: The presence of burrowing seabirds and land-use of Tussac grasslands in the Falkland Islands may explain plant biodiversity, as well as chemical characteristics of soils and plants. In February 2016, 88 plots across five locations were sampled for % vegetation cover (native vs. invasive), nutrient analysis of soil and plants, and seabird nesting density. The results will inform management and conservation efforts of degraded Tussac grasslands.

Research Description:

Seabird guano is known to support island vegetation globally (Mulder *et al.* 2011). Generally, marine-derived nutrients (i.e. nitrogen and phosphorus) of plants and soil tend to increase with seabird densities. However, there are several reasons why nutrient concentrations of plants may not increase linearly with increased seabird density across systems (Mulder *et al.* 2011). Nitrogen and phosphorus may be in forms unavailable to plants; alternately, plants may be limited by other resources (e.g. precipitation, sunlight, Ca^{2+} , Mg^{2+} , CO_2) and thus will not respond to nutrient additions from guano.

Seabirds utilize soft Tussac grass (*Poa flabellata*) peat to build nests within burrows, which are often high in organic matter. With a loss of 80% of Tussac grass habitat, and declines in seabird populations (Woods and Woods, 2006) understanding the importance of marine-derived nutrients to Tussac grasslands is critical for land-use management efforts and to the conservation of vegetation and wildlife alike.



Fig. 1. Location of Tussac grasslands sampled.

Five selected Tussac grasslands represent varying land uses: seasonal rotation grazing (cattle in winter only), no grazing, historical over-grazing. At each location seabird nesting

density, % vegetation cover, invasive plants, and native plants were quantified using randomized plots (5m x 5m). Soil samples will be analyzed for exchangeable nitrogen (NH_4 and NO_3), pH, $\delta^{15}\text{N}$, and total N, P, K. Nutrient characteristics of Tussac grasses will also be analyzed for total N, P, and K. Vegetation % cover and number of species were correlated with seabird nesting density, when possible. Preliminary results (Fig. 2) show that the number of plant species decline with an increase in the number of seabird burrows at Kidney Island.

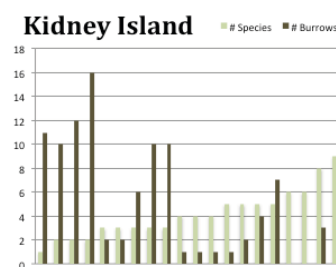


Fig. 2. Number of plant species is negatively correlated with the number of seabird burrows at Kidney Island ($r^2 = -0.661$, $n = 20$).

Acknowledgements: I gratefully thank the NSF A2C2 IGERT Fellowship, the Falkland Islands Department of Agriculture, and the South Atlantic Environmental Research Institute.

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The ATLAS System: An Autonomous Terrestrial Laser Scanner for Monitoring Large Tidewater Glaciers

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Abstract: This paper describes the development and deployment of an autonomous full-waveform, long range (6-10 km) terrestrial LiDAR scanning system for extended unattended operation (> 1 year) in a remote Arctic environment.

Tidewater glaciers draining the Greenland Ice Sheet exhibit dynamic behaviors across a range of spatial and temporal scales, posing a challenge to both *in situ* and remote sensing observational strategies. *In situ* measurements can capture variability over very short time intervals, but with limited spatial coverage and at significant cost and risk to deploy. Conversely, airborne and satellite remote sensing is capable of measuring changes over large spatial extents but at limited temporal sampling. In recent work, we have shown that long-range Terrestrial LiDAR Scanning (TLS) from fixed near-situ locations is capable of combining the rapid acquisition capabilities of *in situ* measurements with the broad spatial coverage of traditional remote sensing. LiDAR (Light Detection and Ranging) scanners have typically operated for short-duration campaigns (days to weeks) due to the technical complexity of the instrumentation, but the “snapshot” nature of observations has limited their contribution to studies of tidewater glacier studies.

We have engineered a system that is capable of year-round unattended operation. The instrument uses an innovative 1064 μ m wavelength laser which has been optimized for snow and ice, and allows us to acquire multi-dimensional point-cloud measurements of a ~60 km² region every 6-hours. Year-round operation at high latitudes is made possible by a robust power system comprised of solar photovoltaic panels, wind turbines, methanol fuel cells, and LiFePO₄ battery packs. Communication and control functions are integrated with the power management, allowing for remote monitoring of system performance.

The system was deployed at Helheim Glacier, southeast Greenland in late July, 2015. Helheim Glacier is a large tidewater glacier of the

Greenland Ice Sheet and the focus of a coordinated interdisciplinary program to study its dynamics and interaction with the ocean. Results from our year-round scanning instrument will provide new insights into short- and long-term ice motion and terminus behavior at temporal and spatial resolutions previously not possible.

While our primary interest is polar glaciology, ATLAS has potential applications in other remote environments for studies requiring long-term time series of high-resolution surface topography.

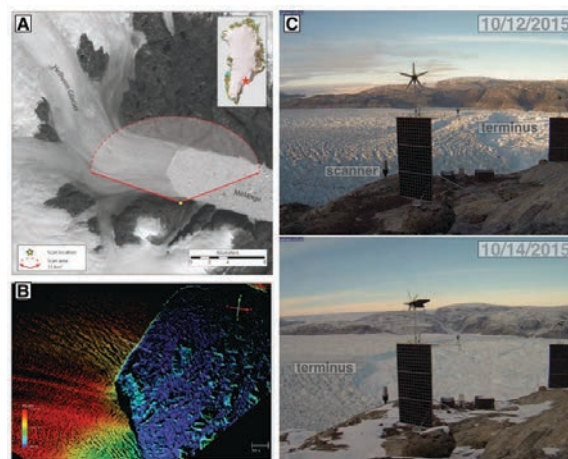


Figure 1. (a) ATLAS swath coverage over the terminus region of Helheim Glacier. (b) A digital elevation model produced by a single scan. (c) and (d) System as deployed at Helheim Glacier, showing large terminus position changes (km-scale) over a 2-day interval.

Acknowledgements: This project is financed by the Heising-Simons Foundation, Los Altos, California.

Investigating the Human History of the Falkland Islands

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Abstract: This project aims to determine if there was a human presence in the Falkland Islands prior to European arrival in the eighteenth century and to assess the potential link between humans and the arrival time of the warrah to the islands. Using a combined approach of archaeology and paleoecological charcoal analysis, this study is the first of its kind in the Falklands and will contribute greatly to the understanding of the natural and human history of the islands.

When Europeans first arrived on the shores of the Falkland Islands they were greeted by an enigmatic canid, *Dusycion australis*, locally known as the warrah, but there were no human inhabitants present at that time. The absence of human inhabitants at the time of European arrival, coupled with a complete lack of any archaeological sites within the islands, has led to the assumption that humans had not reached the island prior to European arrival. However, the presence of the warrah, which was the only terrestrial mammal and predator native to the islands, and the discovery of multiple stone points on several outlying islands, suggest a possible alternative explanation for the human history of the Falklands.¹

In the absence of known archaeological sites, charcoal is a useful indirect proxy for identifying a pre-colonial human presence, as background charcoal levels typically increase by an order of magnitude following initial human arrival on islands. The initial colonizers of remote islands may be few in number making it difficult to detect initial arrival through material evidence, which is where the use of indirect evidence of human activities such as landscape modification and the introduction of alien species can be revealing.²

During a recent expedition to the Falklands we collected several peat cores and columns from target locations throughout the islands for charcoal analysis (figure 1). Target locations were chosen based upon a combination of map surveys, landowner feedback, and paleo-landscape features that were analyzed for factors favorable for human habitation. These factors include: proximity to present day bird colonies and availability of marine resources, proximity to

fresh water, availability of wind sheltered terrain, and alleged artifact locations. Finally, the availability of intact peat bogs dictated where cores were taken from.



Fig. 1. Target locations where peat columns were extracted (red stars) during 2016 Falkland Islands expedition.

Acknowledgements: We would like to thank Dan and Betty Churchill, the Geological Society of America, the donors who supported our experiment.com crowdfunding campaign and the many Falklands landowners for their cooperation and support.

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A Hybrid Approach to Understanding Community Resilience in Peru

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Abstract: Unprecedented climate change (CC) impacts in the Andes pose water security issues for dependent communities throughout Peru's Santa Rio watershed. Peruvians are among those most vulnerable to CC impacts on the hydraulic system due to their increasing water dependence on rapidly disappearing alpine glaciers. While state-designed ecosystem-based adaptation (EBA) interventions are underway throughout the Peruvian highlands, they remain reminiscent of coercive management approaches that are theorized to produce unsustainable outcomes. This research project takes a multi-sited case-study approach to explore dimensions of efficacy and equity in EBA schemes in two highland communities. Additionally, the project builds on recent hybrid methodologies for assessing community resilience to CC impacts, striving to co-construct a monitoring and evaluation tool that reflects and bridges local and scientific knowledges.

Adaptation actions to climate change (CC) can be made autonomously, or without explicit planning efforts; however, little evidence suggests that this response alone will sufficiently adapt societies to intensifying CC risks. In this view, nascent adaptation policy and planning interventions are rapidly emerging across a range of geo-political scales. However, not all adaptation efforts will arrive at their intended end goals of vulnerability reduction and enhanced resilience; some will prove maladaptive, inadvertently (re)producing the vulnerabilities they aimed to redress (Marino and Ribot, 2012). While causes of adaptive policy failures are complex and not fully understood, a recent paradigm shift in environmental governance scholarship emphasizes movement away from coercive centralized management to decentralized, multilevel or hybrid governance approaches in order to achieve conservation, adaptation or sustainability goals (Lemos and Agrawal, 2006). Despite this, adaptation interventions often remain characteristic of top-down technical approaches, avoidant of local engagement.

Through a multi-sited case-study approach in the Peruvian highlands, this proposed research investigates dimensions of equity and efficacy in state-designed, ecosystem-based adaptation (EBA) efforts that seem to epitomize earlier coercive management regimes. Peruvian societies are among those most vulnerable to CC impacts on the hydraulic system due to growing state-wide water demands on a rapidly retreating glacier water supply. These ancient water towers that have served Peruvians for millennia show a rapid decline in glacier

coverage of more than 25% since 1970 and are expected to completely disappear by as early as mid-century. Under these CC impacts, Peruvians are experiencing water scarcity issues across water, food, and energy sectors.

Methods: The research will employ an iterative, two-phase, mixed-methods approach with fieldwork spanning 2015 - 2017. Phase-one, consists of employing qualitative research methods including interviews, observation, and participatory action research, in order to gain contextual insights into place-based indicators of resilience, and to co-construct a resilience assessment tool merging local and scientific knowledges. Phase-two consists of developing and implementing a questionnaire to measure community resilience in two purposively sampled villages in the Peruvian highlands, aiming for insights into EBA's community resilience outcomes.

Acknowledgments: This research was supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423.

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Currents of the Past: Archaeological Evidence for Past Changes in Fish Ecology in the Gulf of Maine - Update and Review of Specialized Protocol

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Abstract: This project focuses on previously unexplored small fish remains from a series of rare Archaic-period shell midden archaeological sites along the Gulf of Maine. We have gathered archaeological samples from three sites to investigate a possible abrupt change in Gulf of Maine currents – and associated changes in fish populations – at approximately 3,800 B.P. corresponding with the disappearance of swordfish (*Xiphias gladius*) remains archaeologically.

One of the most profound changes in Gulf of Maine fisheries ecology occurred during the Late Archaic period at approx. 4200 B.P. when swordfish abruptly disappear from the archaeological record. The presence of swordfish is assumed to signal a period of warmer sea surface temperatures within the Gulf of Maine, possibly due to a shift in the Gulf Stream and an interruption of the cold-water Labrador current (Sanger 1988). Five endangered coastal archaeology sites from Frenchman Bay in Maine to the Hampton Estuary in New Hampshire preserve archaeological evidence of this possible change from warm to cold water marine fish communities *that may be the reverse of modern trends toward warmer environmental conditions*, and the associated cultural reactions. We are exploring this possible change, the degree to which it was expressed, and its broader effects on fisheries and fish ecology.

We have identified and sampled critical archaeological strata from surviving portions of three archaeological sites along the Gulf of Maine coast: the Waterside site in Sorrento, ME, the Nevin site in Blue Hill, ME, and the Seabrook Marsh site in Seabrook, NH. The Waterside site was sampled in 2013 and has been reported on previously (Heller and Robinson 2015). The Nevin and Seabrook Marsh sites were excavated during the summer and fall field season of 2015; both yielded excellent samples.

We have now completed our sampling and are moving forward with sample processing and analysis. Samples from the Seabrook Marsh site have necessitated creation of a specialized protocol to handle particular characteristics of samples recovered from a salt marsh.

The Seabrook occupation soils were covered by an accumulation of salt-marsh beginning soon after deposition and have remained submerged by ocean water during all by low tides for over 3000 years. These samples cannot be allowed to dry before processing due to increased acidification and formation of gypsum crystals as evaporation occurs. Since they must be processed wet, organics that typically would float to the surface during water processing instead sink to the bottom and are lost, requiring an alteration in processing equipment and protocol. Further, once soils have been removed, samples require fresh-water baths to remove salts before they can be allowed to dry.

Acknowledgements: We would like to thank the Archaeological Conservancy for permission and support of our investigations at the Waterside Shellheap, NextEra Energy for permission to excavate on the property of Seabrook Station, and the Maine Historical Preservation Commission for their support in our investigations at the Nevin site. This research was supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423.

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Differential Gene Expression in American Lobster Associated with Environmental Stress and Epizootic Shell Disease Infection in the Gulf of Maine

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Abstract: The American lobster represents a major commodity throughout the species' range. However, epizootic shell disease (ESD) has become an increasing threat to the stability of the lobster fishery. We used a transcriptome-wide analysis of gene expression to evaluate the hypothesis that host susceptibility to ESD coincides with environmentally-induced physiological stress. Preliminary results indicate numerous genes are differentially expressed depending on environmental conditions and presence of ESD infection.

The American lobster (*Homarus americanus*) fishery, which represents an economically and ecologically important resource throughout the northwestern Atlantic Ocean, is currently being threatened by the spread of epizootic shell disease (ESD). An initial outbreak of ESD was first detected in Long Island Sound in the mid-1990's and was followed by the spread of ESD throughout southern New England lobster stocks, including recent expansion into the Gulf of Maine. ESD appears as disfiguring lesions on the carapace of infected individuals, consequently reducing their market value. Extreme cases can also diminish individuals' abilities to molt and reproduce, thereby potentially endangering population stability.

Environmentally-induced physiological stress has been implicated as a major contributor to host susceptibility to ESD (Tlusty et al. 2007). For instance, our research has indicated that climate change-related factors such as bottom water temperature and salinity significantly influence where the disease occurs throughout Long Island Sound. Patterns of ESD expansion also support a link to environmentally-induced stress, as the disease's northward spread has coincided with warming water temperatures along the New England coast.

We used an analyses of transcriptome-wide gene expression to evaluate whether physiological stress coincides with ESD presence. We sequenced RNA from the hepatopancreas tissue of seven lobsters from each of three groups: ESD-infected from southern Maine (i.e., presumably more stressful environment), healthy from southern Maine, and healthy lobsters from Downeast Maine (presumably less stressful environment. Initial

results indicated numerous genes are differentially expressed between all sample group pairings, with the greatest number of differences evident between healthy lobsters from Downeast Maine and infected lobsters from southern Maine (Fig. 1).

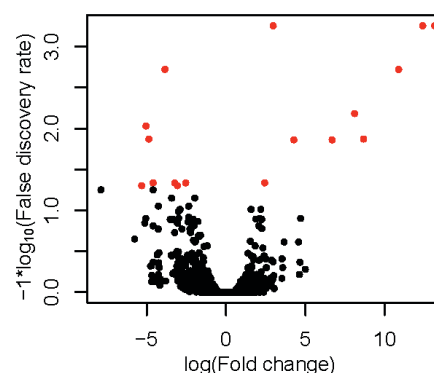


Fig. 1. Volcano plot indicating genes with significant changes in expression (fold change; red dots) between ESD infected lobsters in southern Maine and apparently healthy lobsters from Downeast Maine.

Acknowledgements: This research is supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423, US National Science Foundation project grant 1313627 and the University of Maine.

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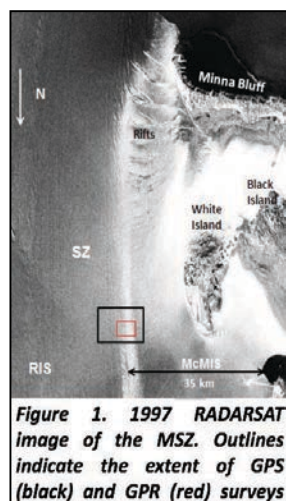
Crevasse Extent and Lateral Shearing of the McMurdo Shear Zone, Antarctica, Using GPR and GPS Observations

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Abstract: Lateral resistance arising from the shearing motion of the fast-moving Ross Ice Shelf (RIS) and the slow moving McMurdo Ice Shelf (MIS) likely plays a role in the stability of the western portion of the RIS. Observations of unusual crevasse geometries may be suggestive of possible weakening of the shear zone. This study incorporates GPS surveys to study the surface kinematics of the shear zone between the MIS and RIS and GPR surveys to determine crevasse location and orientation within an area of localized strain and longitudinal stretching.

The McMurdo Shear Zone (MSZ) is a 5-10 km section of heavily crevassed ice along part of the western margin of Antarctica's largest ice shelf, the Ross Ice Shelf (RIS). The stability of the MSZ, a crucial pinning point of the RIS, will likely



have an impact on stresses distributed throughout the RIS in the future. In situ GPR and GPS surveys were conducted to determine crevasse extent and surface kinematics. GPS surveys spanned a 12 x 12 km grid with 29 poles surveyed over 2 consecutive field seasons. In addition, GPR surveys utilized a lightweight remote-controlled robot to tow

a 200 MHz antenna within a 5 x 5.7 km grid with 50 m spacing between transects. Analysis of the GPS data indicates a sharp velocity gradient across the shear zone with velocities ranging from 180 m/yr on the MIS side to 460 m/yr on the RIS side (Figure 2). Strain rates range between 0 and 0.016 yr⁻¹ with crevasse initiation occurring at ~0.01 yr⁻¹ which falls within the published estimates required for crevasse initiation¹. The strongest shear strain occurs where longitudinal velocity gradient shifts from compression to stretching.

GPR analysis reveals parabolic diffractions indicative of both surface and basal crevasses. Firn crevasse strike angles typically range from 35–40° to transect direction with basal crevasse

strike angles ranging from 27–50°. Spatial correspondence between near-surface and basal crevasse signatures suggests coeval fracturing.

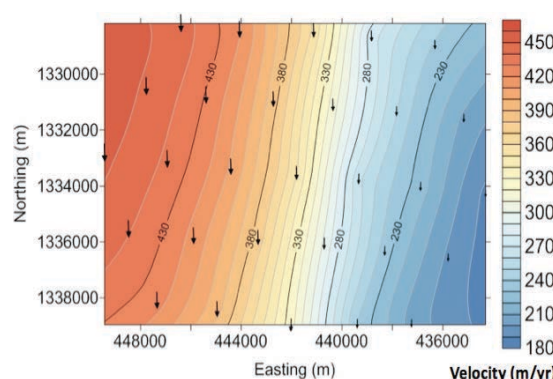


Figure 2. Velocity contours (m/yr) with overlaid vector grid. Both velocity magnitude and direction are dominated by northward velocity (downward)

Further investigation of temporal changes in crevasse extent and orientation may reveal weakening of the RIS lateral margin. Efforts to quantify this weakening and incorporate observations within an ice-sheet numerical modeling framework is currently underway.

Acknowledgements: Gratitude for the support of Dr. Gordon Hamilton, Dr. Peter Koons, and Dr. Steven Arcone with funding from the National Science Foundation grant ANT-1246400.

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Millennial-scale Reconstruction of the Last Glacial Maximum and Onset of the Termination: A ^{10}Be Chronology of the Right Lateral Moraines of the Former Pukaki Glacier, Southern Alps, New Zealand

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Abstract: The last glacial termination is the largest climate reorganization of the past 100,000 years. However, the drivers of this transition from full-glacial to full-interglacial conditions remain enigmatic. Glacial chronologies from extra polar latitudes afford insight into atmospheric temperature changes associated with the last glacial termination. The maritime glaciers of the New Zealand Southern Alps are particularly sensitive recorders of summertime atmospheric temperature. Precisely documenting when these glaciers began to recede from last glacial maximum (LGM) positions is important for addressing hypotheses for the last termination in the Southern Hemisphere. Here, we present a precise 10-Beryllium (^{10}Be) surface exposure-age chronology of glacial landforms near Lake Pukaki, central Southern Alps. This chronology documents when the ice-age Pukaki Glacier began to recede at the onset of the termination.

The Southern Alps of New Zealand are situated in the southwest Pacific Ocean and span a large latitudinal range (~40–46°S), making them ideal for studying past behavior of the southern hemisphere westerly wind belt. A working hypothesis from Denton et al. (2010) suggests the increased sea-ice extent in the northern hemisphere shifted the thermal equator south, and thereby the wind belts, during the last glacial termination. We can test this and other hypotheses of the last glacial termination by comparing an atmospheric temperature proxy to other climate records in order to determine what caused the largest climate transition in the past 100,000 years.

However, some previously published glacial chronologies of neighboring alpine systems within the Southern Alps of New Zealand afford conflicting interpretations for the timing and behavior at the onset of the termination. From the Rakaia and Rangitata systems, interpretations of surface exposure-ages indicate gradual retreat during Heinrich Stadial 1 (HS1; 18–15 ka) (Rother et al. 2014; Shulmeister et al. 2010). In contrast, multiple surface exposure-age datasets from Ohau and Pukaki valleys, and a different chronology from Rakaia valley, suggest rapid retreat initiated close to the onset of HS1, ~18 ka (e.g. Doughty et al., 2015; Kelley et al., 2014; Putnam et al., 2013).

Here I present a ^{10}Be surface exposure-age chronology of past ice extent as recorded by the

right lateral moraine deposits of the former Pukaki Glacier. This chronology spans the local last glacial maximum and onset of the last glacial termination. Preliminary data indicate rapid recession at the onset of HS1, and therefore are in closer agreement with the interpretations from the studies of Doughty et al. (2015), Kelley et al. (2014), and Putnam et al. (2013).

Acknowledgements: This project was funded by the Comer Science and Education Foundation, the Quesada Family Foundation, and the NSF grant # 1102782. Project members: George Denton, Aaron Putnam, Joerg Schaefer, and Mike Kaplan. Additional field and laboratory team members: David Barrell, Roseanne Schwartz, Jeremy Frisch, Jean Hanley, and Colin Dowey.

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The Relationship Between Climate Change and the Distribution Patterns of Planktonic Diatoms in Lake Superior

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Abstract: We are investigating the ecology of key diatom species in Lake Superior that are indicators of thermal structure in smaller lakes. We are examining nearly two decades of long-term chemical and biological monitoring from several sites throughout the lake. We hypothesize that diatom indicators will have similar responses to climate in Lake Superior as they do in smaller lakes.

Introduction:

Major physical and biological changes are occurring in Lake Superior, but the relationship between the two remains a mystery. Lake Superior surface temperatures have been increasing faster than regional air temperatures, with climate implicated as potentially driving unexplained changes in the diatom community. [2]. Diatoms, microscopic algae, are ideal organisms for studying biological response to climate change since they respond quickly to environmental changes, form a major component of the Lake Superior flora, and have long been used in ecological studies. We are investigating the ecology of key diatom species in small lakes that have been used as climate indicators of epilimnion depth, the upper warm layer of lakes that forms in the summer months [3]. For example, species such as *Discotella stelligera* are associated with a shallower epilimnion (Fig. 1a), while *Lindavia comensis* is associated with an intermediate epilimnion (Fig. 1b), and *Lindavia bodanica* with a deeper epilimnion (Fig. 1 c).

Objective:

This study will help identify the role of climate in driving modern diatom changes in Lake Superior. We expect key diatoms to have similar relationships to thermal structure in Lake Superior as they do in small lakes. Results will inform the suitability of applying diatom indicators across systems of varying size, while potentially identifying new diatom indicators of climate change in large systems that may be unique or broadly applicable. This will increase our understanding of variations in diatom ecology and applicability of diatom climate indicators across systems.

Methods:

We are using monitoring data collected by the EPA since 1996 to investigate the relationship between diatoms and thermal structure. Multiple linear regressions of thermal structure and other ecological variables are being used to test previously identified diatom indicators of climate change and test potential new ones.

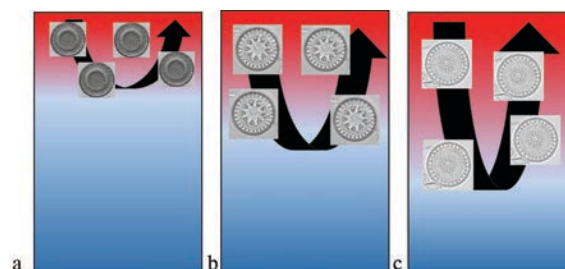


Figure 1. Conceptual diagram of hypothesized response of key diatom species to thermal structure in Lake Superior. The species are expected to be found at highest abundances at differing epilimnion depth, which increase from left to right.

Acknowledgements: This project is funded by the National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423.

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Re-analysis of Landsat Images Shows Tropical Glacier Retreat Slower than Previously Thought: Nevado Coropuna, Peru

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Abstract: We analyzed 21 Landsat images from 1980 to 2014 to measure aerial changes in the ice cap at the Nevado Coropuna volcanic complex, Peru. Although previous studies have reported ice loss rates of 1.4 km²/yr, we estimate ice loss to be 0.41 km² yr⁻¹. We analyzed 258 Landsat scenes to find annual snow minimums using the Normalized Difference Snow Index (NDSI). Although some predict that Coropuna will be a non-contributor to water supply by 2025, our results suggest that this will not be the case.

Nevado Coropuna (15° 33' S, 72° 38' W, 6,425 m.a.s.l.) is the largest body of ice in the tropics and the largest supply of fresh water for Southern Peru. Because the ice sits on top of a volcano that has had activity during the Holocene, it is a threat to nearby agricultural villages in the surrounding canyons.

We measured snow and ice extents in 258 Landsat 4, 5, and 7 scenes using the NDSI from 1986 to 2014 in addition to one digitized Landsat 2 scene from 1980. We find that the ice on Coropuna is retreating at 0.41 km²yr⁻¹. This is one third the rate previously published by others (Silverio and Jaquet, 2012; Peduzzi et al, 2010; Racoviteanu et al, 2007).

Previous authors have misclassified snow as ice because they have not paid close attention to the start and end times of the precipitation season. This has led to over estimations of shrinking rates (Fig. 1) and has mislead governmental organizations such as the US AID, IPCC, Peruvian Environmental Ministry, and the Peruvian Meteorological Service in reports on climate adaptation in Southern Peru to determine that the ice cap will no longer be a contributor to water supply by 2025.

The ice cap area has decreased 24.0% from 58.0 km² in 1980 to 44.1 km² in 2014. . Our work shows that care must be taken when selecting satellite imagery for determining the extents of glacierized areas to ensure that snow cover, which can obscure ice boundaries, is at an annual minimum. Precipitation seasons of the high mountains can be slightly different than surrounding lowland areas, leading to confusion regarding the precipitation season. By analyzing only those images just prior to the start of the wet season, determined via analyzing images for snow cover, measurements of glacial ice area are more likely to be accurate. This has significant implications for water planning in

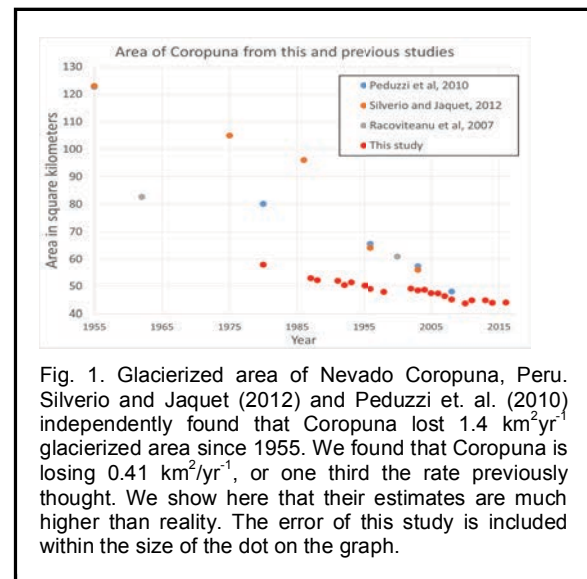


Fig. 1. Glacierized area of Nevado Coropuna, Peru. Silverio and Jaquet (2012) and Peduzzi et. al. (2010) independently found that Coropuna lost 1.4 km²yr⁻¹ glacierized area since 1955. We found that Coropuna is losing 0.41 km²yr⁻¹, or one third the rate previously thought. We show here that their estimates are much higher than reality. The error of this study is included within the size of the dot on the graph.

Peru, which relies on glacial meltwater for domestic, industrial, and agricultural uses in addition to hazard planning in the region from a future volcanic event.

Acknowledgements: We would like to acknowledge Dan and Betty Churchill for supporting our 2015 field season in Peru.

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A 2060-Year Record of Atmospheric Arsenic Deposition from South Pole Ice Core

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Abstract: Using a South Pole ice core covering the last 2060 years we present a high-resolution (~9 samples/year), continuous record of As concentrations from Antarctica. We investigate the natural variability of As and evaluate the anthropogenic contribution.

Arsenic is one of the most toxic elements in the environment and can be found in low concentrations throughout the geosphere. It can enter the environment through both natural processes (mostly from volcanoes and biogenic emission), and anthropogenic activities. Several studies report increases in As concentrations during the late 20th century in soil, water and air worldwide, and in many cases elevated As values are attributed to the human activities. Our record shows a significant increase (by a factor of ~4) in As concentration and As enrichment (by a factor of ~5) since 1970 A.D. (Fig.1). Comparison with previously reported Antarctic As records (Hong et al., 2012, Rong et al., 2016, Schwanck et al., 2016) shows that the recent increase in As concentration is widespread. As enrichment in recent decades has been caused by anthropogenic emissions, in particular, from copper production in Chile and from coal combustion throughout the Southern Hemisphere.

Our records suggest, that human activities affected atmospheric As deposition not only in the 20th century, but in early periods too. We observe several periods of increased As concentrations during the last 2060 years. Our estimation of the natural contribution shows that crustal dust and marine aerosols input is negligible. Volcanic contributions, mostly from Mount Erebus, could be significant. During intervals with increased As concentrations, however, volcanic input explains only ~13% of the total As. The other important natural source for As is marine biogenic emission, however, published studies do not provide sufficient data to allow us to make a quantitative estimation.

We also observed simultaneous increases in Pb, Cu, Zn, Mn and Cd (elements with high EF values), suggesting that human activities were

contaminating the atmosphere long before the 20th century.

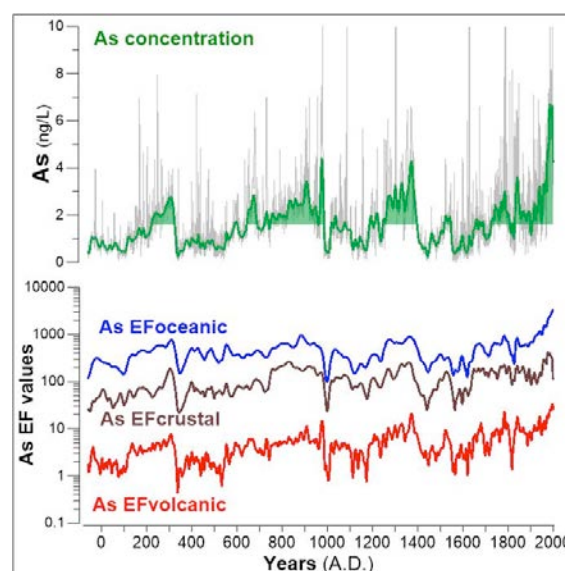


Fig. 1. SPRESSO As concentrations, and crustal, oceanic and volcanic enrichment factors (EF) values for the period from -60 to 2000 A.D.

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A 40,000+ Year Ice Core Record of Southern Hemisphere Climate Variability From the South Pole

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Abstract: The South Pole ice core project is a U.S. effort funded by the National Science Foundation to drill and recover a new ice core from South Pole, Antarctica. The ice core will provide an environmental record spanning approximately 40,000 years that will be used to investigate the magnitude and timing of changes in climate and climate forcing through time.

The ice core was drilled to a target depth of 1500 meters and will provide records of stable isotopes, aerosols, and atmospheric gases spanning approximately 40,000 years. The South Pole site preserves unique climate records by combining cold temperatures typical of East Antarctica with a relatively high accumulation rate due to West Antarctic influence. The South Pole ice core extends the international array of ice cores used to investigate environmental change before, during, and since the last glacial/interglacial transition. The scientific goal is to assess and understand changes in atmospheric chemistry, climate, and biogeochemistry. Drilling was planned for the 2014-2015 and 2015-2016 field seasons, and a new intermediate-depth drill was used to recover the ice core, developed and built by the Ice Drilling Design and Operations (IDDO) group at the University of Wisconsin Madison.

Drilling was completed in the 2014-2015 (~700 m / through the Holocene) and 2015-2016 (to 1751 m / ~50,000 years) field seasons. The upper 500 m was processed at the National Ice Core Laboratory in summer 2015, and samples are currently being analyzed at our collaborative facilities. The UMaine portion of our group is responsible for measuring the physical (concentration and size distribution) and chemical (trace element concentration) composition of dust. In particular, we are focusing on the bioavailable fraction of several

key elements, in an attempt to quantify the impact of dust fertilization on Southern Ocean productivity.

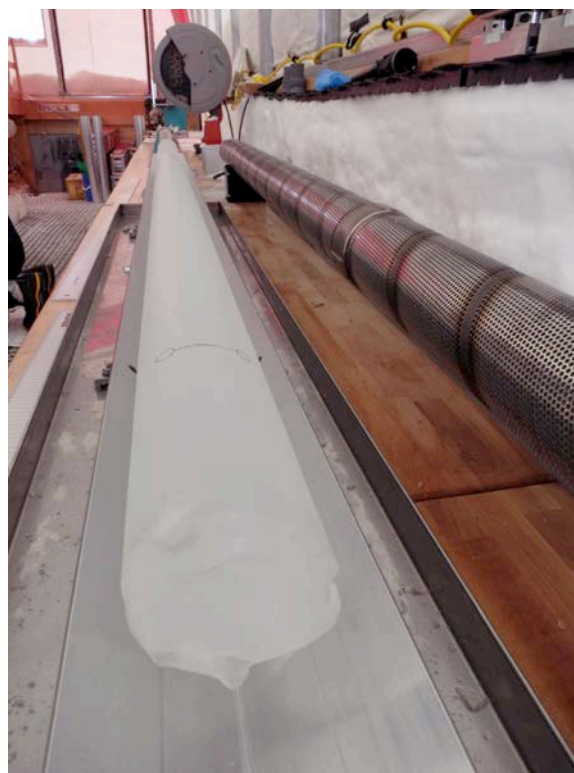


Fig. 1. Newly drilled South Pole ice core, 2016 (Murat Aydin).

Acknowledgements: Funding for the project is provided by NSF PLR-144397.

The Impact of Climate Change on Harmful Algal Blooms and Algal Toxin Effects on the Development of Neurodegenerative Disorders

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Abstract: Rapidly increasing global temperatures will likely lead to an abrupt increase in fresh water harmful algal blooms (HAB) and their associated toxins. Chronic exposure to one HAB toxin, BMAA, has been associated with the development of sporadic Amyotrophic Lateral sclerosis (ALS). Using zebrafish to study the effects of environmentally relevant concentrations of BMAA in public freshwater bodies in New England will improve our understanding of how increased exposure to the toxin could affect people's health, and may provide an avenue for the development of novel treatments for ALS. Results of this project will be disseminated to policymakers and the general public.

The goal of this project is to study the effects of environmentally relevant concentrations of fresh water HAB toxins on zebrafish neuromuscular fitness, a model system for Amyotrophic Lateral Sclerosis. Increasing surface temperatures (**Figure 1**) will likely lead to an increase in water temperatures globally, including in New England's fresh water sources. Furthermore, increasing water temperatures may increase the prevalence of HABs and their associated toxins. Chronic exposure to one toxin, BMAA, has been associated with an increased prevalence of ALS (Banack et al. 2015; Holtcamp, 2012). Studying how abrupt climate change will affect the concentrations of BMAA in New England lakes will improve our understanding of how increased chronic exposure may affect people exposed to the toxin through local drinking water sources.

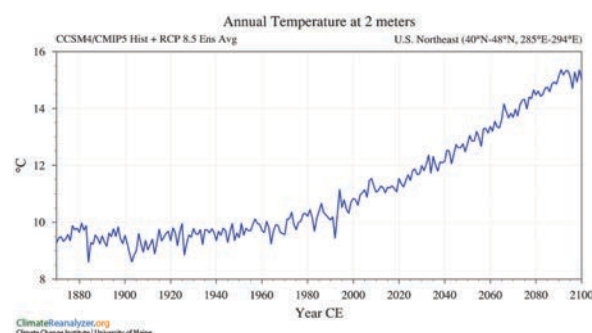


Figure 1. 2-meter surface temperature profile for New England states (U.S. Northeast) from 1880-2100 using the CCSM4 Historical + RCP 8.5 dataset. Temperatures are predicted to rapidly increase in New England states over the next several decades.

Zebrafish will be used to study ALS. Studying the effects of BMAA on zebrafish neuromuscular fitness may lead to novel drug therapies to prevent or reduce the symptoms associated with environmentally-induced ALS.

With the assistance of Maine's DEP and CDC, the results of the project will be distributed to local communities via seminars, posters, pamphlets, news articles, or a website to inform the general public about the potential health effects of BMAA in their local drinking water supplies. The project results will also enable policy makers to develop or modify policies to improve or reduce the prevalence of BMAA in local drinking water sources.

Acknowledgements: This research was supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423.

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Cryptotephra in Maine

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Abstract: Recently, almost a dozen very fine-grained volcanic ash (cryptotephra) layers were found in the peatlands of Maine, Nova Scotia and Newfoundland (Pyne-O'Donnell et al. 2012; Jensen et al. 2014; Mackay et al. 2016) contributing to the emerging North American tephrochronological framework. Tephra-based isochrones help to reconstruct past carbon accumulation rates required for realistic parameterization of carbon cycling in existing and future computer models.

Background: Traditionally, tephrochronology has been a major tool for paleoclimate work, but was only useful in areas within a few hundred kilometers of the volcanic source. However, in recent years, cryptotephra layers have emerged as important, widespread, time-stratigraphic markers (isochrones). The microscopic volcanic glass particles found in Maine peat cores (see Fig. 1) may be geochemically fingerprinted and have already been tied to several known Holocene eruptions from the US West coast, Alaska, Kamchatka and Japan.



Fig. 1. Sites with cryptotephra layers are shown in red.

The chronology of these cryptotephra layers offers a unique opportunity to study regional postglacial landscape evolution, interaction of land–sea systems, and determination of precise rates of carbon removal from the atmosphere.

We propose to improve the quantification of carbon accumulation rates in peat bogs in the eastern US and Canada using expertise and methodologies already developed by our collaborators from University of Southampton,

Aberystwyth University, and Queen's University Belfast, Swansea University.

The new data will help to establish a baseline for past and present regional climate variability in Maine required for improving modeling of future climate and, most importantly, for realistic parameterization of carbon cycling in existing and future computer models.

We will update the status of this project and discuss future research plans.

Acknowledgements: Method development was partially supported by NSF grants PLR-1142007 and 1142069. S.A. Norton assisted with the Caribou Bog site.

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Diagnostics, Trends and Climate Model Projections of U.S. Summer Heat Waves

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Abstract: Heat waves can have myriad impacts ranging from adverse effects on human health, to increases in energy and water demand, to crop stress. This new project will undertake a comprehensive study of U.S. summer heat waves, including their regional frequency and persistence characteristics, linkages to the large-scale atmospheric circulation and regional associations with land-atmosphere coupling. Heat wave definitions that include atmospheric moisture will also be considered. Station observations, various atmospheric reanalysis products and output from coupled climate model simulations and projections will be utilized in the analysis.

Project Goals

The overall goal of the study is to enhance our current understanding of U.S. summer heat waves, investigate the ability of climate models to capture the observed characteristics and examine how such characteristics will change in the future. Diagnostic analyses will include linkages to the large-scale circulation (Figure 1), heat budgets and comparison of behavior between observations and climate models.

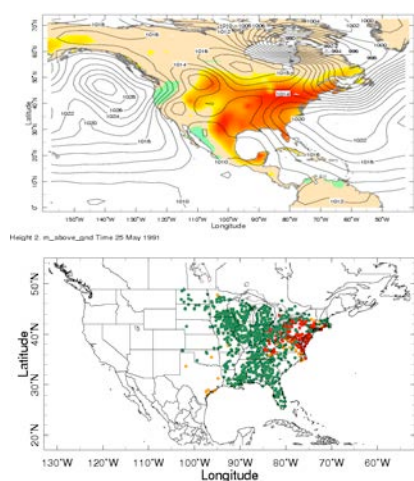


Fig. 1. (Top) Sea level pressure and specific humidity anomaly patterns during the heat wave of May 1991 (a “humid” heat wave). (Bot.) Red dots indicate heat wave conditions in maximum temperature, green in minimum temperature, and orange in mean temperature. Maps are for a single day in the middle of the heat wave (May 21, 1991).

The work will involve extensive use of observational data, reanalysis products and coupled climate model output. Regional variations in heat wave behavior are of particular interest as is the role of land surface condition in

enhancing the likelihood of heat waves (Figure 2). Changes in the land surface condition (e.g. soil moisture) alters the surface energy balance and thus surface air temperature.

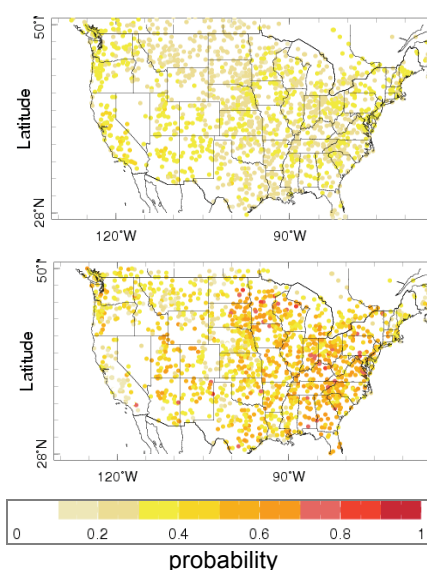


Fig. 2. (Top). The unconditional probability of a heat wave occurring during June-August (1971-2000). (Bot.) The conditional probability given antecedent drought conditions during the same summer months.

The contribution of other dynamical and thermodynamical processes to extreme daily temperatures will be quantified via heat budget analyses. Source regions of atmospheric moisture for heat waves with high specific humidity will be evaluated as a function of region and heat wave persistence characteristics.

Acknowledgements: Funding for this project is provided by a grant from the National Oceanic and Atmospheric Administration, grant number NA140AR4310204.

Deciphering the Mechanisms Behind Climate-driven Changes in the Relative Abundances of the Diatom *Cyclotella*

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Abstract: Many paleolimnological studies have reported increases in the relative abundance of *Cyclotella* across many lakes in the Northern Hemisphere. However, the actual mechanisms responsible for these changes are still not evident. The primary goal of this study is to decipher those mechanisms behind the climate-driven changes in the relative abundance of *Cyclotella*.

Cyclotella, is a small size planktonic diatom. Diatoms are photosynthetic algae, that have a siliceous cell wall and are found in almost every aquatic environment. Several paleolimnological studies across the Northern Hemisphere have reported a sudden increase in the relative abundance of *Cyclotella*, which is thought to be a key indicator of warming across lakes in arctic, alpine, and boreal regions^{2,3,4}. However, this change is not uniform across all regions, as some studies have reported decrease in abundances in the same regions over similar time frames¹. The potential mechanisms for this expansion have been associated with direct climate impacts through temperature² or indirect climate impacts through interactive effects of water column stability, i.e. mixing depth (light), and nutrients³.

The primary objective of this project is to investigate the interactive effects of temperature, light and nutrients on *Cyclotella* abundances and growth rates. To do so, we conducted (2x2x2) factorial design experiments in-lakes with 2 different levels of temperature, high (11-13°C) and low (7-8°C); along with 2 different levels of light, high (60% of ambient PAR) and low (25% of ambient PAR); and two levels of nutrients, with nutrients (Nitrogen 8 µM and Phosphorus 1 µM) and without nutrients. The secondary objective is to determine how the structure of phytoplankton communities alters the response of *Cyclotella stelligera* to abiotic factors. Since it was a common species in both lakes, we analysed the response of *Cyclotella stelligera*, one with phytoplankton assemblages dominated by diatoms, and one dominated by other phyla in the same set of experiments. We found variability in the responses of *Cyclotella* taxa to interactive effects of temperature, light and nutrients. Each species responded differently to tested variables. In high temperature treatments with high light and nutrients addition, *Cyclotella*

stelligera cell densities increased in a diatom-dominated lake and decreased in a phytoplankton dominated lake. This study will provide more ecological information for key species to improve our ability to assess variable changes across these systems.

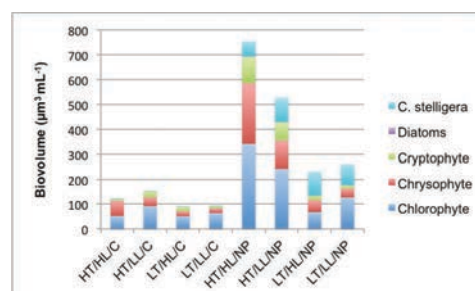


Fig1. Biovolume of *Cyclotella stelligera* in a phytoplankton-dominated lake, under high temperature (HT), low temperature (LT), high light (HL), low light (LL), nutrients (N) and control (C).

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Project BISON: Bison Industry & Science Observation Network – A New Stakeholder Citizen Science Collaboration

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Abstract: Climate change is likely to threaten agricultural sustainability, but the impacts of increased temperatures on large livestock operations, such as bison, remains unknown. The fossil record suggests bison decrease in size during warmer climates, but modeling the relationship between climate change and morphology requires contemporary calibrations across geographic regions. The citizen science initiative, Project BISON, will fill this critical knowledge gap while building partnerships with ranchers to transition to adapt to climate change.

Background: Food security, especially grazing livestock, is reliant upon a predictable climate for sustainable production¹. Bison have adapted to climate changes in the fossil record by changing their body size; as temperatures increase, bison shrink². Diminishing body size reduces meat production. To assess similar contemporary morphological changes, cooperation with bison ranchers is essential. However, this requires robust comparative fossil and modern bison calcaneal datasets for morphological analysis; currently 1197 fossil and 30 modern are curated.

To solve this critical knowledge gap, we created a new initiative: Project BISON (www.projectbison.net), which leverage bison ranchers as citizen scientists. Ranchers provide a hock (see Fig. 1) from each bison upon its death (either natural or culled).



Fig. 1. Hock location on bison; left, bison with 'clothes on' and, right, bison with 'clothes off.'

The hock contains the calcaneum, a bone that indicates body size because it is weight bearing, additionally, preserves well in the fossil record. We will also collect environmental data that influence body size, to better isolate the importance of climate: weight, age, sex, weaning date, a broadside photograph of animal prior to harvest, hanging weight, diet, and geographic location. We will also survey ranchers to learn about operation factors, e.g. - quantity of breeder animals and average age, frequency of

trade, and regional bison association participation. Once samples are received, we will macerate each hock to isolate the bones. These will be regressed against the geographic data collected in our surveys to isolate the variables influencing body size, and to identify geospatial patterns.

Ultimately, Project BISON results will be used to isolate the variables that most strongly affect body size, i.e., temperature, precipitation, diet strategy, and herd dynamics management. A long-term goal of this project is to develop regional climate-scenario adaptive management strategies, as well as capacity building with stakeholders. Results will be disseminated directly with the community.

Initial Results: Nine ranches have enrolled and filled out the initial survey from CO, ID, MN, OR, UT, WI, and WY representing small and large ranches (herd pop.: 13-3500; acreage: 10-28000). We are awaiting shipments of hocks from ranchers (autumn harvest is typically) and enrolling additional ranchers to the project.

Acknowledgements: Rachel Martin, Gloria Lima, Chason Frost, Trevor Lessard. NSF IGERT program grant DGE-1144423, Western Bison Association, Larry D. Agenbroad Legacy Fund, and Throlson American Bison Foundation.

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Developing a Methodology for Characterizing Pollutant Flow Through a Glaciated Ecosystem

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Abstract: Pollutants released by industrialized nations between 1960 and 2004 have been transported northward through atmospheric processes and deposited into glaciated alpine ecosystems. Many of these chemicals retain their original structure and are absorbed into the biota thousands of miles away from where they were originally utilized. With a warming climate increasing the melt of alpine glaciers, these glaciers may be introducing growing amounts of toxins into the watershed. While studies have demonstrated the existence of resident pollutants within glaciated ecosystems, no one has used standard toxicological testing methods to assess the risk posed by these compounds when released in glacial outflows. The goal of this study is to develop a framework to assess the conditions under which glacial release of persistent organic pollutants are a risk to the health of downstream communities.

Field work in the Eastern Alaskan Tanana Mountains (figure 1) led by Dr. Chris Gerbi and Dr. Seth Campbell is currently looking at the rheology and morphology of Jarvis Glacier. This glacier is located southeast of Fairbanks, and is the top of the watershed for over 200,000 local residents. While taking ground penetrating radar measurements in order to gain an understanding of the structure of the glacier, we will also be taking samples to understand the potential release of pollutants as Jarvis Glacier continues to lose mass.

Methodology developed by the Environmental Protection Agency to measure legacy pollutants and industrial pesticides in urban watersheds can be adapted to sample snow, ice and glacial meltwater. Sampling these three phases will allow researchers to develop a baseline understanding of pollutant flow through the glaciated watershed. Methodology for testing recent snowfall utilizes permeable membrane filtration technology created for testing urban drinking water, although quantities tested are exponentially greater than in an urban setting. The second phase of sampling to determine concentration of pollutants in summer melt utilizes lipid-coated filtration technology that samples large quantities of streamflow through passive sampling. The final phase will incorporate ice core sampling to gain an understanding of pollutants in glacial firn and ice. Pollutants in glaciers are found in trace amounts, and sampling must subsequently

represent large quantities of water, filtered to separate the hydrophobic pollutants from the meltwater. The Jarvis Glacier sampling of recently deposited snowpack, legacy glacial firn and ice and meltwater will allow the research team to create a profile of the movement of pollutants through the glacial system, and into the ecosystem below.

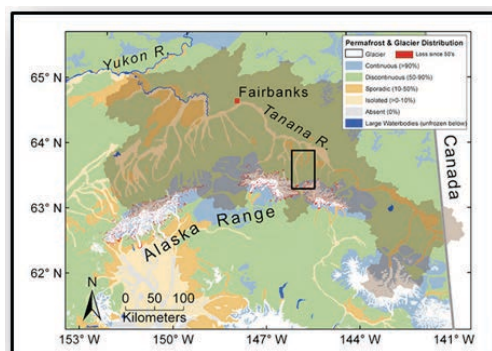


Figure 1. Map of Jarvis glacier sampling site. UAF WERC Group

Acknowledgements: Gratitude for the support of Dr. Karl Kreutz, Dr. Chris Gerbi, Dr. Brian Perkins, Dr. Jules Blais, Dr. Aaron Putnam, Dr. Shaleen Jain and Dr. Sean Birkel. Thank you also to Dr. Carol Kim and Scott Delcourt for their ongoing support. Support provided by the NSF Adaptation Abrupt Climate Change IGERT program grant DGE- 1144423 and NSF award PLR-1503924.

New Technique to Monitor Airborne Pollen using Rainwater Particulate Filters

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Abstract: The National Atmospheric Deposition Program filters particulates, including airborne pollen, from precipitation samples collected at 265 sites in the U.S. and Canada. Recovery and identification of pollen from the filters will expand the current limited scope of airborne pollen monitoring to enhance allergy and asthma treatment, define floristic zones, and document phenology response to climate change and increasing CO₂ levels.

Project Goals

This project seeks to expand areal monitoring of airborne pollen from the current 30 monitoring sites in Canada and ~24 National Allergy Bureau monitoring sites in the United States. Identifying the timing of release of tree and herb pollen is critical for effective treatment of pollen-induced allergies and asthma. Establishing bloom time response to climate shifts and increasing atmospheric CO₂ will further enhance proactive asthma treatment, better define floristic zones, and aid in forecasting effects of climate change.

Traditional rotor rod capture of airborne pollen provides real-time monitoring for both quantitative (pollen/m³ air) and qualitative reporting. However, the equipment is expensive to install and requires ongoing supplies and personnel time. Monitoring sites are limited to ~24 urban locations and reporting format is inconsistent among sites.



Figure 1. Active NADP stations. NADP, 2015. NADP 2014 Annual Summary. NADP Data Report 2015-01. Illinois State Water Survey, University of Illinois at Urbana-Champaign, IL.

The National Atmospheric Deposition Program (NADP) monitors precipitation chemistry at 265 sites throughout Canada and the U.S. with nine collections sites in Maine. Precipitation is collected weekly, with samples sent to the NADP laboratory in Illinois where particulates

are filtered out with a 0.45µm polyethersulfone membrane filter, and the water is analyzed for inorganic solutes. For this project, instead of discarding the filters, NADP sent a set of filters to CCI for exploratory pollen analysis.

Research Component

Before we can identify the pollen, we must separate the cells from the filter. Two methods proved effective: 1) wash the cells from the filter using 5% KOH under pressure with a vacuum filter holder; 2) dissolve the filters in n-methyl-2-pyrrolidone (NMP). Once the cells are free of the filter, they can be cleared with acetolysis for definitive identification, excess water removed with alcohol, put into deionized water for FlowCam analysis, and stored in silicon oil for traditional pollen examination.

Initial Results

Here we report the first results from methods development and comparison of the two extraction techniques. Rinsing the cells under pressure recovered 89% of the pollen cells. Dissolving the filters in NMP recovered 100% of the captured pollen cells. The latter procedure is time consuming and uses expensive and hazardous chemicals. While we cannot quantify pollen from the filters with this method, we can identify bloom times, establish dominant pollen type, and improve taxonomy over traditional methods. If successful, this approach could inform evidence-based climate adaption drawn from synergy among environmental monitoring programs.

Acknowledgements: We thank the Council of State and Territorial Epidemiologists and Centers for Disease Control for endorsing this project.

A Pleistocene Disturbance Event Drives Modern Diversity Patterns in Coastal Marsh Birds

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Abstract: We test for the ability of ecosystem disturbance events occurring over multiple time scales (from decadal to millennial) to predict the modern bird community in the tidal marshes of the Northeastern US. The strongest predictor was the timing of deglaciation and marsh formation. Older marshes are dominated by specialist taxa that likely prevent colonization by generalists, while more recently deglaciated landscapes (further from glacial refugial populations) are dominated by generalist colonist taxa. Diversity peaks at marshes of intermediate age.

Paleo-drivers of bird community structure:

There is growing evidence that paleo-timescale events are important determinants in the present-day distribution of organisms. Long-term climate patterns are known to drive both ecological and evolutionary mechanisms operating over millennia and to create patterns persisting into the modern era. We measured both specialization and species diversity in tidal-marsh bird communities to explore the relationship between these indices and several potential drivers of biodiversity across several orders of timescale magnitude. These drivers included 1) a recent, intense hurricane event driving a large-scale perturbation of this ecosystem (2 ya), 2) gradual modification of marshes through installation of human infrastructure (~200 ya), and 3) marsh formation and development after the Last Glacial Maximum (LGM, ~20,000 ya).

We found that both habitat specialization and species diversity patterns were best explained by regional patterns of marsh establishment following the retreat of the Laurentide ice sheet. We hypothesize that the formation of marsh millennia earlier in the southern part of our survey area allowed for either the persistence of or the earlier evolution of marsh specialization by bird species than those occupying much younger, northern marshes. This is the first demonstration of vertebrate functional diversity patterns driven by paleo-climate events at this large of a spatial scale, and it highlights the potential importance of historical contingency for shaping biodiversity.

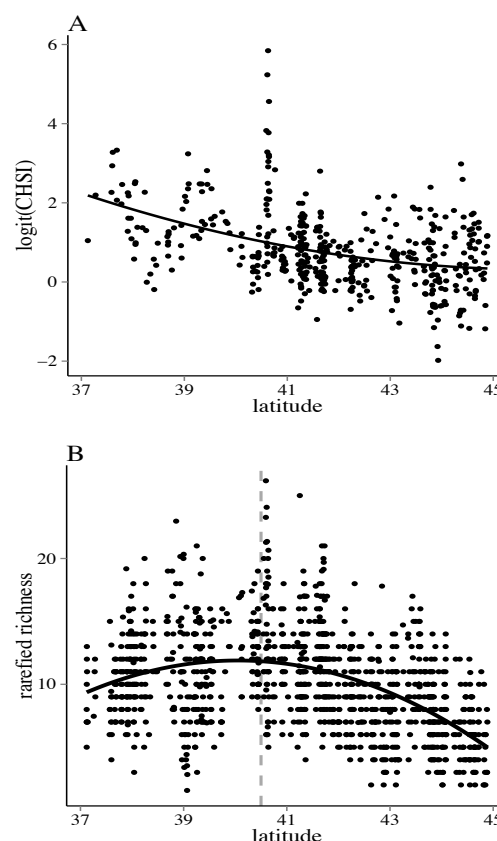


Fig. 1. The relationship between either (A) the mean of a Community Habitat Specialization Index (CHSI) or (B) species richness and latitude. Diversity peaks at the LGM (dashed line), while specialization peaks in the oldest marshes.

Acknowledgements: Primary funding through the National Science Foundation (DGE-1144423 & DEB-1340008) and the US Fish and Wildlife Service (P11AT00245, 50154-0-G004A, U2-5-R-1).

Cathedral Glacier: A Shrinking Cirque Glacier in Northern British Columbia

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Abstract: The Cathedral Glacier located in northern British Columbia, Canada is a small cirque glacier at the eastern edge of the Juneau Icefield. Small glaciers make up roughly 10% of the glacial mass in the world playing an important role in sea level rise. Small glaciers also respond faster to changes in climate due to their small thermal mass and higher surface area to volume ratio. The Cathedral Glacier has been retreating since about 1920 and from when the first map was made in 1977 to today has lost roughly half its volume.

Project Goals:

The goal of this project was to quantify the mass loss of the Cathedral Glacier using a photogrammetric map made in 1977 to a 3D model made in 2015 using Structure from Motion. The ice loss will also be compared with the changes in temperature and precipitation in the area over the same time period.

The archive photographs show intermediate terminus locations.

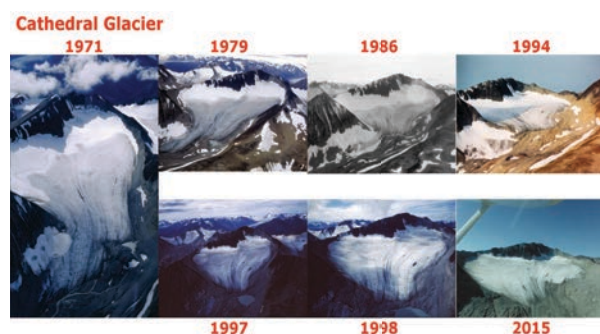


Fig. 1. Time series of the Cathedral Glacier 1971-2015

Initial Results: Using the average temperature and precipitation from period 1921-1950, the period from 1970 to 2015 was detrended to show anomalies from the 1921-1950 normal. (Fig. 2 & 3). The five year moving average temperature was hotter through almost the entire period than the normal; the five year moving average precipitation was lower for almost the entire period.

Being in a continental climate that has low precipitation to begin with these two changes in

climate result in the Cathedral glacier and nearby glaciers disappearing.

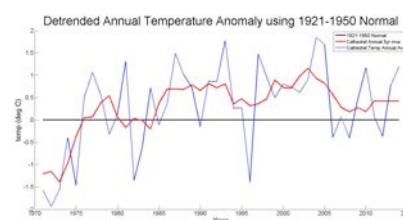


Fig 2. Annual Temperature Anomalies 1970-2015

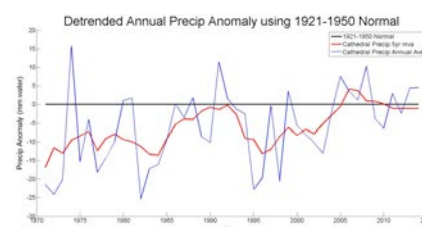


Fig 2. Annual Precipitation Anomalies 1970-2015

Acknowledgements: Travel funding provided by the Dan and Betty Churchill Exploration Fund. Logistics support from the Juneau Icefield Research Program. Photos of the glacier from Dr. Keith Mountain, Steve Wilson and the Dr. Maynard M. Miller photography archive.

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Kilimanjaro Northern Ice Field 2015 - Preliminary Results

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Abstract: Analysis of ice collected from the Northern Kilimanjaro Glacier ice cliff in 2015 indicates that the climate record is still preserved.

Ice core paleoclimate studies focus primarily on the Polar Regions. In recent decades, more ice cores have been recovered from high mountain glaciers around the globe. Despite the recent collection effort, a large spatial data gap remains between the mid latitudes and the tropics. To help fill the gap, ice from Kilimanjaro Glacier Northern Ice Field ice cliff (>5700 m, 3°3'S, 37°20'E) was collected in September 2015. Kilimanjaro's summit ice fields are rapidly disappearing, taking with them unique paleo-environmental information stored in the ice, information that can still be retrieved by drilling ice cores.

Mt Kilimanjaro is located in a zone of seasonal dry tropical climate (Müller, 1983). The distribution of precipitation over the year follows the intertropical convergence zone. Rainfall and temperature vary with altitude and exposure to the dominant wind from the Indian Ocean. Two distinct rainy seasons occur on Kilimanjaro, one from March to May and another from October to November. The driest period is from August to October (Mölg et al., 2006).

The Northern Ice Field is classified as a plateau glacier system. Kilimanjaro Glacier surface ice temperature is close to 0°C, this suggests that surface melting is common. Field observations during drilling reveal melt features on the glacier surface and water in the borehole. So far, the ice cores drilled on Kilimanjaro have been interpreted as quasi-continuous Holocene climate records, going back about 11,700 years within about 50 meters of ice thickness (Thompson et al. 2002). Clearly this requires a large number of very thin annual layers.

Preliminary glaciochemical laser (Fig. 1) and isotopic analyses of the basal cliff ice indicate that the climate record is still preserved. Mean

annual layer thickness in the basal ice is about 1 cm based on visual stratigraphy. Standard ice core continuous melting procedures could not have detected such thin annual layers. Kilimanjaro ice core record may reveal past atmospheric circulation patterns over this part of the tropical African continent.

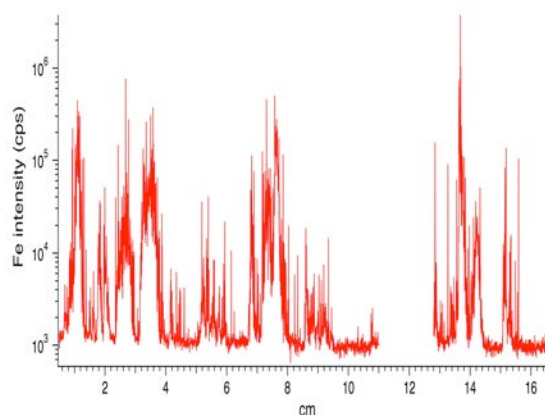


Fig 1. Laser ablated ICP-MS Fe data (the break in the record is associated with a break in the ice sample).

Acknowledgements: The National Geographic Society's Global Exploration Fund - Northern Europe.

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Unraveling the Impacts of Temperature, Flow, Prey Availability, and Competition on Juvenile Atlantic Salmon (*Salmo salar*) Performance in a Rapidly Changing Climate

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Abstract: Atlantic salmon face multiple threats stemming from climate change and invasive species. Extreme precipitation events (flooding /droughts) and heat waves are expected to occur more frequently and with stronger magnitudes in the future than is currently experienced. We are investigating how Atlantic salmon performance is modified by competition with invasive smallmouth bass and native brook trout under different temperature, flow, and prey regimes. We anticipate that our research will better inform management solutions by helping managers identify and prioritize critical salmon nursery habitat for stocking, dam removal or culvert replacement in light of climate changes that may occur rapidly in the state of Maine.

Research Goals

Extreme precipitation events and heat waves are expected to occur more frequently in the future¹ and could impact the recovery of Atlantic salmon (*Salmo salar*) in Maine streams, alter competition with native brook trout (*Salvelinus fontinalis*), and facilitate range expansion of non-native warm-water competitors, such as smallmouth bass (*Micropterus dolomieu*). However, little is known about the impacts of smallmouth bass competition on salmon performance despite the fact that invasive smallmouth bass have a history of prolific range expansion in Maine.

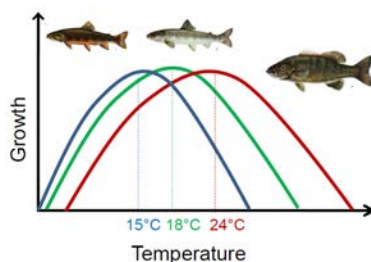


Figure 1. Approximated growth curves for brook trout, Atlantic salmon, and smallmouth bass along a gradient of stream temperature. Optimal temperatures for growth are identified.

¹ IPCC. 2014. Climate change 2014: synthesis report. Contribution of working groups I, II, and III to the fifth assessment report of the intergovernmental panel on climate change {core writing team, R.K. Pachauri and L.A. Meyer (eds)}. IPCC, Geneva, Switzerland, 151 pp.

We will be using a combination of bioenergetic modeling based on growth (Figure 1) and empirical data to accomplish the following four objectives: 1.Determine how salmon performance (foraging behavior and energetics) is influenced by competition with native brook trout and invasive smallmouth bass along gradients of temperature, flow, and prey availability; 2.Use microhabitat-based foraging and bioenergetics models to predict and explain variation in growth due to competition along environmental gradients; 3.Test these model predictions with experiments in stream mesocosms that simulate realistic conditions of habitat complexity and prey diversity at low and high flow conditions; 4.Field-test predictions of habitat suitability by assessing performance of stocked salmon fry among streams that vary in temperature, hydrology, geomorphology, prey availability, and competitors.

We anticipate that our research will help better inform adaptive management solutions for managers who seek to anticipate impacts of climate change on juvenile salmon production.

Acknowledgements: This research was supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423 and Maine Sea Grant.

The P301 Web API

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Abstract: The P301 Web API is a RESTful interface that allows P301 users to share data that have been uploaded to the P301 system. The system supports accessing data in JavaScript Object Notation (JSON) and Extensible Markup Language (XML) formats, which helps to facilitate the development of Web-based applications. A variety of queries for accessing the data in the system allows for flexibility in client system designs.

P301 Web API Design

The P301 Web API allows users to access P301 data in JSON or XML formats. The system provides current P301 users a straightforward mechanism to expose their data to the public. Any data that has been loaded in the P301 system can be shared through the public P301 Web API by marking it in the system as publicly viewable. The API has been designed using a RESTful approach that has two immediate outcomes: data is accessible for public investigation; and the interface allows developers flexibility in creating applications for the data sets.

The API is written in Java, which allows the P301 Web API to make use of a variety of functions previously written for the core P301 system. The Postgres database is shared by the two systems so that query results and Java objects can be used by both code bases.

The JSON and XML responses generated by the P301 Web API are created when a query to the API is made. As shown in Fig. 1 to the right, the queries are first processed and checked for correctness. If everything passes muster, then a Postgres database query is performed. The results of the query are converted to Java objects. The Java objects are then converted into JSON or XML and sent back to the Web client.

Querying Data

In order to better understand how interaction with the P301 Web API works, consider a few example queries.

First, “What are the available data sets provided by the system?” This can be achieved by sending a formatted string to the P301 Web API

that indicates data sets have been requested. The type of the result data list (JSON/XML) is specified in the request's header.

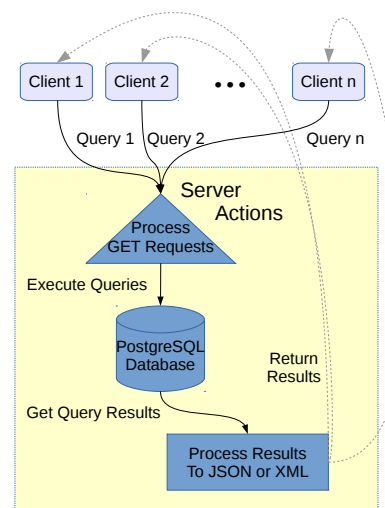


Fig. 1. P301 Web API query processing. Multiple clients can access P301 data through a common interface. Database queries and JSON processing happens on the server and is shown in the yellow area.

Second, “How can I get more information about a data set?” This is answered by appending the desired data set name to the query string sent to the server, which allows the client to select either meta data or actual data in the results.

Specifying a number of optional attributes can be used to further filter the query results. These features help to facilitate development of Web-based applications for the climate-related data stored in the P301 system.

This work was supported in part by the U.S. National Science Foundation grant EAR-1027960.

Quantifying the Role of Lakes in the Arctic Carbon Cycle

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Abstract: Rapid, recent changes in the concentrations of dissolved organic carbon (DOC) concentrations in lakes of southwest Greenland raise questions about broader changes in carbon cycling in the Arctic. We are beginning to quantify carbon (C) pools and fluxes in a suite of lakes spanning from the Greenland Ice Sheet to the coast to better quantify carbon dynamics in this area.

The important role of lakes in regional C cycles at lower latitudes has been increasingly recognized recently, with synthesis papers focusing on “active pipe” models that incorporate lakes as reactors for organic carbon (Cole et al. 2007; Tranvik et al. 2009). These syntheses have revealed several important points: 1) terrestrial ecosystems deliver approximately twice as much C to inland aquatic systems as to the ocean; 2) net C fluxes tend to be greater per unit area in freshwater systems compared to the surrounding terrestrial area; 3) freshwater systems affect regional C balances and need to be included in terrestrial C budgets. Broadly, lakes are sites of intense organic C mineralization and hence CO₂ emission but can also sequester large amounts of C in their sediments (Cole et al. 2007), with a three-fold higher burial of organic C than oceans. This underscores the need for a more comprehensive understanding of C dynamics in arctic lake ecosystems to improve regional C budgets.

While it is expected that C dynamics are likely changing in lakes across the Arctic, southwest Greenland is one of the few locations where lakewater DOC concentrations and their changes over time have been measured (Saros et al. 2015), with substantial declines occurring sometime between 2003 and 2013 (Fig. 1). We infer that these changes in lakewater DOC are signaling broader changes in the C cycle of the area, as it does at lower latitudes.

We are currently conducting additional measures of C pools and fluxes across a suite of lakes in southwest Greenland spanning from the ice sheet to the coast. These lakes have low C burial efficiencies; we are focusing on water column measurements of CO₂ as well as dissolved and particulate C.

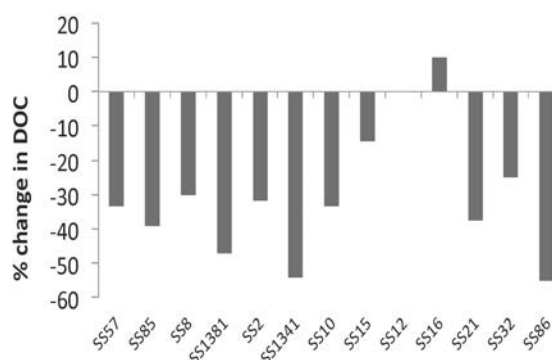


Fig. 1. Percent change in DOC concentrations in a sub-set of lakes in southwest Greenland between 2003 to 2013 (Saros et al. 2015), showing that DOC declined substantially in most lakes.

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Inferring Greenland Fjord and Coastal Bathymetry Using Icebergs

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Abstract: The transport of heat in warm Atlantic Waters exerts an important control on the mass loss of Greenland's marine terminating outlet glaciers. Fjord bathymetry places an important constraint on the ability of this heat to reach glacier termini, yet the bathymetry of most of Greenland's fjords is not well resolved. Here methodology is developed to infer fjord bathymetry using icebergs as observed in remotely sensed datasets. Preliminary results in regions with bathymetric measurements validate the method.

The response of the Greenland ice sheet (GIS) to climate changes has become increasingly pronounced over the past two decades. These changes are extremely evident along the margins of the ice sheet, where outlet glaciers channel ice from the ice sheet interior and often terminate in marine environments. Here, heat transported in relatively warm, salty, dense Atlantic Waters circulating off the coast of Greenland (e.g. Straneo *et al.* 2010) comes into contact with the marine terminating outlet glaciers and exerts an important control on their mass loss.

One of the controlling factors determining whether or not these warm Atlantic Waters penetrate into the fjords is the fjord bathymetry; the presence of a shallow bathymetric sill acts as a barrier and can prevent these warm waters from entering the fjord (Holland *et al.* 2008). Yet the bathymetry of most of Greenland's fjords is not resolved in sufficient detail to indicate the presence or absence of a sill, limiting our ability to predict dynamic ice responses to an increased flux of heat from the ocean.

Here we develop a methodology to infer fjord bathymetry using icebergs observed in remotely sensed datasets. First, we identify regions where icebergs become lodged as they flow out of the fjord (iceberg stranding). Then, we extract the stranded iceberg freeboards (height of the iceberg above the water surface) from digital elevation models (DEMs). From the freeboard we estimate the iceberg draft (depth of the iceberg below the water's surface) and hence the maximum water depth. Preliminary results in regions where bathymetric measurements are available validate the method and encourage its application in uncharted fjords.

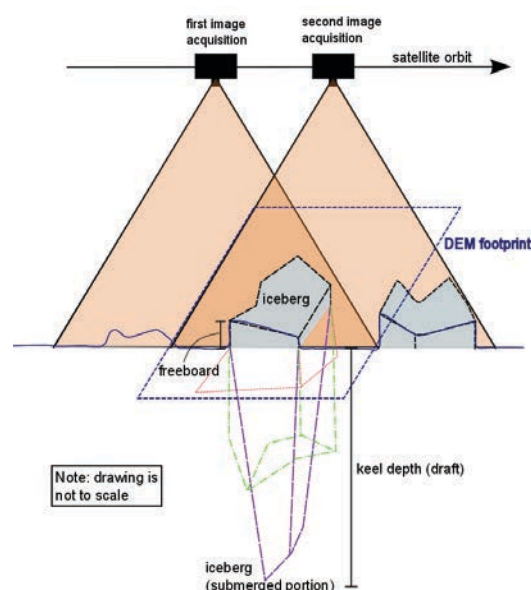


Figure 1: A conceptual model illustrating how iceberg keel depth (draft) is approximated. Shown here is the keel depth for the hypothetical submerged iceberg profile outlined in purple.

Acknowledgements: This work is supported by a NASA NESSF dissertation fellowship (grant NNX15AP08H) and by the US NSF A2C2 IGERT program (grant DGE-1144423).

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Do United States Protected Areas Conserve Nature's Environmental Stage?

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Abstract: Diversity within the physical environment, such as climatic, geologic, and topographic heterogeneity, provides the vital stage for biodiversity and ecological processes. Despite this, our protected areas are often designed to protect focal endangered species or communities, and not diverse physical environments. I propose to analyze how well United States' protected areas reserves capture the available environmental diversity. This information could highlight physical environments which are under-protected, and foster more climate change resilient reserves.

Protecting biodiversity in the face of climate change requires us to anticipate that species ranges will move, and recognize that establishing protected areas around current locations of may be insufficient for protecting future biodiversity. Thus, some have argued for protecting unique and heterogeneous physical environments as a 'coarse filter' strategy (Hunter et al. 1988) which could more effectively conserve a large number of species, in contrast with a 'fine filter' approach designed around individual species in decline. A coarse filter reserve design would aim to protect climates, soils, geomorphology, and topography, with the expectation that diverse physical environments will remain species-rich in a range of climatic conditions. This perspective has been termed 'conserving nature's stage' (Anderson et al. 2010, Gill et al. 2015), and recently been a focus for a special issue in the journal *Conservation Biology* (2015).

There is mounting evidence that regions with high climate, geologic, and edaphic heterogeneity harbor increased biodiversity (Anderson et al. 2010). Yet, despite the growing recognition that physical diversity is important for conserving biodiversity, we do not know how well our current protected areas capture this abiotic diversity. This is critical because protected areas are one of conservation's most relied upon tools in preventing biodiversity loss, and United States protected areas have been criticized for over-emphasizing biological diversity relative to abiotic diversity (Brilhá 2002).

Using the USGS protected areas database (Schruben et al. 1994), I propose to assess how well United States Protected Areas capture the

available environmental diversity. Environmental variables analyzed will include climate, geologic bedrock, and topography. I will also test whether protected areas with more physical diversity contain more species. This will assess how well our current reserves function as a coarse filter strategy, and could highlight aspects of the physical environment which are under-represented in our parks.

Acknowledgements: I would like to thank Jacquelyn Gill, CCI and SBE for supporting this research, and USGS for making the data necessary for this study available.

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The Nevin Shellheap: Deconstructing a Red Paint Cemetery

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Abstract: The Nevin Shellheap is located in Blue Hill Bay, Maine. It contains one of the most significant cemeteries of the Moorehead Burial Tradition. Preservation of human remains and the associated elaborate funerary artifacts and ecofacts within the shell midden has made this site unique from other Archaic period cemetery sites in the Gulf of Maine despite the destructive effects of erosion due to sea level rise over the last 5,000 years.

The Archaic period in Maine was a time of transition and innovation in response to complex regional variations of the environment. These variations influenced technological, social and ritual patterns that defined this distinct time period.

The Moorehead Burial Tradition is a broadly defined burial pattern known for its formal cemeteries with intensive use of red ochre and elaborate funerary offerings (Robinson 1996). When human remains are not identifiably present, diagnostic funerary artifacts and ecofacts are the most visible characteristics to identify cemeteries.

Mortuary rituals can be complicated and often difficult to interpret from the archaeological record. The rituals form deliberate sacred spaces that serve to symbolically integrate kinship groups and to provide continuity through time of buried descent groups (Hutchinson 2002).

This research project consists of an analysis of the cemetery at the Nevin Shellheap with emphasis on the spatial and temporal relationship of the burials and diagnostic artifacts (including incised moose bone daggers, swordfish sword foreshafts and ground stone tools) within the complex stratigraphy of the shell midden.

Also vitally important in the analysis is the relationship of funerary objects with individuals in each burial, in particular gender and age and their aligned placement within each grave as primary or secondary interments.

The Nevin Shellheap was originally excavated in 1936-1937 by Douglas Byers and Fred Johnson representing the R.S. Peabody Foundation in Andover, Massachusetts. What was originally

thought of as a habitation site with complex stratigraphy, the Nevin Shellheap revealed a rare, well-preserved formal cemetery.

This research will contribute to a better understanding of mortuary behaviors and their integration with other cultural sub-systems, such as settlement and subsistence, during the Archaic period.



Fig. 1. Funerary Assemblage Sample

Acknowledgements: Assistance has come from the University of Maine Climate Change Institute and Department of Anthropology, the R.S. Peabody Museum in Andover, Massachusetts, the Wabanaki NAGPRA Committee and the Abbe Museum in Bar Harbor, Maine.

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Success in Finding the ‘Oldest Ice’ at the Allan Hills Blue Ice Area, Antarctica

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Abstract: For the first time high resolution, high quality ground penetrating radar (GPR) data have been collected from the Allan Hills Blue Ice Area (AH BIA), Antarctica. These data provide a significant contribution to the ongoing search for the ‘Oldest Ice’.

Comparison of δD_{ice} and $\delta^{18}O_{atm}$ measurements from ice core S27 and surface samples collected along the primary flowline (transect A-B) within the AH BIA to those from other published ice core records points to ages up to at least 400 ka. $\delta^{40}Ar/^{38}Ar$ measurements of an ice core collected away from the primary flowline (BIT-58) give an average $^{40}Ar_{atm}$ age of 990 ka \pm 110 ka. This 1 Ma unit is a good representation of how old ice can be present in the area. The complicated subglacial topography of the region provides ideal conditions for trapping and preserving pockets of very old ice, including along the primary flowline.

Ma ice layer throughout the region. The profile shown in Fig. 2 illustrates how potentially very old ice could be trapped in several locations in the area.

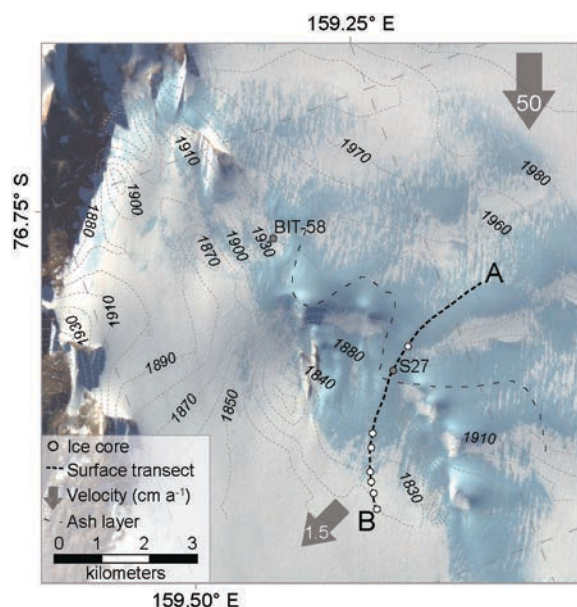


Fig. 1. Map of the main icefield of the AH BIA showing ice core drilling sites. The ash layer here is the 115ka marker in Fig. 2.

A recent NSF award (PLR-1443461) provided the funding necessary to conduct a comprehensive ground penetrating radar (GPR) survey aimed at tracing the signature of the 1

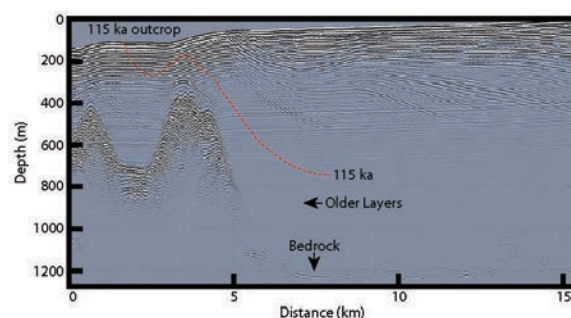


Fig. 2. 7MHz RES profile illustrating undisturbed stratigraphy at ~1000m and ~450m of undisturbed ice older than 115 ka (H. Conway, personal communication)..

Acknowledgements: Funding for this research provided by NSF OPP through grants 0838843, 0229245, 9527571, and 1443461. We also gratefully acknowledge field assistance from Mike Waszkiewicz, Kristin Schild, Melissa Rohde, Erik Venteris, Leigh Stearns, and Laura Kehrl. Flights by Kenn Borek Air Ltd. Logistics by Raytheon Polar Services (2004-2011) and Lockheed Martin's Antarctic Support Contractor (2016).

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One Must First Create a Time-Scale – LA-ICP-MS at Colle Gnifetti

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Abstract: Comparison of well-dated LA-ICP-MS signals from the Colle Gnifetti ice core with written records of European cultural activities form the backbone of a collaboration between the Climate Change Institute and the Initiative for the Science of the Human Past at Harvard University.

Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) offers minimally destructive ice core impurity analysis at unsurpassed sub-mm resolution. This method is uniquely suited for exploring the closely spaced layers of ice within samples collected at low accumulation sites or in regions of highly compressed and thinned ice.

The Colle Gnifetti glacier (Monte Rosa, Swiss-Italian Alps – Fig. 1) is the only European ice core drilling site with an annual net snow accumulation low enough to archive multi-millennial records in spite of its limited ice thickness. However its rapid layer thinning limits the use of layer counting in creating age-depth models when traditional melt-based signals are used. Thus, an instrument like the W.M. Keck LA-ICP-MS is needed to create a time-scale at this glacier.

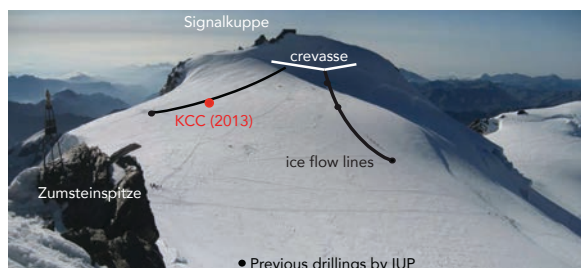


Fig. 1. The Colle Gnifetti glacier and the location of the 2013 ice core (KCC) in relation to the full array.

Over the past 2.5 years ice core KCC, drilled in 2013, has been sampled more densely than any other ice core - ever. Using the 1.5 million laser calcium data points collected in combination with 0.5cm resolution melt-based data (Fig. 2) and discrete ICP-MS samples, a time-scale has been created covering the past 3000 years.

Preliminary comparisons of additional elements, including those derived mainly from anthropogenic activities - like lead and copper - with written accounts show exciting parallels thereby increasing confidence in the age-depth scale.

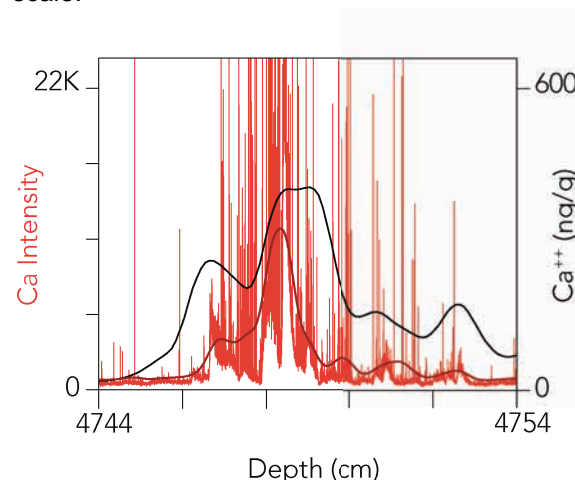


Fig. 2. Comparison of state of the art LA-ICP-MS measurements (raw = red, 0.5cm smooth = maroon) with melt-based measurements (black) at shallow depths confirms the values of annual layer counting of LA-ICP-MS signals at greater depths.

Acknowledgements: Financial support from the Arcadia Fund and the Initiative for the Science of the Human Past at Harvard University. Thanks also to: Physical Institute Uni Bern for drilling the 2013 CG ice core, our field team, the University of Fribourg, the staffs of the Capanna Margherita Hut, AirZermatt and Alpin Cargo, Sepp Kipfstuhl and Johannes Freitag for their assistance during processing of KCC at AWI, and Mike Handley and Andrei Kurbatov for helpful discussions about ICP-MS operation and experimental design, respectively.

The University of Maine Climate Change Capacity Discovery Survey – Preliminary Results

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3. *School of Forest Resources, University of Maine.*

Abstract: A survey aimed at determining institutional capacity in the realm of climate change at the University of Maine was conducted in January of 2016. An online directory of expertise is the anticipated deliverable of this campus-wide survey, though intangible benefits including an increase in collaboration resulting from the growing awareness of our collective work are also expected.

The University of Maine is nationally and internationally recognized for expertise across a broad range of physical, biological, chemical, social, and economic disciplines related to climate change. This work is housed in highly identifiable units like the Climate Change Institute as well across many of the research centers, outreach organizations and academic units at the University of Maine. This work encompasses energy, human health, natural resources (food systems, forest resources, freshwater and oceans), the built environment, and increasingly includes the arts and humanities. In 2014 the University of Maine administration designated Climate Change as a Signature Area of Excellence.

Maine on the broadly defined subject of our changing climate and to strengthen awareness, communication and coordination at our institution. This survey was intended to identify both those who consider climate change part of their program identity, as well as those whose expertise relates to changing patterns of temperature, moisture, and atmospheric chemistry and the consequences of these changes. Collectively, these faculty and staff represent the depth of resources and expertise at the University of Maine that supports our mission to serve students and society on climate concerns and opportunities. The goal was institutional capacity discovery leading to a directory of expertise, and hopefully the synergies that would flow from a growing awareness of our collective work. The directory is to be posted on the Maine Climate News web site.

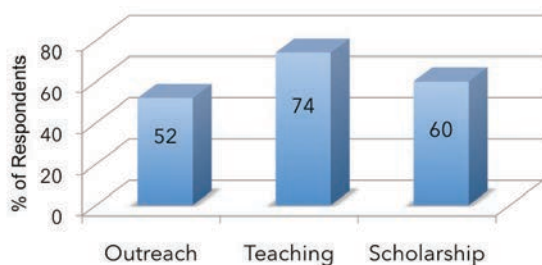


Fig. 1. Percent of respondents reporting involvement in outreach, teaching, and scholarship related to climate change.

In January of 2016 a survey was conducted by the Climate Change Institute, under the auspices of that designation, to better define the expertise and resources at the University of

Sea Level Rise Impacts on Archaeological Resources as a Result of Population Resettlement: A Case Study

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2. *Department of Anthropology, University of Maine.*
3. *School of Earth and Climate Sciences, University of Maine.*

Abstract: Coastal communities in the United States are facing challenges posed by sea level rise. As coastal areas are inundated and subjected to coastal processes, mitigation of threats to the archaeological record are generally limited to immediately threatened sites of great local significance, while the destruction of sites by the resettlement of affected communities has been given little attention. We report a pilot study in Casco Bay, Maine, using archaeological survey data, digital elevation models, coastline geology, local sea level rise and flood projections, tax records and census data to predict the potential locations of impact to cultural resources beyond the immediate impact zone through landward relocation housing and associated infrastructure.

Project Goals:

Casco Bay has a wealth of archaeological resources, located in densely populated coastal areas as well as less-developed inland regions. Impacts of climate change, particularly rising sea levels¹, increases in frequency and severity of storm surge and riverine inundation, and erosion will disproportionately affect coastal settlements. Globally, communities have begun to armor coasts, protect infrastructure, and even relocate.

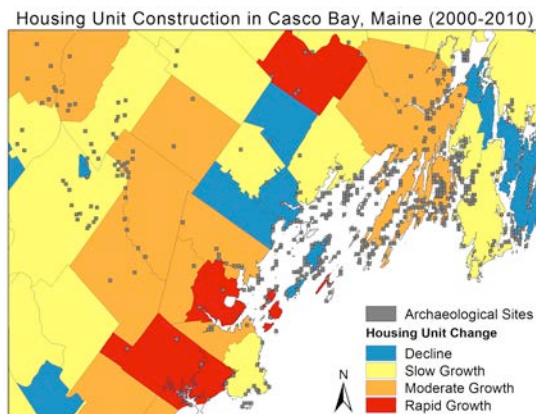


Fig. 1. Development threatens archaeological sites.

This project aims to establish the groundwork for communities to mitigate threats to cultural resources by identifying where populations are likely to expand, and by indicating where sites may be negatively impacted as a result.

Initial Results:

Census data show increases in population density in Portland, but also increases in housing

construction elsewhere, particularly in non-coastal Sagadahoc County², and in more distant 'turnpike towns'. While coastal urban centers may be vulnerable to impacts of climate change, mitigation of threats through improved infrastructure may increase resilience of these hubs to sea level rise in comparison to rural areas where economic incentives to fortify coasts or replenish eroding beaches do not exist. In this scenario, urban populations may also become denser, in turn threatening cultural resources. Densification in these formerly less developed areas will bring new individuals into contact with archaeological sites, increasing risk of destruction (Fig. 1). In towns prioritizing mitigation, reinforcement of coastlines and other construction will also negatively impact cultural resources. It is imperative for archaeologists to work with climate scientists, urban planners and communities to identify and protect sites threatened by secondary impacts of climate change. Growing an engaged public archaeology through concerted education will help promote understanding of and participation in stewardship of our archaeological resources.

Acknowledgements: This research is funded by a Climate Change Institute Research Assistantship. Archaeological survey data and support graciously provided by Arthur Spiess (Maine Historic Preservation Commission) and Nathan Hamilton (USM), GIS data from MEGIS.

Bibliography: [1] Lentz, Erika E., et al., "Evaluation of dynamic coastal response to sea-level rise modifies inundation likelihood." *Nature Climate Change* (2016). [2] Christopher Mazur and Ellen Wilson, *Housing characteristics: 2010*. US Census Bureau, 2011.

A Bi-Hemispheric Perspective on the Last Glacial Termination From the Southern Alps of New Zealand and the Altai Mountains of Western Mongolia

Peter D. Strand¹, Aaron E. Putnam¹, Joerg M. Schaefer², George H. Denton¹, David J.A. Barrell³, David E. Putnam⁴, Oyungerel Sambuu⁵, Ariunsanaa Dorj⁵, Pagamsuren Amarsaikhan⁵, Tsetsenbileg Bavuu⁵, Tobias N.B. Koffman², Rosanne Schwartz²

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2. *Lamont-Doherty Earth Observatory, New York.*
3. *GNS Science, New Zealand.*
4. *Environmental Science and Sustainability, University of Maine.*
5. *School of Geology and Mining Engineering, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia.*

Abstract: An understanding of the last glacial termination will help hone our understanding of the processes that drove warming to completion and of the climate system sensitivity to natural and human forcing factors, such as atmospheric CO₂. Here, we test possible drivers of the last glacial termination by comparing chronologies of mountain glacier recession in the middle latitudes of both polar hemispheres. We present ¹⁰Be surface-exposure chronologies and glacial geomorphologic maps of mountain glacier recession since the Last Glacial Maximum in the Southern Alps of New Zealand (44°S, 170°E) and in the Altai Mountains of western Mongolia (49°N, 88°E).

The last glacial termination (~18,000 – 11,000 yrs ago) represents the last great global warming and the last time CO₂ rose by a substantial amount before the industrial period. In addition, a prominent version of the Milankovitch (1941) hypothesis of ice ages is that variations of Earth's ice sheets are paced by periodic changes in Earth's orbit and consequent seasonal redistribution of incoming solar radiation at 65°N latitude.

Extra-polar mountain glaciers are highly sensitive to atmospheric temperature, and glacier landforms afford insight into past climate conditions. I present ¹⁰Be surface-exposure chronologies and glacial geomorphologic maps of mountain glacier recession since the Last Glacial Maximum in the Southern Alps of New Zealand (44°S, 170°E) and in the Altai Mountains of western Mongolia (49°N, 88°E) (Figure 1). I used the ¹⁰Be exposure-age dating technique to determine the chronology of glacial landforms northeast of Lake Pukaki.

The highest-elevation, left-lateral deposits of the former Pukaki glacier reveal six glacier advances during MIS 4, 3 and 2. This chronology reveals that glaciers in the Southern Alps of New Zealand repeatedly achieved full-glacial extents throughout Marine Isotope Stages (MIS) 4, 3 and 2. The results suggest that the timing of millennial-scale maxima and minima of glaciers in the Southern Alps of New Zealand are not correlated with orbitally-driven insolation changes. Rather, the ¹⁰Be surface-exposure record of this study provides evidence that the climate of the Southern

Hemisphere mid-latitudes responded to other climate drivers.

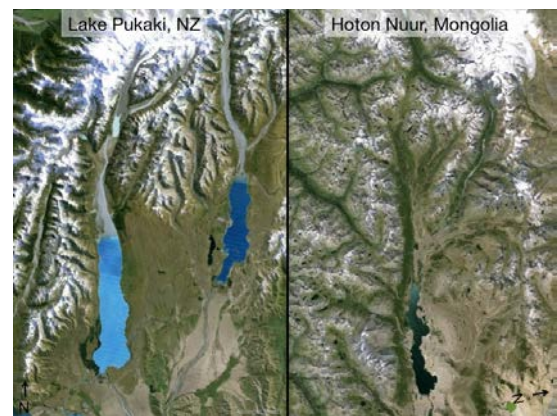


Figure 1. Comparison the Lake Pukaki valley, New Zealand and Hoton Nuur valley, Mongolia

In the Mongolian Altai, preliminary ¹⁰Be ages indicate that the last glacial termination may have been underway prior to that in New Zealand. On the basis of these two chronologies, we evaluate the relative roles of rising atmospheric CO₂, local insolation forcing, and ocean-atmosphere reorganizations in driving the warming that ended the last ice age.

Acknowledgements: We thank the Gary C. Comer Science and Education Foundation, the National Science Foundation, and the Quesada Family Foundation for support.

Modeling Spatiotemporal Variability of the Bioclimate Envelope of *Homarus Americanus* in the Coastal Waters of Maine and New Hampshire

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2. School of Marine Sciences, University of Maine.

Abstract: A bioclimate envelope model was developed to evaluate the potential impacts of climate variability on American lobster (*Homarus americanus*). Bioclimate envelopes were defined by season-, sex-, and stage- specific Habitat Suitability Indices (HSI) based on (1) bottom temperature, (2) bottom salinity, and (3) depth. This study provides a modeling framework to reconstruct climatically suitable lobster ranges that can be used to formulate climate-based hypotheses for future studies of this species.

American lobster, *Homarus americanus*, is a large benthic crustacean present throughout coastal Northwest Atlantic waters. Due to its ectothermic nature, climate change could significantly impact *H. americanus* abundance by altering bottom-up forces (e.g. climate-driven changes in environment and resources).

A bioclimate envelope model was developed to evaluate spatiotemporal variability of a climate-driven habitat suitability *H. americanus* in the coastal waters of Maine and New Hampshire from 1978 to 2013 (Tanaka and Chen 2016).

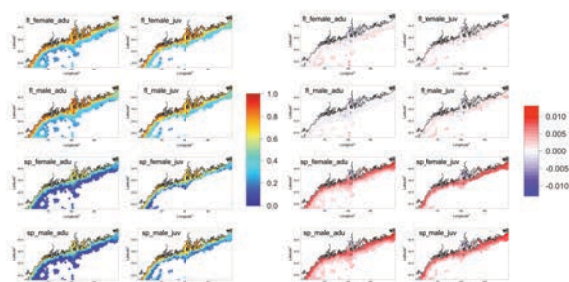


Fig. 1. Left: Season, sex, and stage specific maps illustrating the spatial distribution of the median habitat suitability index (HSI) over 1978 - 2013 in the coastal waters of Maine and New Hampshire for *Homarus americanus*. Right: Season, sex, and stage specific heat maps illustrating change in HSI over 1978 - 2013 in the coastal waters of Maine and New Hampshire for *Homarus americanus*. fl: Fall (September-November); sp: Spring (April-June); adu: Adult (>60 mm carapace length); juv: Juvenile (<= 60 mm carapace length).

The model predictions indicated higher habitat suitability in inshore waters for both adult and juvenile lobsters. A statistically significant increasing trend in habitat suitability was

observed for both sexes and stages (juvenile and adult) during the spring (April-June), while no significant trend in habitat suitability was observed in the fall (September-November).

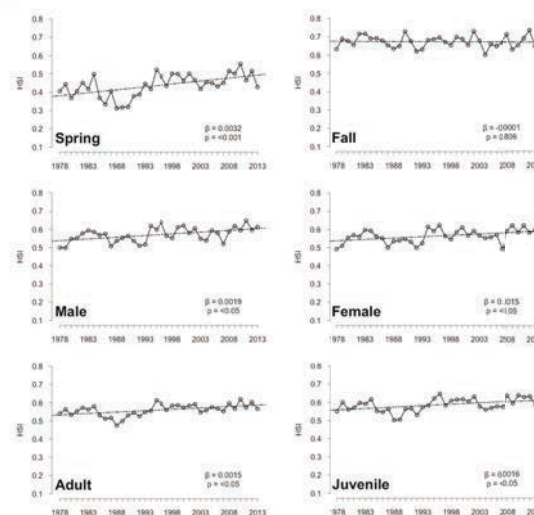


Fig. 2. Median habitat suitability index (HSI) for each year from 1978 to 2013 (solid line). The trend in both seasons-sexes, and stages was shown by the fitted linear regression model (dashed line).

Acknowledgements: This study was funded by the NSF Adaptation to Abrupt Climate Change IGERT program (DGE-1144423) and NSF Coastal SEES program.

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Epilimnion Thickness of Lakes in Acadia National Park: Biological Implications in a Changing Climate

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Abstract: The clarity of lakes in Acadia National Park has been declining over the past two decades, as has the thickness of the epilimnion, a trend linked to increases in dissolved organic carbon (DOC). In this study, we explore the biological implications of declining in lake clarity and epilimnion thickness, focusing specifically on phytoplankton biomass and community structure.

In recent years, water clarity in Jordan Pond and across lakes in Acadia National Park has been declining. There are several unknowns about how the recent change in lake clarity is influencing lake biota currently and how it will do so in the future.

The recent change in lake clarity has been accompanied by a thinning of the epilimnia, the warm mixed surface layer of lakes. A previous study in Acadia National Park pairing historical monitoring data with high frequency data from Jordan Pond revealed that the declining trends in clarity and epilimnion thickness were largely due to changes in dissolved organic carbon (DOC) concentrations (Strock et al. 2016, in press).

Few studies have manipulated the biological implications of altered thermal structure predicted to occur with changes in DOC, despite its essential role in regulating light and nutrient availability for phytoplankton. In this study, experiments were performed in Jordan Pond (a low DOC, high transparency system) and Seal Cove (a high DOC, low transparency system) to test the effects of altered light conditions experienced under altered simulated epilimnion thicknesses on phytoplankton biomass and biovolume.

In Seal Cove, the experiment revealed that in high light conditions of a thinner epilimnion, total biovolume did not change between treatments, but total chlorophyll did change significantly. Therefore, the experiment reveals that low light (i.e. a thicker epilimnion) resulted in higher chlorophyll concentrations. The experiment in

Jordan Pond revealed no significant changes in biovolume or biomass.

These experiments suggest that the altered light conditions that accompany changing epilimnion thickness may have stronger effects on phytoplankton physiology than abundance or diversity, and that high DOC systems are likely to exhibit a pronounced response to changes in epilimnion thickness. Experiments such as this are essential to understanding how climate change will influence lake ecosystems and water quality in the changing climate.

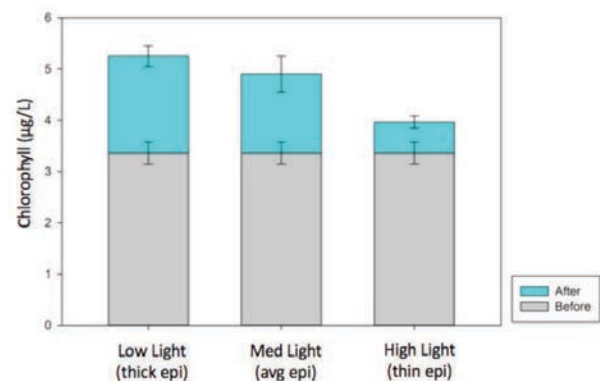


Fig.1 Results from Seal Cove Experimental Manipulation of Epilimnion Thickness.

Acknowledgements: This research was funded by a grant from Canon, Inc.

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Development of a Modeling Framework to Assess the Effects of Environmental Heterogeneity in Sea Scallop (*Placopecten Magellanicus*) Abundance, Distribution, and Growth: Application to the Maine Fishery

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2. School of Marine Sciences, University of Maine.

Abstract: This project will develop a modeling framework to project spatio-temporal variability in sea scallop (*Placopecten magellanicus*) habitat, distribution, and growth rates with respect to underlying environmental conditions in the Gulf of Maine. Modeling outputs will be used to evaluate potential impacts of climate change on scallop population dynamics and to improve stock assessment and management for this fishery.

Sea scallop (*Placopecten magellanicus*) abundance, distribution, and life history parameters are impacted by environmental variables such as depth, bottom type, current velocity, temperature, and salinity. Habitat characteristics affect scallops throughout their entire life cycle, e.g., settlement in the larval stage or feeding, growth, and predation risk in juvenile and adult phases (Shumway and Parsons, 2006). Despite the clear influence of habitat on scallop distribution and life history parameters, quantitative studies on scallop-habitat relationships remain rare (Mendo et al., 2014).

This study will develop a modeling framework to quantify potential impacts of environmental variability on scallop population dynamics, and to incorporate possible habitat variability into the assessment and management of the Gulf of Maine (GoM) scallop population. The framework will comprise a variety of approaches to quantitatively describe different aspects of scallop ecology including a habitat suitability index (HSI) model (see Fig. 1), a scallop distributional model, and habitat-life-history models.

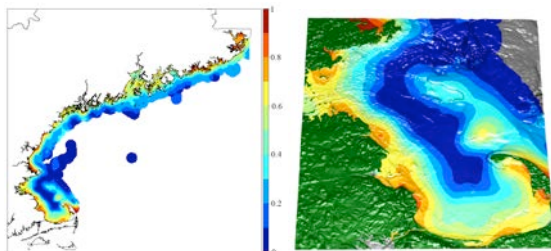


Fig. 1. Preliminary outputs from habitat suitability index (HSI) model predicting habitat value for sea scallops (*Placopecten magellanicus*). HSI values range from 0-1, with 1 being most the suitable habitat.

In light of recent extreme warming events within the Gulf of Maine (Mills et al., 2013) it is becoming increasingly important to view resource management from within the context of climate change. This project will provide an unprecedented opportunity to evaluate the potential impacts of abrupt climate change on the dynamics of scallops. The modeling framework developed for this project will be used for forecasting how scallop populations are likely to respond to a warming Gulf of Maine ecosystem under various climate change scenarios, and to evaluate effectiveness of possible future mitigation efforts.

Acknowledgements: This research was supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423 as well as the Maine Department of Marine Resources.

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Effects of Geese on Nutrient and Carbon Inputs to Arctic Lakes in Southwest Greenland

Carl Tugend^{1,2}, Jasmine Saros^{1,2}

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2. *School of Biology and Ecology, University of Maine.*

Abstract: Global goose populations have nearly doubled since the 1970's which is mainly attributed to a lower winter mortality rate. With the majority of geese breeding ground being located in the Arctic this could lead to numerous ecosystem implications. With few studies examining the effects of geese on freshwater systems, the impacts of this population increase on arctic lakes is unclear. We are investigating whether geese enhance nutrient and organic carbon loading rates to lake ecosystems in Southwest Greenland.

Climate change in the Arctic generates a complex series of stressors that could change catchment hydrology, vegetation, and habitat for wildlife. It also alters wildlife distribution, expansion, and foraging behaviors. Low nutrient freshwater bodies are susceptible to changes in external inputs of nutrients and carbon, altering their biogeochemistry (Ghislain et al 2010).

Geese in particular may have a large impact on arctic freshwater systems. To date, only a few studies have been conducted on the effects of geese on Arctic lake systems. Grazing and grubbing (act of foraging under the soil surface) by geese have led to the large scale destruction of salt marshes and in some areas goose activity has led to 30-75% increase in nutrient loading rates in freshwater systems. (Jefferies 1998; Walker et al. 2003). Geese populations have been on the rise since the turn of the century due to an increase in winter survivorship most likely due to changes in southern agricultural practices allowing for a larger food supply and elevated winter body conditions (Ghislain et al 2010).

The goal of this project is to understand the effects of geese on nutrient and carbon inputs to Arctic lakes of Southwest Greenland. This research will allow us to understand how changes in geese population size and duration at these lakes will alter lake water chemistry. This will give insight into what to expect in the future and possible management plans in order to address these changes.

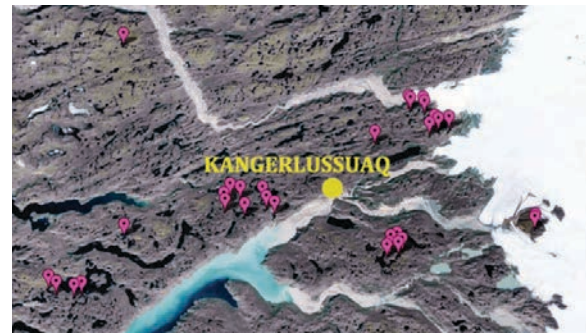


Fig 1 Map of the study area, with all lakes with available water chemistry data indicated. A subset of these lakes will be used in this study.

Acknowledgements: We are very grateful to The Dan and Betty Churchill Exploration Fund.

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Investigating the Response of Maine's Drinking Water Resources to Extreme Precipitation Events

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1. *Climate Change Institute, University of Maine.*
2. *School Biology and Ecology, University of Maine.*
3. *School of Economics, University of Maine.*

Abstract: Increases in dissolved organic carbon (DOC) in aquatic ecosystems have occurred as a result of increased extreme precipitation events in the northeastern U.S. DOC is a fundamental regulator of aquatic ecosystem structure and function and little is known about the implications of elevated DOC concentrations on water quality. The goal of this study is to evaluate immediate chemical and biological changes in water quality from extreme rain events and subsequent increases in DOC on Maine's drinking water lakes.

Maine lakes serve as a high quality source of drinking water for many residents. However, this high quality water is being threatened by a rapidly changing climate, in particular, extreme precipitation events, which have increased in frequency in the northeastern U.S. by 60-70% since the 1950's (Madsen & Wilcox 2012). Analysis of a 30-year database of surface water geochemistry and watershed-specific landscape data for 84 remote lakes throughout the northeast suggests increased concentrations of dissolved organic carbon (DOC) in lakes during extreme wet years (Strock et al. 2016). Increases in DOC, an important regulator of ecosystem function, can influence overall water quality and can have implications for drinking water treatment processes. Currently, the extent to which changing precipitation is altering the type and quantity of DOC and consequently the biota of Maine's lakes is unclear.

The goal of this research is to quantify immediate changes in drinking water lakes from extreme precipitation events through measurement of key water quality metrics. These metrics include: DOC quantity, DOC quality, nutrients, algal biomass and community structure. A subset of 6 drinking water sources were sampled for these metrics 24 hours before, 24-48 hours after, 5-7 days after, and 3 weeks after an extreme precipitation event. Three types of responses were found across lakes: 1) sustained increase in DOC after an event; 2) initial spike in DOC after the event, followed by return to pre-storm concentrations; 3) no change in DOC (Fig. 1).

This research will help inform potential future modification of drinking water adaptation and management strategies.

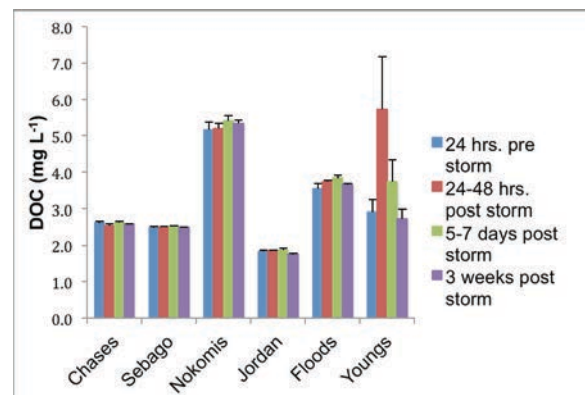


Fig. 1. DOC concentrations before and after an extreme precipitation event across 6 Maine drinking water lakes. Each DOC concentration is averaged from 3 storm events.

Acknowledgements: This research was supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423.

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Adapting to Abrupt Climate Change in Palau Utilizing Traditional Environmental Knowledge and Scientific Data

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2. Climate Change Institute, University of Maine.

Abstract: In the Western Pacific island nation of Palau, rapid sea level rise and ocean acidification linked to abrupt climate change (ACC) threaten Palauans' subsistence and economic livelihoods. I study local perceptions of climate change to uncover Palauans' adaptive capacity to ACC impacts. I also examine how traditional environmental knowledge (TEK) can be employed alongside scientific climate data and projections to create locally appropriate and effective adaptation policy solutions.

Research

Palau is experiencing decadal scale sea level rise, ocean acidification and ocean warming (Ngemas et al. 2011). Sea-level rise is causing coastal erosion, direct inundation of infrastructure and crops, and salinization of freshwater resources. Ocean acidification and warming is resulting in coral bleaching of the near-shore coral reefs that Palauans heavily rely on for both subsistence and economic means. ACC impacts are exacerbated in Palau by preexisting anthropogenic issues such as urbanization, increasing coastal population densities, reliance on foreign aid, water pollution, and unsustainable fishing practices.

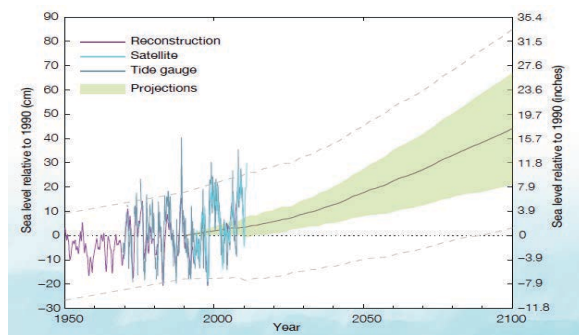


Fig. 1. Palau sea level rise under IPCC medium emission scenarios (Ngemas et al. 2011)

Palauans inhabit both low-lying coral atolls and mountainous high islands with low coastal plains. Thus Palauans can be highly adaptable to ACC through the synthesis of culturally appropriate and scientifically informed policy solutions.

Recent adaptation policy in Pacific Islands has largely failed because policy is being communicated and employed in ways that do not acknowledge local understandings, practice

and knowledge systems (Nunn 2013). My research uncovers climate change perceptions in Palau that reveal Palauans' adaptive capacity to ACC impacts. Furthermore, I study TEK as a vast information base that elucidates local expertise about past environmental conditions, subtle yet important changes that have occurred in the environment and contemporary adaptive response to a changing environment. Finally, this innovative and potentially replicable research utilizes contextual, local TEK while integrating the measurements and projections of biophysical scientists to generate locally effective climate change policy solutions.



Image. 1. Palauan Subsistence Fishermen.

Acknowledgements: This research is supported by the US National Science Foundation Adaptation to Abrupt Climate Change IGERT program grant DGE-1144423

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Ancient Ashes: New Methodology to Effectively Capture and Analyze Crypto-tephra in Ice Cores

Sarah Wheatley¹, Andrei Kurbatov^{1,2}, and Martin Yates²

1. *Climate Change Institute, University of Maine.*
2. *School of Earth and Climate Sciences, University of Maine.*

Abstract: By improving ice core sampling methodology, novel analysis of super fine volcanic ash (cryptotephra) from large, tropical volcanic eruptions became possible. Cryptotephra has been elusive in ice core records for several decades; probably due to both physical and instrumental limitations. However, with new techniques, tropical cryptotephra that is essential for refining ice core chronology can be both found and analyzed.

Project Description

Previous methods for mounting tephra particles include liquid adhesive, carbon planchets, filters, carbon adhesive, double-sided tape, and epoxy. While these materials are effective for capturing large (visible) tephra particles, few have managed to both capture and successfully analyze glass shards smaller than 10 μm . Because the majority of tephra deposited from tropical volcanic events is smaller than 10 μm , our new method will help further refine timescales across multiple ice cores.

Summary of Methods

Some of the most common methods are highlighted by Kuehn and Froese (2010), most of which involve mounting the particles on a carbon planchet, which eliminates the need for applying conductive coating to the sample, a process which is necessary for analysis in multiple instruments, such as the Scanning Electron Microscope (SEM).



Fig. 1. Single-opening epoxy mounts, polished on each side for flatness, adhered to specially formulated tape and a super flat hard drive surface.

While Kuehn and Froese (2010) and Hall and Hayward (2014) outline several effective methods for capturing particles in the 3-5 μm range, there are multiple steps involved that can be eliminated with newer products and simpler, more efficient methodology. Instead of filling pores of a carbon planchet with epoxy, or evaporating meltwater directly onto the carbon planchet, the multiple products and steps involved in the mounting process can be replaced with Kapton Double Sided

Polyimide Tape (KT) and used computer hard drive disks (see Fig. 1).

Both expensive and difficult to use, carbon planchets are no longer necessary since the hard drives are flat enough to ensure a smooth mounting surface, and the use of the temperature resistant tape can guarantee both a sealed area to prevent leaks during heating/evaporation and a smooth enough surface to keep particles in place for backfilling the sample hole with epoxy.

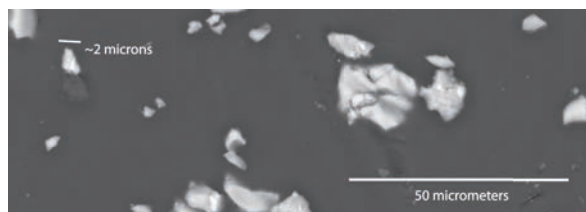


Fig. 2. View of an unpolished epoxy mount and tephra particles viewed under the SEM at 20 kV and 10 probe current in a high vacuum. Note the sub-micron particles mounted alongside the 20 μm particles.

New methods allow for effective capture of over 99% of tephra smaller than 5 μm from ice core samples, as well as the ability to view and analyze the particles under the SEM (see Fig. 2).

Acknowledgements: NSF Grant # PLR-1142007. CCI graduate scholarship. Donna Kalteyer and Natasha McWalters for laboratory assistance.

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APPENDIX F: HIGHLIGHTED STUDENT PROFILES



Despite seeing exponential growth in the lobster resource over the last several decades, many lobstermen recognize the need to act now, while things are good, to prevent calamitous economic and social impacts in the future.

“A lot of the folks I’m talking to recognize that there is a need to fish smarter, and not harder, if the industry is going to deal with climate change.”

— Samuel Belknap, Ph.D. student in Anthropology & Environmental Policy; Climate Change Institute

SAM BELKNAP’S dissertation research focuses on the social and cultural foundations of leadership within Maine’s iconic lobster industry. He is particularly interested in the rapid rate of environmental change currently being experienced in the Gulf of Maine, which has spurred a large group of lobstermen to become actively engaged in discussions of climate change adaptation.

Sam hopes that by understanding how leadership emerges and succeeds in this setting, we can help an industry known around the world to adapt to potentially disruptive environmental change.



Maine’s Iconic Lobsters Industry

Sam spent the summer of 2014 interning for the Island Institute (Rockland, Maine) a nonprofit that works to sustain Maine’s island and remote coastal communities. During his time there, he helped write public comment on fisheries legislation and co-developed and hosted 3 state-wide meetings that drew participants from across the country and focused on issues of climate change adaptation in Maine.

climate change adaptation

A2C2 IGERT

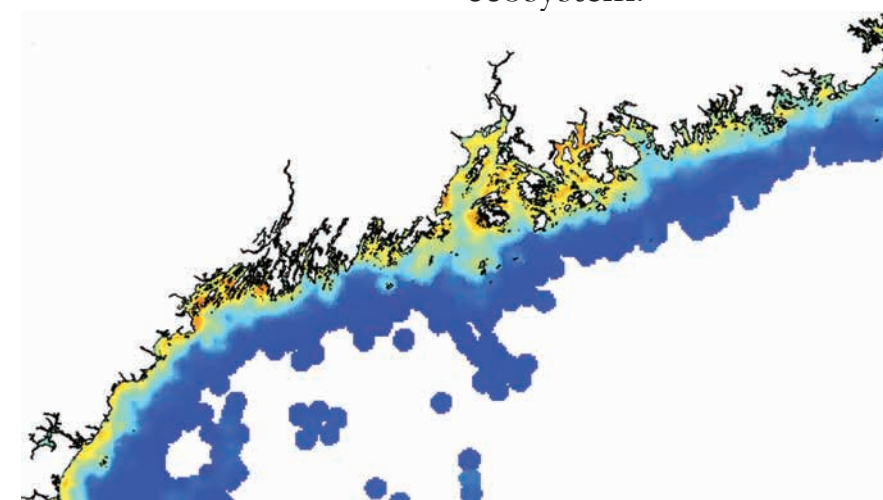


"I knew that the IGERT program would be the best choice for me to obtain training beyond conventional natural and social science disciplinary boundaries. It has been a very challenging, but rewarding experience."

— Kisei Tanaka, Ph.D. student in Ecology & Environmental Science; Climate Change Institute

KISEI TANAKA is working to develop a new modeling framework for American lobster in the Gulf of Maine and southern New England that will quantify spatial and temporal changes in species distribution and suitable habitat availability.

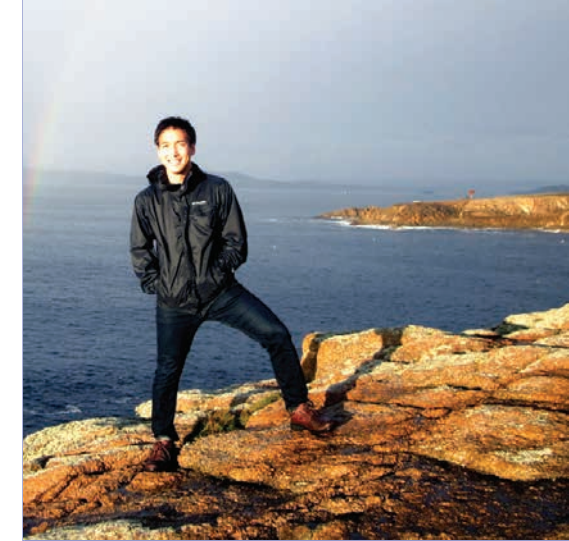
Overall, his dissertation research (which has already resulted in several publications in peer reviewed journals) will provide the modeling framework to use environmental information for improving lobster stock assessment and management given the expected changes in the northeastern U.S. marine ecosystem.



innovation in modeling

A2C2 IGERT

Surprisingly, the current lobster stock assessment does not incorporate the impact of key environmental variables such as water temperature. Incorporating this information into stock assessments and habitat maps (like the one shown to the right) will be critical for effective lobster fisheries management.



Modeling Framework

Kisei plans to do an internship at Woods Hole Oceanographic Institution in Massachusetts. The Marine Policy Center at Woods Hole conducts social scientific research that integrates economics, policy analysis, and law with the Institution's basic research in ocean sciences. This integrative approach will provide Kisei with an outstanding opportunity to put his innovative models to work in informing more sophisticated fisheries management.