



CLIMATE CHANGE INSTITUTE FY2019 Annual Report

Research Activity for the period
July 1, 2018 - June 30, 2019



Annual Report - FY 2019

Research Activity for the period of July 1, 2018 to June 30, 2019

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FY 2019 Annual Report



Executive Summary

• *Major Accomplishments*

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 and climate in general is recognized as a Signature Research area in the University of Maine. CCI has a legacy of transformational contributions to the understanding of the physical, chemical, biological and social interfacing of climate change and the application of these findings at local to international scales. CCI continues to maintain its high level of research funding, return on indirect, publications, state, national and international collaboration, outreach and its role as the focal point for the University of Maine's climate change research excellence. Examples of accomplishments for the current reporting year follow. CCI is currently involved in 108 research grants and contracts. Return on investment remains high at \$7.50. Research productivity is summarized in the form of peer-reviewed publications (206), 130 presentations, 4 workshops, and 24 tours. CCI provides a climate change medium for several academic units at the university (eg., Schools of Earth and Climate Sciences, Marine Sciences, Biology and Ecology, Business, Department of Anthropology); and interacts with State of Maine agencies (eg., Department of Environmental Protection, Department of Conservation, Forestry and Agriculture, Department of Transportation, Maine Geological Survey, Maine Inland Fisheries and Wildlife, Maine Center for Disease Control, Department of Licensing and Regulatory Services); federal agencies (eg., Environmental Protection Agency, Department of the Interior, National Park Service, US Department of Agriculture, US Forest Service, Natural Resource Conservation Service, US Department of Commerce, National Oceanic and Atmospheric Administration; Maine-based non-governmental organizations (eg., Blue Hill Heritage Trust, Friends of Acadia, Maine Lakes Society, Maine Audubon); and both national (eg., Harvard, Princeton, Dartmouth, University of Washington, University of Colorado) and international research organizations (eg., Scientific Committee for Antarctic Research, University of the Arctic, United Nations, Victoria University (New Zealand), Universidade Federal do Rio Grande do Sul (Brazil), Magallanes University (Chile), Australian National University, Heidelberg University and Alfred Wegener Institute (Germany). CCI has a long tradition of outreach through various media venues, public talks, popular articles, and web-based software with the most prominent example being Climate Reanalyzer.

Examples of Highlights (For more detail see <https://climatechange.umaine.edu/>)

- Mayewski leads National Geographic, Rolex Expedition to Mt. Everest.
- It Doesn't Help to Believe No One Will Survive Climate Change – Vice – Gill, Sandweiss et al.
- 2000 years of North Atlantic Arctic Climate – Quaternary Science Review – Auger, Mayewski, Maasch, Schuenemann, Carleton, Birkel, Saros.
- Climate Reanalyzer cited in article by The Buffalo News and many other media outlets – Birkel.
- Working Waterfront adapts UMaine release about Gill's Siberia expedition, film.
- Journal of the North Atlantic & Arctic interviews Mayewski about glacial melt.
- Arctic scientists turn to comedy to discuss serious environmental changes – K. Miner.
- Smart Water Magazine published UMaine release on lake study by Warner, Saros.
- Yale Climate Connections quotes McDonough MacKenzie in article on premature springs.
- Sandweiss featured in Science Channel documentary episode on pyramids.
- National Geographic Society Early Career Grant awarded to K. Glover.
- Mayewski speaker at National Geographic Explorers Festival.
- Mayewski speaks about polar vortex on NBC Nightly News.

- Sandweiss co-writes monograph, delivers talks in Georgia, Denmark.
- AP cites Climate Reanalyzer in report on cold snap – Birkel.
- Scientists model Mercury’s glaciers – J. Fastook.
- Explosive Cause of the Dark Ages – Mayewski and Kurbatov.
- UMaine representatives attend International Conference of the Parties (COP24) Convention in Poland.
- National Geographic quotes Enderlin in article on Greenland’s ‘unprecedented’ ice loss.
- Quantifying Risk from Glacial Release of Organochlorine Pollutants in the Arctic – K. Miner.
- DDT in Alaska Meltwater Poses Cancer Risk for People Who Eat Lots of Fish – K. Miner.
- Evidence for a volcanic underpinning of the Atlantic multidecadal oscillation – Birkel et al.
- New York Times and others cite A. More et al. in article on Europe’s past frozen in Swiss ice.
- Glacier Calving Rates Due to Subglacial Discharge, Fjord Circulation – K. Schild et al.
- Annual Simpson Lecture to focus on climatic, cultural history of El Niño– D. Sandweiss.
- Polar Studies Are Essential Tools for Facing the Biggest Challenge of Our Times, Mayewski.
- Media feature Climate Reanalyzer map in reports on July, August heat waves.

CCI continues to maintain its legacy of field expeditions throughout Maine and the world and as a consequence offering the more than 50 graduate students supported and associated with CCI faculty research grants the opportunity to experience on the ground research and career changing experiences. CCI’s eleven research laboratories continue to produce high quality data leading to transformational scientific discoveries.

Serving Maine & Beyond

Community Engagement

CCI standardly provides lectures and other services to K-12, colleges and universities, public, governmental and non-governmental audiences in addition to conducting environmental monitoring of lakes, forests, coastal areas and ecosystems. *Examples below are* presented in the form of media coverage to demonstrate the public reach and application of selected CCI activities:

- CCI’s 27th Annual Borns Symposium – an American Geophysical Union style conference focused on grad student presentations and posters with ~100 people this year.
- McDonough MacKenzie documents dramatic loss of native plants on MDI.
- Fernandez testifies on behalf of the University of Maine in support of Governor Mills’ bill to establish a Maine Climate Council.
- Study finds changing dissolved organic carbon in Maine lakes key to maintaining drinking water quality – K. Warner and J. Saros.
- CCI researchers awarded fellowships to study Acadia National Park – McDonough MacKenzie.
- CCI graduate student researchers attend GradCAP workshop.
- Ellsworth American quotes Isenhour in article on recycling.
- BDN interviews Birkel about Maine record high temperatures.
- Maine Public quotes Fernandez in report on emissions bill.
- Fernandez provides testimony before the Committee on Environment and Natural Resources.
- Botanists find climate change puts spring wildflowers in the shade –McDonough MacKenzie.
- Birkel quoted in WGME report on climate change, lake ice.
- News Center Maine speaks with Birkel and Elias about tick research.
- Isenhour discusses sustainability research, no-shopping concept in Press Herald article.
- Press Herald interviews Elias, Dill for Lyme disease article.
- WVII interviews Birkel about new UMaine climate report.
- Coastal Maine Climate Futures report –Birkel and Mayewski.
- A Lesson in Advocacy – A Turning Point in UMaine’s History –Jacobson, Norton et al.
- BDN publishes op-ed by Mayewski on Green New Deal.
- Sorg report cited in AP article about Maine Public Health Association annual conference.
- Losing Winter: Climate Change in Ski Country and What We Can do About it – Fernandez.
- World Climate Interactive Negotiation Simulations held at Maine schools in October 2019.
- WVII quotes Fernandez in report on citizens’ hearing.

- BDN quotes Birkel in article on early fall foliage.
- BDN interviews Elias for article on invasive Japanese barberry, ticks.
- News Center Maine features Climate Reanalyzer map in reports on heat records worldwide.
- WMTW quotes Birkel, Mallory in report on Maine’s climate future.

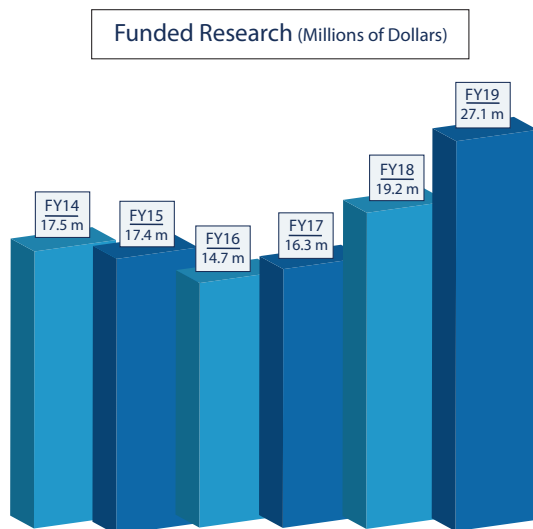
Economic Development –The Climate Futures planning framework for local to global scale plausible scenario planning is nearly complete with applications to commodities, business, policy and public well-being.

Workforce Development - Activities continue to provide local and broader based plausible climate predictions including the impact of climate change on Maine’s commodities. This information is essential to planning for future workplace development and opportunities.

One University Initiatives - CCI has a long history of collaboration within the University of Maine (currently with 20 units), within Maine (currently with 35 entities), nationally (currently with >25 institutions) and internationally (currently with >30 countries). As part of the evolving One University initiative CCI collaborates with the University of Southern Maine (e.g., “Arctic Showcase”) and the University of Maine Law School (e.g., joint BUA course and the Arctic Futures Institute) – most recently through a workshop in South Greenland attended by 16 UMS researchers.

Financial Sustainability

Research Funding - Submitted & Awarded, Trends



Contracts – N/A

Private Giving/Fundraising

Dan & Betty Churchill Fund, The William Bingham Foundation, Muharram & Barbara Gokcen Fund, Russell Grinnell Memorial Trust, Quesada Fund

Initiatives to Increase Fiscal Efficiency

CCI discontinued base phone service for all CCI graduate students several years ago; all toll calls related to research are debited to grants; CCI built three web conferencing facilities for <\$1000 each that are used regularly for national and international meetings, courses and conferences; CCI routinely upgrades facilities and equipment to improve efficiency and avoid more costly interventions in the future.

Culture of Excellence

Professional Development/Mentoring of Faculty and Staff - CCI actively mentors students, early career faculty and staff through discussion and involvement in joint research projects.

Faculty & Staff Achievements (major examples)

- UMaine 2018-2019 Outstanding Faculty Mentor Impact Award – J. Saros.
- 2019 Rising Tide Excellence in Faculty Mentoring – J. Saros.
- College names Brenda Hall winner of 2019 Outstanding Research Award.
- 2019 Presidential Research and Creative Achievement Award – J. Saros.
- Lee receives inaugural Outstanding Research Administration Award.
- UMaine faculty members receive tenure and/or promotion – J. Gill.
- National Geographic Society Early Career Grant awarded to K. Glover.
- National Order of Scientific Merit – J. Cardia Simoes.
- Sandweiss named president-elect of Phi Kappa Phi.
- 2018 Geddes Simpson Distinguished Lecturer – D. Sandweiss.
- 2019 Society of American Archaeology Presidential Recognition Award – D. Sandweiss.
- AAAS Early Career Communication Finalist – J. Gill.
- NSF Early Career Awards – Putnam, Allen

Innovative Projects

- UMaine earns STARS Silver sustainability rating – Dixon (CCI and UM Dir. Sustainability).

Student Engagement, Student Success

Student Research, Scholarship or Creative Activities (examples, for details see

[https://climatechange.umaine.edu/wp-](https://climatechange.umaine.edu/wp-content/uploads/sites/439/2019/05/2019COMBINEDMINIPAPERSFINALreducedsize.pdf)

[content/uploads/sites/439/2019/05/2019COMBINEDMINIPAPERSFINALreducedsize.pdf](https://climatechange.umaine.edu/wp-content/uploads/sites/439/2019/05/2019COMBINEDMINIPAPERSFINALreducedsize.pdf))

- Framework for an Arctic Population Risk Assessment – *J. Auger*.
- Virtual Reconstruction of the Ostra Collecting Site, Peru: Phase 1 – *E. Blackwood*.
- Relative Sea-Level Curve for the Pine Island Bay Region, Antarctica – *S. Braddock, M. Spoth*.
- Lake Characteristics that Determine Ecological Sensitivity to Nutrient Deposition – *B. Burpee*.
- Southern Hemisphere Westerly Wind System Variability – *A. Chesler*.
- Iceberg Melt Rates and Glacier Dynamics on the Antarctic Peninsula – *M. Dryak*.
- Deer Ticks Helped Along by Warming Climate and Deer – *S. Elias*.
- Ecological Responses to Reduced Acid Deposition in Acadia Park – *R. Fowler, K. Warner*.
- Fire, Foxes and Bones in the Falkland Islands – *K. Hamley*.
- Plankton Dynamics in Ice-Covered Arctic Lakes – *V. Hazukova*.
- Spatial/Temporal Reconstruction of Past Fire and Vegetation in the Amazon – *B. Heijink*.
- Crevasse Initiation and History Within the McMurdo Shear Zone, Antarctica – *L. Kaluzienski*.
- Glacial Lake Filling, Draining, and Hazards Yukon, Canada – *W. Kochtitzky*.
- Greenland Marine-Terminating Glaciers Investigated Through Satellite Imagery – *J. Liu*.
- Long-Term Perspective on the Sensitivity of Lake Trophic State Changes in Maine – *S. Lukasik*.
- Dog Burials Reveal Human-Canine Interactions in the Maine/Maritime Region – *A. Mann*.
- Glacier Surface Melt and Isotope Signal Preservation in Arctic Ice Cores – *E. McConnell*.
- Multi-Level Governance of Climate Change Adaptation – *A. McGinn*.
- Chronicles from the Mammoth Steppe – *A. Mereghetti*.
- Land-Terminating Glaciers and Ross Sea Ice, Antarctica – *M. Miles*.
- Quantifying the Volume of a Diatom – *J. Mohan*.
- Ecology of Key Diatom Taxa in Relation to Climate – *E. Pedraza Garzon*.
- Cosmogenic ¹⁰Be Surface Exposure Dating Moraine Chronology New Zealand – *N. Potter*.
- Annual Variability in a 1,600 Year Ice Core Record from Central Asia – *C. Rodda, E. Korotkikh*.
- Ice core Dating Integration in the Climate Data Workbench – *M. Royer*.
- Circulation Changes in the North Atlantic and Summer Precipitation in NE U.S. – *J. Simonson*.
- Millennial-Scale Cycles of the Southern Hemisphere Westerlies Falkland Islands – *M. Spoth*.

- Molluscan Climate Proxies and El Niño-Southern Oscillation (ENSO) – *A. St. Amand*.
- A Bi-Hemispheric Perspective on the Last Glacial Termination - *P. Strand*.
- Model Biases in Sea Surface Temperature and Tropical Cyclone Characteristics – *H. Tubbs*.
- Reconstruction of Koettlitz Glacier, Antarctica During the Last Glacial Maximum – *T. Walther*.
- Effects of Storms on Dissolved Organic Carbon (DOC) in Boreal Lakes – *K. Warner, R. Fowler*.
- Lake Sediment Record of Environmental and Human Changes in Jamaica – *M. Williams*.

Student Funding

CCI faculty research grants currently support 53 graduate students. In addition, NSF Graduate Research Fellowships were awarded to: Ani St. Amand, Anna McGinn and William Kochtitzky.

Student Awards

- Churchill Award for Outstanding Exploration (2019 Harold W. Borns Symposium) A. McGinn.
- Best Presentation (2019 Harold W. Borns Symposium) – M. Williams, M. Dryak (co-winners).
- Best Poster Award (2019 Harold W. Borns Symposium) – M. Miles, A. Mereghetti (co-winners).
- Student Outstanding Service Award (2019 Harold W. Borns Symposium) – A. McGinn, W. Kochtitzky (co-winners).
- 2019 CCI Award - University of Maine Graduate Symposium – J. Smith-Mayo, R. Tasnim, J. Mohan.
- 2019 MSGC Summer Fellowship Awards – C. Deck, E. McConnell.

Student Presentations and Projects

- World Climate Negotiations Simulations held at Maine schools – A. McGinn and W. Kochtitzky.
- Follow a Researcher highlights UMaine student studying iceberg melt – M. Dryak.
- Press Herald interviews S. Elias, G. Dill for Lyme disease article.
- National Geographic reports on Antarctica research expedition by B. Hall & M. Spoth.
- Will Kochtitzky awarded 2019-20 Fulbright grant.
- Jessica Scheick’s research reveals icebergs can help predict sea level rise, Eos reports.
- UMaine Social media spotlight: E. Blackwood.
- Emily Blackwood chairs Advances in Heritage Preservation – 2019 Society of American Archaeology.
- Kit Hamley poster, “Fire and Foxes” – 2019 Society of American Archaeology Annual Meeting.
- Chris Sockalexis presented a talk – 2019 Society of American Archaeology Annual Meeting.
- Ani St. Amand presented a poster – 2019 Society of American Archaeology Annual Meeting.
- BDN interviews S. Elias for article on invasive Japanese barberry, ticks.
- Sierra magazine interviews A. Boucher for article on diversity in field research.

Preserving-Restoring Infrastructure

Renovation or Construction Projects Completed - N/A

Renovation/Construction Projects Planned for Upcoming Year

- Completion of unfinished area third floor Bryand.

Anticipated Challenges/Needs

For the Climate Change Institute to continue to function at the cutting edge of climate change and continue to thrive and lead in the nation and the world requires resources. Following from CCI’s recently developed Climate Change Institute Strategic Plan (2019) are the most essential needs for the agenda described above. Many components of the plan build on the strengths of CCI in research to address the growing needs to enhance outreach to public and private constituencies. Some needs will benefit from being funded through shared relationships with other units on campus.

Priority Staff Needs

- Base funding for Communications/Outreach/Science Writer
- Base funding for part-time Computer Systems Administrator

Critical Tenure Track Faculty Needs (some co-sponsored with academic units)

- Tenure track Maine State Climatologist. To interact with Maine stakeholders, facilitate collaboration between CCI, Cooperative Extension, NOAA, and the NWS, undertake climate modeling research, and oversee the development and expansion of CCI Big Data analysis and visualization tools. Likely tenure home for this position is SECS.
- Tenure track Marine Geologist emphasizing coastal erosion/policy. The likely tenure home for this position is SECS (reflecting imminent J. Kelley retirement).
- Tenure track Paleontologist/Zooarchaeologist (with specialization in the Arctic, coastal/marine systems, or fauna of the Americas, reflecting loss of expertise and unit strengths in coastal zooarchaeology, Arctic/Subarctic archaeology, and the paleoecology and human history of the Americas). Likely tenure home for this position is SMS.
- Tenure track Aquatic Geochemist/Paleolimnologist (reflecting S. Norton retirement) with likely tenure home SECS.
- Tenure track Permafrost Scientist (expertise specifically in permafrost field or remote sensing research, numerical modeling, and/or biogeochemistry processes). Likely tenure home SECS.
- Tenure track Social Scientist (human dimensions of changing Arctic). To support decision-support science, climate adaptation, outreach, and service aspects of CCI. Likely tenure home is the Department of Anthropology (reflecting imminent J. Roscoe retirement).

Graduate Student Resources

- Additional graduate student assistantships

Additional Faculty/Scientist Needs for Grand Challenges

- Climate/Earth Systems Modeler
- Atmospheric Scientist/Meteorologist

New Initiatives

Growing Convergence Research - Integrating knowledge, methods, and expertise from different disciplines and forming novel frameworks to catalyze scientific discovery and innovation.

Expanding Arctic Research and Education – Enhancing our world-renowned leadership as a center for research and education on Arctic change.

Climate Futures - Providing an interactive framework for developing plausible scenarios for near to long-term future climate with a focus on: health, ecosystem services, economy, hazards, environmental and energy policy, geopolitics, cultural heritage, and quality of life.

Improved Interactions with Decision-Makers - Unravelling human and environment interactions (past and present) as guidelines for better decisions now and in the future.

Big Data - Using interdisciplinary teams and innovative technologies to integrate diverse physical, chemical, biological, and social science data to solve climate-driven complex problems.

Enhanced Science Communication – Bringing climate science into the public sphere with clear explanations and applications for people and ecosystems.

Internal or External Center/Institute Reviews

Completed or In Progress During the Year - Following on CCI's tradition of developing and enacting 5 year plans CCI completed, as of May 2019 - *Climate Change Institute Strategic Plan*. The plan was coordinated by the CCI Policy Advisory Committee in consultation with the CCI Director and Associate Director.

Upcoming in the Next Year – N/A

Awards Submitted (#)	Awards Submitted (\$)	Awards Received (#)	Awards Received (\$)
30,931,730	75	13,149,134	43

Contracts Received (#)	Contracts Received (\$)
0	0

UGrads Supported (#)	UGrads Supported (\$)	Grads Supported (#)	Grads Supported (\$)
20	33,267	CCI Funded Graduate Students (20) CCI Affiliated Graduate Students (33)	459,149

Staff Supported (#)	Staff Supported (\$)
6	329,551

Joint Faculty (#)	Associate Faculty (#)	External Associates (#)	Research Faculty (#)
Joint Faculty (13) Cooperating Faculty (20) Adjunct Faculty (6)	2	6	16

Publications (#)	Presentations (#)	Workshops (#)	Tours (#)
206	130	4	24

Patents (#)	Licenses (#)	Spin-off Companies (#)	IP Revenue (\$)
0	0	0	0

Gifts / Donations (\$)	Other Revenue (\$)
155,019	0