



CLIMATE CHANGE INSTITUTE FY2020 Annual Report

Research Activity for the period
July 1, 2019 - June 30, 2020

EXECUTIVE SUMMARY

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 frequency and magnitude of storms, floods, droughts, wildfires and other extreme events. The Climate Change Institute 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 aspects of climate change and the application of these findings at local to international scales. CCI continues to maintain its high level of interdisciplinary activity, research funding, return on indirect, publications, state, national/international leadership, outreach and its role as the focal point for the University of Maine's climate change research excellence (Figure 1). Examples for the current reporting year follow. CCI currently administers 70 research grants and contracts. CCI return on investment for FY2020 remains high at 29.10 factored using the Research Information Management Tool and based on activity by all CCI affiliated researchers. Research productivity as summarized in the form of peer-reviewed publications (183), 132 presentations, field studies ranging from Maine to the remotest reaches of the planet, 47 workshops, and 16 tours. CCI provides a climate change framework (Figure 1) for several academic units at the university (eg., Schools of Earth and Climate Sciences, Marine Sciences, Biology and Ecology, Business, Department of Anthropology) and the University of Maine Law School. CCI interacts with:

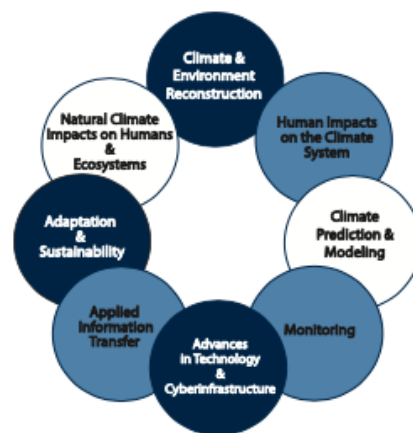


Figure 1 - Examples of CCI research themes that interface with other UM units.

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) including a prominent role in Gov. Mills' Maine Climate Council; federal agencies (eg., National Science Foundation, 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, Columbia, 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 numerous media venues, public talks, popular articles, and web-based software with the most prominent example being Climate Reanalyzer.

CCI continues to maintain its legacy of field expeditions throughout Maine and the world and as a consequence offers the more than 50 graduate students associated with CCI the opportunity to experience on the ground research and career changing experiences. CCI's eleven research laboratories continue to produce high quality data and hands on opportunities for students - all leading to transformational scientific discoveries. For more detail see

<https://climatechange.umaine.edu/>

ACCOMPLISHMENTS, CHALLENGES, GOALS FOR NEXT YEAR

1. Support and grow Maine's economy

- a. Impact – The table below summarizes CCI faculty total award history for awards issued FY2020 (top); submission history total in FY2020 (middle) and FY2020 Award History (Active in Range) total of all active awards in FY 2020 whose grant term date has not yet expired (bottom). The Research Information Management Tool was used to run queries for the FY2020 totals; the information presented within the table below represents grant activity from all CCI affiliated researchers (Appendix A). CCI ROI for FY2020 is 29.10 with a funding success rate of 75% (see Appendix A for details). FY2020 CCI Gifts & Donations total \$86,788.

CCI AWARD & SUBMISSION HISTORY - FY2020		
TOTALS INCLUDE GRANTS/SUBMISSIONS BY ALL AFFILIATED RESEARCHERS		
CCI AWARD HISTORY - FY2020		
# TOTAL AWARDS	TOTAL OF ALL PROJECTS	ROI - FY 2020
48	\$20,170,478	29.10
CCI GRANT SUBMISSION HISTORY - FY2020		
# TOTAL AWARDS	TOTAL OF ALL PROJECTS	
66	\$29,587,395	
CCI AWARD HISTORY (ACTIVE IN RANGE - includes all currently active grant awards) - FY2020		
# TOTAL AWARDS	TOTAL OF ALL PROJECTS	
155	\$63,871,303	

Achievements/awards/honors examples:

Mayewski leads the interdisciplinary National Geographic and Rolex Perpetual Planet Everest Expedition including five other CCI researchers (Putnam, Potocki, Clifford, Strand, Mattas).
 CLAS Interdisciplinary Graduate Student Award (2020) – Abigail Mann.
 McDonough MacKenzie receives Ecological Society of America award for young scientists.
 Kit Hamley receives Edith Patch award.
 Frankie St. Amand receives Janet Waldron Doctoral Research Fellowship.
 WiSTEMM recognizes Presidential Award winner Jasmine Saros.
 Jacquelyn Gill's 'Warm Regards' nominated for iHeartRadio's 'Best Green Podcast'.
 Jasmine Saros named Fellow of Association for the Sciences of Limnology & Oceanography.
 NCAAE Founder's Award named for Daniel Sandweiss.
 Arctic Futures Workshop 2019-20 brings UMS researchers and students together resulting in collaborative research and new proposals focused on Maine and the Arctic.
 Brenda Hall receives 2019 NSFA Outstanding Research Award.
 Brenda Hall receives 2020 Rising Tide Career Recognition Award.
 Karl Kreutz – Science Ed. Research Center (SERC) On the Cutting Edge Top Contributor, 2019.
 Brian McGill named 2019 ISI Highly Cited Researcher (top 0.1% of researchers for research citations for preceding 10 years).
 Laura Rickard inducted into the Phi Kappa Phi honors society, Chapter 1 UMaine 2020.

b. Authentic Experience examples:

CCI IceBreaker Event – annual venue for CCI faculty and new and current CCI graduate students to explore areas of collaborative research.

CCI Research Expedition examples – all include faculty and graduate students (examples):

- Rediscovering the Ancient Maya City of Tikin Ha, Belize.
- Chasing the Mammoth Steppe – Exploring the Past and Present of Megafauna in the Arctic, Sakha Republic, Yakutia.
- Creating the Midden Minders Citizen Science Program, Maine Coastline.
- Biogeography of the Grand Kankakee Marsh, Northern Indiana, U.S.
- Iceland Lightweight Everest Drill Test (March 2019).
- Chasing the Ice in Greenland: How are Lakes Going to be Affected by Earlier Ice-Out?
- How Boulders in Mongolian Mountains Reveal the Pace of Climate Change.
- Predicting the Sensitivity of Boreal Lake Ecosystems to Climate Change, Isle Royale National Park, Michigan.
- South Georgia and South Sandwich Islands Expedition, Southern Ocean.
- CCI leads National Geographic, Rolex Perpetual Planet Extreme Expedition to Mount Everest.
- Molluscan Climate Proxies and El Niño-Southern Oscillation, North Coast, Peru.
- Climate Impacts on Glaciers of the Southern Patagonian Icefield, Chile.

Scholarship & Creative Activity examples:

- Climate-driven Migration: Prioritizing Cultural Resources Threatened by Secondary Impacts of Climate Change – Springer Nature, Natural Hazards - Frankie St. Amand, Daniel H. Sandweiss, Alice R. Kelley.
- Lin Wei: Student from China navigates world through code and choreography with Sean Birkel.
- GlacierHub highlights grad student Clifford’s Saharan dust storm findings.
- Clifford and Kurbatov’s dust storm study among top 10% of JGR: Atmospheres papers.
- Sandwich Enterprise interviews Clifford about Everest experience.
- Graduate students speak at middle school about Everest expedition, Sun Journal reports – P. Strand & L. Mattas.
- Center for Scientific Evidence in Public Issues (EPI Center) at the American Association for the Advancement of Science (AAAS) – E. McConnell.

c. Create and Disseminate New Knowledge examples:

- Fernandez co-chairs Gov. Mills’ Maine Climate council Physical Sciences Basis Team.
- Several CCI researchers play key roles in Maine Climate Council (Fernandez, Birkel, Kelley, Dixon) activities that will set the State’s course in terms of mitigation and adaptation.
- Scientific American quotes Mayewski in article on coronavirus.
- Meet a Climate Scientist Studying Clues Found in Ice – Mayewski – NBC Boston.
- New book Principles of Glacier Mechanics – Roger LeB. Hooke.
- Kreutz studies 10,000 year-old ice to understand Pacific Ocean drivers of Arctic warming.
- C&EN interviews Miner on organic pollutants found in the Arctic.
- Mayewski, Norchi cover story about coronavirus, climate change for Global Geneva.
- ‘The Maine Question’ asks about air quality during pandemic – S. Birkel.
- Second Century Stewardship reports CCI faculty members conduct research in Acadia NP.
- Gill discusses Mount Everest with Live Science for Earth Day article.
- Dr. Harold W. Borns, Jr. remembered in The Antarctic Society publication – April 2020.
- Maine air has become noticeably cleaner during pandemic, Mayewski & Birkel.
- Proceedings of the National Academy of Sciences publishes four UMaine articles linking archaeology, climate change.
- Global Quarantine won’t defer Climate Change – K. Miner.

- Steps and missteps on the path to a 1665–1668 CE date for the VEI 6 eruption of Long Island, Papua New Guinea – Journal of Volcanology and Geothermal Research –Kurbatov.
- Maine Public interviews Mayewski about pollution slowdown due to COVID-19.
- Media reports on historic lead level study involving Mayewski, Kurbatov.
- Glacial termination in South America focus of UMaine-led NSF study. Hall, Denton, Putnam.
- Colleagues celebrate Hal Borns’ legacy of friendship, vision, scientific discovery.
- Medical researchers use Climate Reanalyzer to predict spread of COVID-19 - Birkel.
- Gill interviewed for Grist article on climate crisis.
- Researchers participate in events in advance of Maine Science Festival.
- Isehour recent guest on Maine Public’s ‘Maine Calling’.
- ‘The Maine Question’ talks with Gill about consequences of extinctions.
- Bulletin of Atomic Scientists highlights work of Putnam, Strand, Joyner in Mongolia.
- Campbell part of PBH NewsHour feature about ‘doomsday glacier’.
- Mayewski, Potocki talk about Everest expedition in Belfast.
- Maine’s Climate Future documents progression of accelerating change and its effects – Fernandez and 6 other CCI faculty.
- Penobscot Times shares release about Gill’s fern research.
- Glover has Southern California paleoclimate work featured in Eos Research Spotlight.
- Times Record quotes Dixon about eco-friendly measures.
- Gill to explore why ferns flourished after asteroid strike that doomed dinosaurs.
- Exhibit highlights threatened shell middens with Wabanaki history – A. Kelley, B. Newsom.
- CentralMaine.com reports Fernandez talk at celebration of conservation milestone.
- Washington Post interviews McDonough MacKenzie re research on bird arrivals.
- Speaking in Maine airs Mayewski’s ‘Arctic Climate Change and Maine’ talk.
- Science magazine speaks with Mayewski about Everest expedition.
- Mayewski continues climate change conversation on ‘The Maine Question’.
- Der Spiegel interviews Mayewski about Everest expedition.
- ‘The Maine Question’ probes Mayewski’s explorations, discoveries.
- As climate warms, stronger Saharan dust storms will increase glacier melt, worsen air quality – Clifford quoted in numerous international and national venues.
- Mayewski among scientists ranking world’s most important, most threatened mountain water towers.
- WVII interviews Kurbatov about 2 million-year-old ice cores.
- CCI teams with Princeton to analyze 2 million-year-old ice cores.
- Climate Reanalyzer cited in Stock Daily Dish story about brutal cold – S. Birkel.
- Fowler’s clear focus: Understanding drivers of Jordan Pond water clarity changes.
- National Geographic quotes Mayewski in article about melting glaciers.
- Migratory birds arriving earlier, but not keeping pace with leaf-out. McDonough MacKenzie.
- Winski: 54,000-year-old South Pole ice core reveals past wind patterns, climate.
- Lyon quoted in Press Herald article on threatened bird species in Maine.
- Contributions by Hamilton, Stearns cited in Science magazine article.
- Medical Daily interviews Lyon about heat wave study.
- Ice core source discovery re volcanic activity, climate system interactions –Kurbatov.
- Phys.org publishes study of expanding spatial extent of heat waves –Lyon.
- UMaine experts among leaders in new Climate Adaptation Fellowship –Fernandez.
- Fernandez quoted in Ellsworth American article on going carbon neutral.
- Mayewski quoted in News Center Maine report on rare mosquito-borne virus.
- Koehler, Fernandez cited in Press Herald ‘Maine Gardener’ column on climate change.

- Gill discusses permafrost caves, harrowing medical experience in 2017.
 - Maine Public interviews Fernandez after Maine Climate Council meeting.
 - Isehour part of multidisciplinary NSF project re waste through circular economy.
 - Mayewski featured in BDN 'Climate change and Maine's next 200 years' event.
 - Fernandez discusses state's climate future on Maine Public.
 - Isehour recent guest on Maine Calling.
 - Miner chosen as Ambassador to inspire next generation of STEM pioneers.
 - Birkel talks with WVU about extreme weather, Hurricane Dorian.
 - Allen expert source for WVU's Summit to Shore series.
 - WVU speaks with McDonough MacKenzie, Putnam, Strand re climate research.
 - CCI researchers lead Arctic Futures Workshop in South Greenland.
 - Working Waterfront speaks with Allen about Gulf of Maine temperature research.
 - Researchers reconstruct Holocene climate change in SH - Putnam, Denton.
 - Decades-old pollutants melting out of Himalayan glaciers – K. Miner.
 - Eos speaks with Saros about new research on Greenland, warming trends.
 - For plants, McDonough MacKenzie pens love letter, launches website.
 - Uncontrolled Chemical Releases: A Silent, Growing Threat – EOS – K. Miner.
 - NYT article on study of extreme weather, toxins quotes Miner.
 - Press Herald cites CCI in article on study predicting more 'extreme heat' days.
 - Kelley provides input for ICOMOS climate change, cultural heritage report.
- d. Partnerships, Infrastructure, Communication – examples of primary approaches:
- **Convergence Research** – CCI has a legacy of integrating and sharing knowledge (websites, meetings, methods papers, and expertise from different disciplines) and forming novel frameworks to catalyze scientific discovery and innovation at the university, state, national and international level through leadership of multi- and interdisciplinary projects nationally and internationally.
 - **Arctic Research and Education** – CCI's world-renowned leadership provides a focus for research and education on Arctic change across UM and UMS.
 - **Climate Futures** – A CCI developed 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. Recent products include Maine Climate Futures 2020 and CCI participation in Gov. Mills' Maine Climate Council.
 - **Interactions with Decision-Makers** – example - Maine Climate Council involvement.
 - **Science Communication** – CCI brings climate science into the public sphere with clear explanations and applications for people and ecosystems as noted above in earlier sections of this report.
- e. Great Place to work; Lifelong Relationships
 Almost all CCI graduate students engage in a variety of CCI led field experiences that take them into new places, cultures and experiences for several days to months. Through these activities CCI students and faculty share ideas, research and solve problems as teams. Solving commonly identified scientific problems breaks down barriers allowing identification of individual strengths and the value of teamwork.
- f. Goals for Next Year – CCI strives to continue to stay at the cutting-edge of climate change science and in the process provide a model for students, faculty and staff to learn how to deal with challenges ranging from equipment failures to adjusting to new realities such as those imposed by COVID-19 and throughout by continuing to produce substantive contributions to and applications of climate science.

Appendix A – CCI FY2020 affiliated researchers.



FY2020 Faculty Listing		
Name	Administrative Title	Affiliation
Guleed Ali	Ford Foundation Postdoctoral Fellow	CCI
Katherine Allen	Coop. Assistant Professor	CCI/SECS
Daniel Belknap	Professor Emeritus	CCI/SECS
Nancy Bertler	Adjunct Assistant Research Professor	CCI/Victoria University of Wellington
Sean Birkel	Research Assistant Professor	CCI
Pascal Bohleber	Visiting Postdoctoral Researcher	CCI/University of Venice
Gordon Bromley	Adjunct Assistant Professor	CCI/NUI Galway
Seth Campbell	Research Assistant Professor	CCI/SECS
Fei Chai	Cooperating Professor	CCI/SMS
Sudarshan Chawathe	Cooperating Associate Professor	CCI/SCIS
Ron Davis	Professor Emeritus	CCI/SBE
George Denton	Professor	CCI/SECS
Phillip Dickens	Associate Professor of Computer Science	CCI/SCIS
Daniel Dixon	Research Assistant Professor	CCI/Office of Sustainability
Alice Doughty	External Associate	
James Fastook	Cooperating Professor	CCI/SCIS
Ivan Fernandez	Distinguished Maine Professor	CCI/SFR
Jennifer First	External Associate	CCI/School of Social Work – University of Southern Maine
Jacquelyn Gill	Associate Professor	CCI/SBE
Katherine Glover	Associate	CCI
Brenda Hall	Professor	CCI/SECS
Sarah Hall	Adjunct Research Professor	CCI/College of the Atlantic
Roger Hooke	Research Professor	CCI/SECS
Cindy Isenhour	Associate Professor	CCI/Anthropology Dept.
George Jacobson	Professor Emeritus	CCI/SBE
Shaleen Jain	Cooperating Assistant Professor	CCI/CEE
David Keefer	External Associate	CCI
Alice Kelley	Research Assistant Professor	CCI/SECS
Joseph Kelley	Professor Emeritus	CCI/SECS
Peter Koons	Cooperating Professor	CCI/SECS
Karl Kreutz	Professor	CCI/SECS
Andrei Kurbatov	Associate Professor	CCI/SECS
Justin Lapp	Associate	CCI/Dept. of Mechanical Engineering
Danielle Levesque	Cooperating Assistant Professor	CCI/SBE
Bradfield Lyon	Associate Research Professor	CCI/SBE
Kirk Maasch	Professor	CCI/SBE
Caitlin McDonough MacKenzie	External Associate	CCI
John Mahon	Professor Emeritus	CCI/Maine Business School
Paul Mayewski	Director/Distinguished Maine Professor	CCI/SECS
Brian McGill	Cooperating Assistant Professor	CCI/SBE
Lou McNally	Research Assistant Professor	CCI/UMaine Machias/UMaine Augusta
Kimberley Miner	External Associate	CCI/JPL Caltech
Alexander More	Assistant Research Professor	CCI/Harvard University/Long Island University
Peter Neill	Research Associate	CCI/World Ocean Observatory
Bonnie Newsom	Assistant Professor	CCI/Anthropology Dept.
Charles Norchi	Cooperating Professor	CCI/Maine School of Law
Robert Northington	External Associate	CCI/Husson University
Stephen Norton	Professor Emeritus	CCI/SECS
Andrea Nurse	Research Associate	CCI
Brian Olsen	Associate Professor	CCI/SBE
Gordon Oswald	Research Professor	CCI

Andrew Pershing	Adjunct Professor	CCI/Gulf of Maine Research Institute
Aaron Putnam	Assistant Professor	CCI/SECS
Laura Rickard	Assistant Professor	CCI/Dept. of Communication & Journalism
Paul Roscoe	Professor Emeritus	CCI/Anthropology Dept.
Daniel Sandweiss	Professor	CCI/Anthropology Dept.
David Sanger	Professor Emeritus	CCI/Anthropology Dept.
Jasmine Saros	Professor	CCI/SBE
Joerg Schaefer	Adjunct Professor	CCI/Columbia University
Rachel Schattman	Associate	CCI/SFA
Molly Schaufler	Assistant Research Professor	CCI/SECS
Jessica Scheick	External Associate	
Kristin Schild	Assistant Research Professor	CCI/SECS
Anton Seimon	Adjunct Assistant Professor	CCI/Appalachian State University
Jefferson Simoes	Visiting Professor	CCI/Universidade Federal do Rio Grande do Sul
Bill Sneed	Assistant Research Professor	CCI
Sharon Sneed	Assistant Research Professor	CCI
Kristin Sobolik	Adjunct Professor	CCI/University of Missouri - St. Louis
Marcella Sorg	Research Professor	CCI/MCSPC
J. Curt Stager	External Associate	CCI/Paul Smith's College
Jeff Thaler	Associate Faculty	CCI/Maine School of Law
Andrew Thomas	Cooperating Professor	CCI/SMS
Dominic Winski	Assistant Research Professor	CCI
Manuel Woersdoerfer	Associate	CCI/SCIS
Gregory Zaro	Associate Professor	CCI/Anthropology Dept.