# Witness the ARCTIC

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# ARCUS Member Highlight — Cold Climate Housing Research Center and the National Renewable Energy Laboratory

The Cold Climate Housing Research Center (CCHRC) was formed in 1999 by Alaska homebuilders who identified the need for applied research and testing to create better buildings for the north. Its mission is to promote and advance healthy, affordable, sustainable shelter for Alaskans and circumpolar people. In 2006, CCHRC's LEED Platinum Research and Testing Facility was built in Fairbanks to demonstrate a wide array of cold-climate technologies, including an adjustable foundation on permafrost, solar thermal storage, a ground source heat pump, and many different insulation and ventilation strategies. CCHRC's work benefits circumpolar communities by helping to define the building practices, standards, and policies that shape housing in the north, and working hand-in-hand with communities to ensure housing reflects local climate and culture.

*Figure 1. Fall Colors: CCHRC's Research and Testing Facility in Fairbanks, Alaska is considered the farthest-north LEED Platinum building in the world, demonstrating innovations such as geothermal, solar, and cold-climate building science. Photo Courtesy of CCHRC.*

In 2020, CCHRC joined the Department of Energy (DOE) National Renewable Energy Laboratory (NREL), a world leader in energy efficiency, clean energy, and systems integration. NREL researchers are leading the nation's transformation from a national electrical grid consisting of large centralized power generation to a more integrated and flexible system with greater diversity of resource generation, millions of variable distributed resources, dynamic smart loads, and new energy storage technologies. This partnership brings together NREL's decades-long history working with clean energy technologies and CCHRC's deep experience developing sustainable, culturally appropriate housing with people of the north. It also strengthens collaborations with the University of Alaska as well as federal agencies including Department of Defense, Department of Homeland Security, Department of Housing and Urban Development, and many others who work in the Arctic.

Guiding this work is an Arctic strategy that focuses on transforming communities, strengthening economies, and enhancing resilience and security. The research and experience gained in the Arctic will be applied to create healthy, resilient, sustainable homes and communities worldwide.

# Products & Services

**The Building Science Research Program** tests and vets building envelopes, foundations, heating and mechanical systems, and other elements essential to healthy, durable housing in cold climates. The history of Alaska has shown many building failures from technologies inappropriate for our climatic extremes and soil conditions. CCHRC's building scientists focus on issues like moisture control, thermal performance, heating and domestic hot water, ventilation, and indoor air quality.

*Figure 2. CCHRC works with remote Alaska communities to demonstrate affordable, culturally appropriate homes and train local workforces. In 2013, researchers built two high-efficiency homes with the Yup'ik community of Atmautluak in southwest Alaska. Photo Courtesy of CCHRC.*

**The Sustainable Northern Communities Program** applies the knowledge gained in the lab to housing challenges throughout Alaska and the circumpolar north. Designers work with housing authorities and communities to develop energy efficient buildings that emphasize local resources and local labor, reducing energy use by 80% on average while reducing construction costs dramatically. A "holistic approach" ensures housing and development projects are driven by local communities in accordance with culture, lifestyle, and traditional knowledge.


*Figure 3. CCHRC partnered with the Yup'ik community of Quinhagak in 2010 to build a super-insulated home that could withstand the cold, wet climate of the Bering Sea Village. Photo Courtesy of CCHRC.*

*Figure 4. The octagon-shaped home in Quinhagak was based on the traditional round design of winter shelters built by the local people. Photo Courtesy of CCHRC.*

**The Social and Economic Analysis Program** analyzes and packages data on homes and buildings that is used to inform housing policy and programs. This work provides a deeper understanding of Alaska's housing and commercial building stock, energy use, and potential for energy savings. CCHRC regularly updates Alaska's regional residential energy standards to reflect the best building science and economic considerations. As a direct result, a home built today uses 30% less energy on average than a new home constructed 20 years ago. Durability and indoor air quality have also improved at little additional cost to homeowners.

**CCHRC's Multifaceted Outreach Program** disseminates research and best practices to the public through trade shows, classes, and consulting with contractors and homeowners. CCHRC also maintains a robust library of publications, videos, and multimedia.

**CCHRC's Diverse Staff** support the wide range of programs and services.

For Further Information, contact:

CCHRC Regional Director: Bruno Grunau, Bruno.grunau@nrel.gov
CCHRC Communications Director: Molly Rettig, molly.rettig@nrel.gov
CCHRC Arctic Strategic Program Manager: Sherry Stout, sherry.stout@nrel.gov

# SIPN2 News

The Sea Ice Prediction Network–Phase 2 (SIPN2) is a network of US and international members working to advance research on the processes driving sea ice predictability, prediction products, and the communication of findings to interested stakeholders. SIPN2 is funded by NSF-Arctic Sciences Section and the U.K. Natural Environment Research Council (NERC), with several collaborators and partners.

The Sea Ice Outlook (SIO) provides an open process for those interested in Arctic sea ice to share ideas and predictions for Arctic ice extent, sea-ice probability, ice-free date, and other variables. The SIO produces reports in June, July, and August containing a variety of perspectives on Arctic sea ice—from observations of current conditions, to advanced numerical models, to qualitative perspectives from citizen scientists. Post-season reports provide in-depth analyses of factors driving sea ice, as well as explore the scientific methods for predicting seasonal ice extent.

The 2020 SIO monthly reports for June, July, and August are available online. The September monthly averaged sea ice extent at the end of the 2020 summer melt season was 3.92 million square kilometers. This is the second lowest in the satellite record that began in 1979. A 2020 Interim Post-Season Report, published in mid-October, is intended as a quick postseason update that summarizes how the outlooks did in comparison to the observed September monthly mean extent.

A full post-season report, with a more in-depth analysis of the sea ice season and an evaluation of the accuracy of the Outlook predictions, will be published in February 2021.

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# Surveys Find "Two Kinds" of Public Knowledge about Polar Regions

*By: Lawrence Hamilton, Carsey School of Public Policy, University of New Hampshire*

How much does the US public know about polar regions? Researchers exploring this topic have occasionally mixed factual questions in among the more typical opinion queries on general-public surveys. A recent article in the Journal of Geoscience Education (Hamilton 2020) describes a key finding from these surveys: there are "two kinds" of polar knowledge. One kind is evoked by questions like this:

Which of the following three statements do you think is more accurate? Over the past few years, the ice on the Arctic Ocean in late summer...

- Covers less area than it did 30 years ago (correct)
- Declined but then recovered to about the same area it had 30 years ago
- Covers more area than it did 30 years ago

The declining area of late-summer Arctic sea ice, tracked by satellites over the past 40 years, is a basic and widely reported scientific fact. On surveys, however, many people do not recognize this fact, but answer instead based on their opinion about global warming. Similar results occur if we ask whether, in recent decades, CO2 concentrations in the atmosphere have increased: again, many people give answers contrary to science, but reflecting instead their beliefs or political identity. Although these questions involve important and well-established facts, survey responses defy simple interpretation as indicators of knowledge.

The second type of polar knowledge involves questions that are equally factual, and perhaps equally relevant to climate change, but have answers that cannot be guessed (right or wrongly) from one's political beliefs. For example,

Which best describes the North Pole?

- Ice a few feet or yards thick, over a deep ocean (correct)
- Ice more than a mile thick, over land
- A rocky, mountainous landscape

Opinions about global warming whisper no clues that the first answer (order is rotated on the actual surveys) is correct. Instead, a person needs to be able to visualize a globe, or to know

basic geography—which, unfortunately, many do not. Figure 1 shows parallel results from nationwide and regional surveys: only about 44% could answer this question correctly. It illustrates a second type of polar knowledge, which is independent from political beliefs. Figure 2 shows the percentage of accurate responses to six factual questions, correlatd by respondent political identity

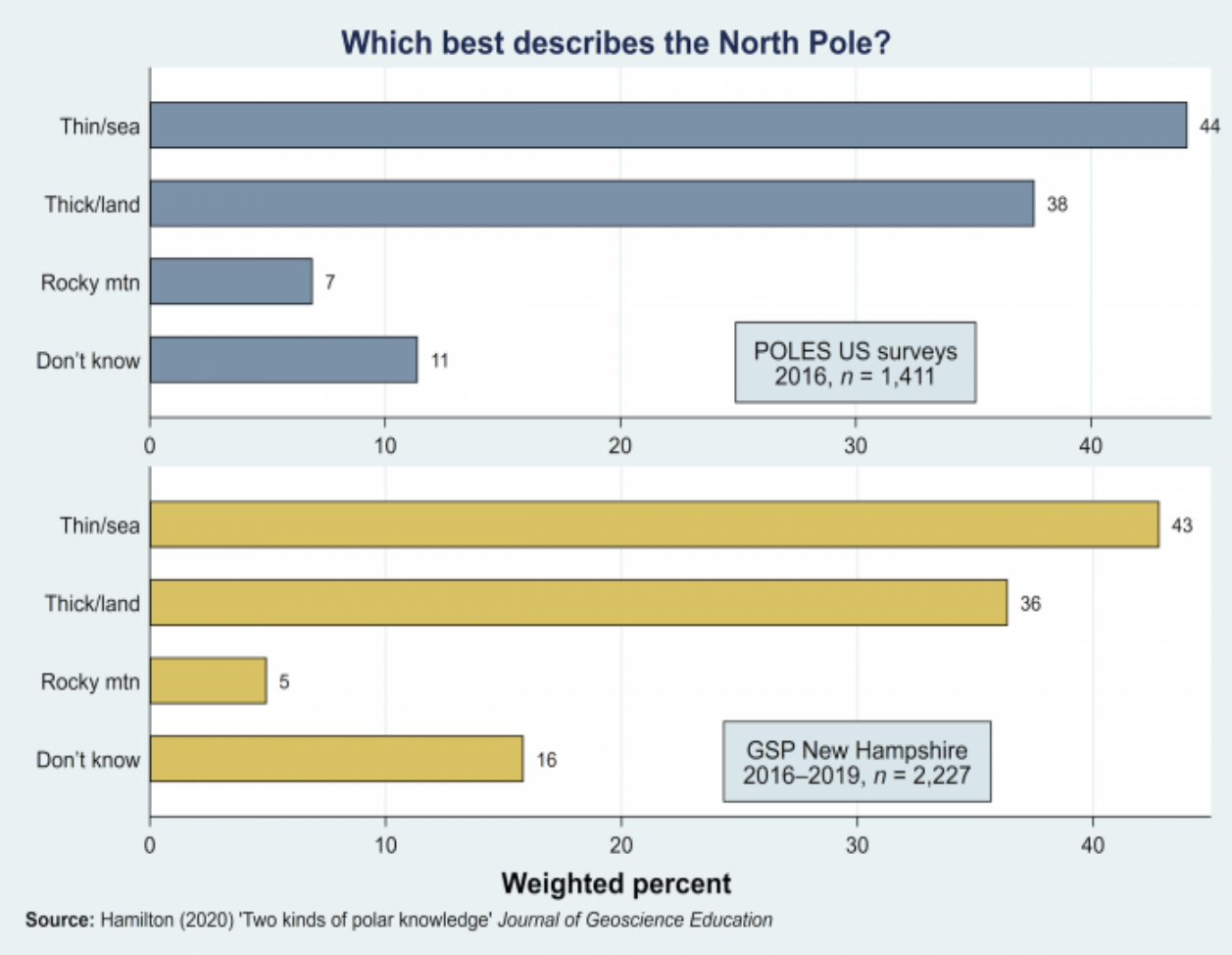


*Figure 1. North Pole question responses from the nationwide POLES surveys (2016) and a series of statewide New Hampshire surveys (2016–2019). Figure from Hamilton (2020).*

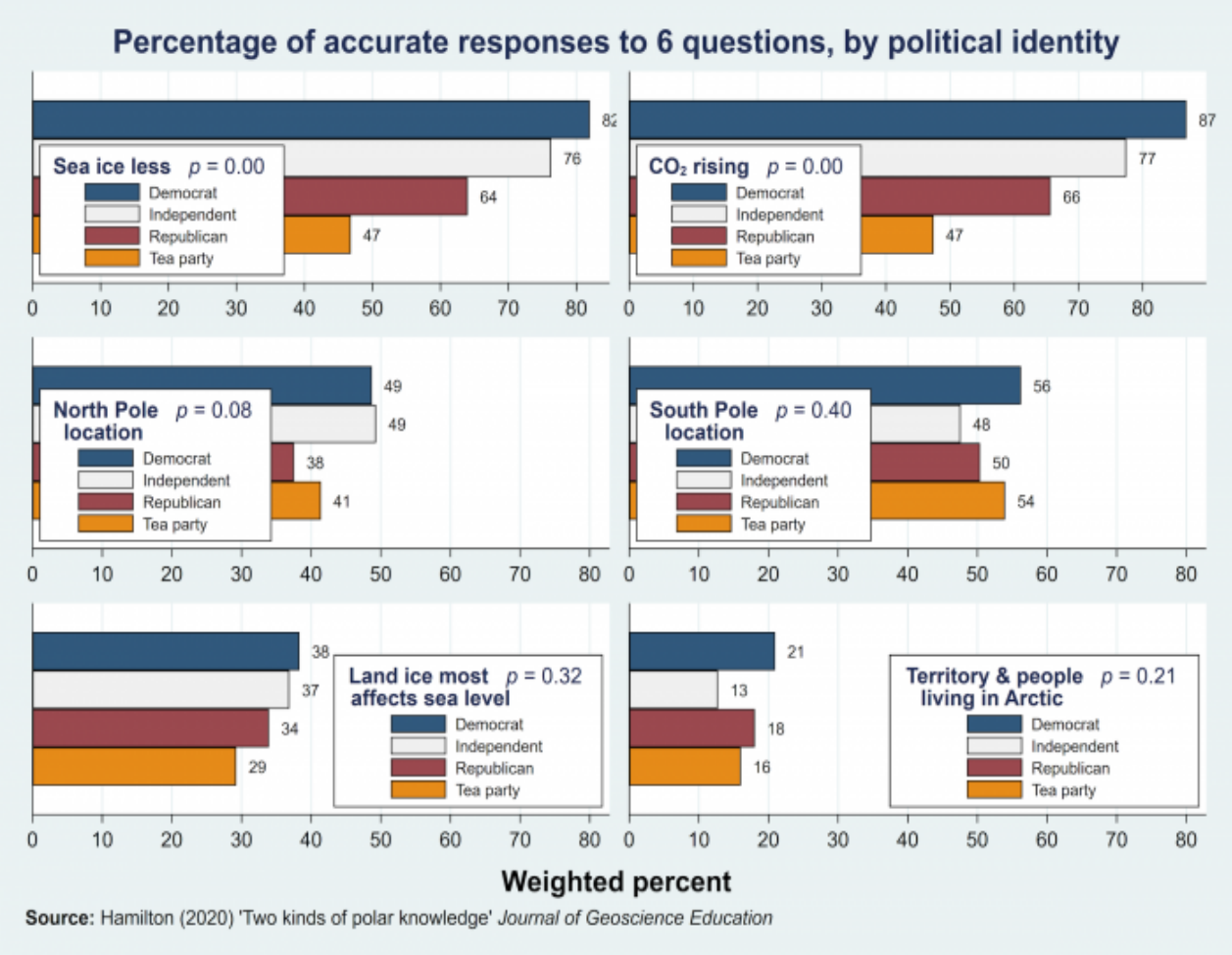


*Figure 2. Percentage of accurate responses to six factual questions, by respondent's political identity (POLES US surveys 2016). Figure from Hamilton (2020).*

How might such belief-neutral knowledge questions be used in research? Panels a–e in Figure 3 show the responses to five questions asked on a nationwide 2016 survey (details in Hamilton 2018). Adding up the number of correct answers yields a belief-neutral knowledge score (panel f), which can be compared with people's self-assessed understanding of climate change. Among some groups, actual and self-assessed knowledge are correlated—as one might hope—but among other groups they are not related at all (Hamilton 2018; Hamilton and Fogg 2019). Another possible application of such measures involves inter-regional or international comparisons. For example, levels of polar knowledge among Australians appear quite similar to general US levels (Tranter 2019). Levels of Arctic knowledge are somewhat higher among Alaska residents compared with other US states—but even among Alaskans, barely half know that the US has territory and people above the Arctic Circle (Hamilton et al. 2017). Whatever the group differences, all of these studies confirm that general-public knowledge about the Earth's polar regions is thin, leaving much room for science communication.

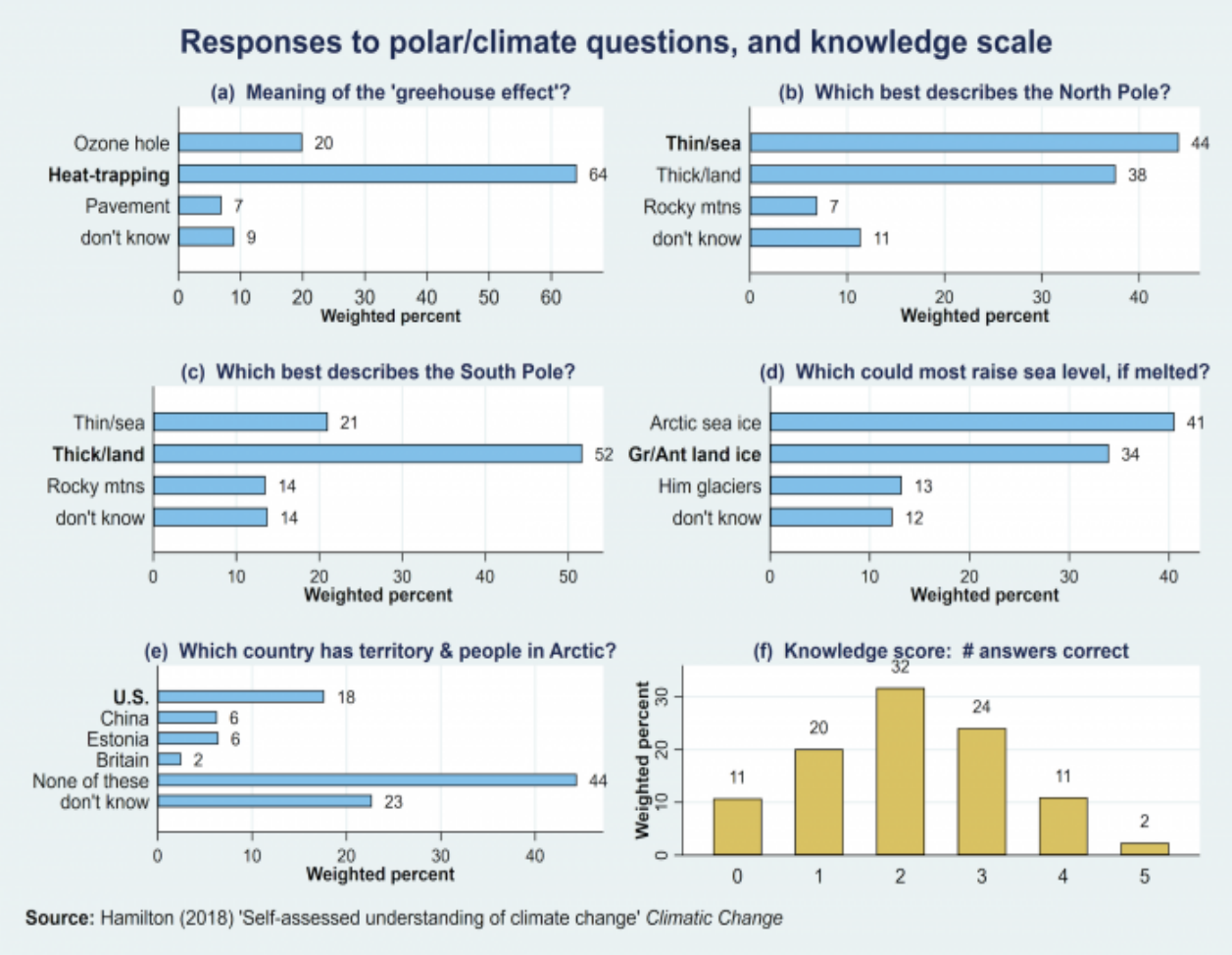


*Figure 3. Basic knowledge questions, and number of answers correct (POLES US surveys 2016). Figure from Hamilton (2018).*

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# About the Author

Lawrence Hamilton is Professor of Sociology and Senior Fellow in the Carsey School of Public Policy at the University of New Hampshire, where he teaches courses about society in the Arctic, survey research, and statistical analysis. His books include Regression with Graphics and Statistics with Stata; the latter has been translated into Arabic and Chinese. Dr. Hamilton's research focuses on human-environment interactions, in locations ranging from Arctic Alaska to northern New England or the Intermountain West. His most recent papers include "Cold winters warming? Perceptions of climate change in the North Country" (Weather, Climate, and Society 2018); "Demographic variation and change in the Inuit Arctic" (Environmental Research Letters. 2018); and "A change in the wind? U.S. public views on renewable energy and climate compared" (Energy, Sustainability and Society 2018).

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# Polar Technology Community: Sharing Experiences and Challenges in Advancing Polar Science

*By: Mark Seefeldt, Research Scientist with the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado Boulder; and Nancy French, Senior Scientist with the Michigan Tech Research Institute*


*Figure 1. Polar Technology Community graphic created by Zeb Polly, ARCUS.*

Antarctica and the Arctic are common with their extreme environments, involving harsh climatological conditions, long polar nights, and concentrated field seasons during the summer months. Scientists and support personnel often encounter difficulties in achieving their goals due to the challenges involved in working in remote and harsh environments of the Arctic and Antarctic. Instrumentation, communications, power systems, and physical infrastructure are frequently modified from what is used in the lower latitudes to adapt and be successful in the polar regions. The result is that those who regularly work in the polar regions are interested in hearing what has worked for others, as well as brainstorming on new ideas to conquer the unforgiving environment. The Polar Technology Community is a new community born out of the Polar Technology Conference series with a goal of bringing common stakeholders together to share experience and ideas in the application of technology to the polar regions.

The Polar Technology Conferences are meetings of experts sharing experiences and challenges related to the applications of technology in the polar regions for the advancement of science goals. The Polar Technology Conferences originated out of informal gatherings at Stanford University in the early 2000s, focused on small autonomous power, weather, and communications systems. Polar Technology Conferences were held annually from 2005–2016 through a community driven effort that kept the Polar Technology Conference alive and relevant. The Polar Technology Conference went into hiatus after the 2016 meeting due the lack of administrative, planning, and funding assistance; but the Polar Technology Conference returned in March 2020 with administrative support from the Arctic Research Consortium of the US (ARCUS) and funding from the National Science Foundation (NSF) Office of Polar Programs.

Participants of the Polar Technology Conferences represent a broad range of stakeholders in the polar regions including industry, academia, government, and military. The 2020 Polar Technology Conference was held at the University of Colorado Boulder from 10–12 March 2020. The original limit for the Polar Technology Conference was placed at 100 participants for funding and organizational considerations. COVID-19 had a significant impact on attendance with 29 cancellations. In the end, the Polar Technology Conference had 82 in-person attendees, representing the USA, Canada, and the United Kingdom, with a number of people from a long waitlist able to attend at the last minute. COVID-19 had the largest impact on international participation with cancelled registrants from China, Russia, United Kingdom, New Zealand, and Denmark. An online option was provided by ARCUS and there were approximately 130 remote attendees.

This year's Polar Technology Conference was centered around six themes: (1) science drivers, (2) instrumentation, (3) power systems, (4) communications, (5) data access and sharing, and (6) overarching and integrative technologies. For each theme, an invited keynote speaker kicked off a series of three presentations followed by a question and answer session for the panel of three presenters. Additionally, posters were presented covering the six themes. Strong interest in satellite communications leading up to the conference led to the formation of a special session with an in-depth overview of satellite communication options and coverage in both the Arctic and the Antarctic. The 2020 Polar Technology Conference also featured a small-format breakout discussion on the first day. The attendees formed groups of six to ten people to address polar challenges using a peer-coaching approach. Each member of a group was provided the opportunity to present a challenge and then receive guidance and problem solving strategies from the collective group. Attention from agencies and organizations outside of NSF for the 2020 Conference confirmed that researchers and technologists working in polar regions—from around the world—are eager to find a forum for exchanging ideas, challenges, and evolving technologies.

The need for a larger and ongoing community, the Polar Technology Community (Polar Technology Conference; Conference; Polar Technology Community) was realized and formed as an outcome of this year's Polar Technology Conference. The resultant Polar Technology Community is a new cohort of polar experts providing a continuing forum for the communication and exchanging of ideas and challenges. In this new structure as a community, the Polar Technology Conference expands the scope of activities beyond a conference, but will continue to focus around biannual Polar Technology Conference Workshops. Additionally, an online community, webinars, and connections with industry will provide ongoing forums for the sharing of ideas and experiences. The online community is being hosted by the Interagency Arctic Research Policy Committee (IARPC) and plans are to have quarterly webinars starting in 2021 to

keep the community active and engaged. As the Polar Technology Conference evolves, attention will remain on dealing with cutting edge technologies for the polar regions across a range of stakeholders. An emphasis will also be placed on increasing the diversity of the community and the inclusion of a broad range of participants. We will focus on expanding diversity in both technological and disciplinary stakeholders that are active in Arctic research, as well as diversity in ethnicity, culture, and gender of our community. Striving for a broad participation will enhance the opportunities available for solving issues and building capability for facing the challenges of polar research.


*Figure 2. Panel discussion at the conclusion of the oral presentations for the Science Drivers theme at the 2020 Polar Technology Conference in Boulder, CO. Each of the six themes included a panel discussion hosted by the oral presenters from that theme. Photo provided by Zeb Polly, ARCUS.*

The Polar Technology Community is expected to have a direct and positive impact on the Arctic and the science conducted in the Arctic. The Arctic is experiencing rapid climate change that is impacting the Indigenous communities, wildlife, and resources of the region. Success in understanding the changing climate of the Arctic is dependent on field programs, instrumentation, communication, and infrastructure for researchers to conduct novel and ongoing investigations. As climate change modifies the research environment, at the same time technologies that support research are changing, with more need for connectivity, instrument precision, and design that allows a range of practitioners to benefit from its use. The hope is that the Polar Technology Conference will be able to contribute, directly or indirectly, to the advancement of understanding and science in the rapidly changing Arctic.

More detailed information the 2020 Polar Technology Conference can be found here.

More information on the Polar Technology Community forum on IARPC can be found here.

*Figure 3. 2020 Polar Technology Conference in breakout groups discussing challenges in applying technology in the polar regions and receiving guidance and problem-solving strategies. Plans are to include similar small group discussion and training components in future Polar Technology Conference workshops. Photo provided by Lisa Sheffield Guy, ARCUS.*

*Figure 4. Attendees at the 2020 Polar Technology Conference listening to the oral presentations for one of the main themes. Each theme had a keynote presentation followed by two selected oral presentations. A question and answer session at the end of each provided dialogue between attendees and speakers. Photo provided by Zeb Polly, ARCUS.*

# About the Authors

Mark Seefeldt is a research scientist with the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado Boulder. His research interests involve Arctic and Antarctic meteorology and climatology with eight field seasons in the Antarctic and one in the Arctic. In recent years, his emphasis has been on the in situ measurement of precipitation in Antarctica.

Nancy French is a Senior Scientist with the Michigan Tech Research Institute where she works on sponsored research at the intersection of ecology and technology. She has focused on using remote sensing and geospatial technologies to study and inform terrestrial ecology, and in particular fire and the impacts of fire on the environment. She has studied fire in the boreal and Arctic region using advanced geospatial analysis and remote sensing supported with fieldwork measuring the structure and function of northern ecosystems.

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# Toolik Field Station Operations and Research Adjust to Impacts of COVID-19

*By: Faustine Bernadac, Toolik Field Station Facility Supervisor/Station Manager and Amanda B. Young Spatial and Environmental Data Center Manager for Toolik Field Station.*

The Toolik Field Station, operated and managed by the Institute of Arctic Biology at the University of Alaska Fairbanks and supported by the Division of Polar Programs, Directorate for Geosciences at the National Science Foundation (NSF), provides housing, meals, laboratory facilities, and support services (mapping services, technical assistance, and collection of standardized environmental data) to Arctic scientists, educators, and students from universities, institutions, and agencies from throughout the US and the world.

The 2020 field season was not spared by the impacts of the COVID-19 pandemic but months of teamwork and collaboration between the NSF, the Arctic logistics contractor, station staff, researchers, and a strict approach to COVID-19 management, have allowed the station to function at a limited capacity while providing remote access support to researchers who were not able to travel to the station.

When COVID-19 started to spread in mid-March, and consequently closed the State of Alaska, Toolik Field Station Management made the decision to close the station to researchers and operate with a minimal team with the added responsibility of providing remote access assistance to researchers not able to perform their work at Toolik. Subsequently, much effort was spent evaluating options for a safe and reasonable reopening to prevent a COVID-19 outbreak in camp.

*Figure 1. Gina Carani, Sous Chef, dressed in protective gear receiving a food delivery. Once the food (or any kind of delivery) was unloaded TFS staff in protective gear would move it to a quarantine location for three days prior to distribution. Photo courtesy of Joe Franich.*

The model agreed upon was a strict 14-day quarantine with two negative COVID tests during quarantine. Anyone wanting to go to Toolik had to comply with the protocol. As a result of this massive planning effort, the station successfully and safely reopened on 15 July. The population peaked at 43 people which, despite being a significant decrease compared to the 156-person population peak in 2019, was a manageable amount of people to accommodate and support in these times of uncertainty and allowed for a productive and successful season. Additional precautionary measures were implemented in camp such as: hand sanitizing, face covering, individual housing, and decontamination protocols for deliveries. Creative collaboration with local companies like the Northern Alaska Tour Company allowed safe transport of samples, freight, and other items to and from the station.

The researchers who came to Toolik this summer were primarily graduate students and research assistants, who are all passionate about Arctic research and Toolik. Due to the reduced population, a lot of quality time was spent discussing how to make Toolik a better place for its community; this resoundingly came down to more proactive communication and improving inclusivity and diversity. There is a severe lack of diversity in Arctic research and Toolik is no different. The Toolik Field Station is committed to improving diversity, equity, inclusion, and belonging at the station, so everyone no matter race, background, gender identity, ability,

experience, or discipline, feels welcome and part of the Arctic research community at Toolik Field Station. Actions for how Toolik will begin to become a more welcoming community will involve more proactive communication between the staff and the researchers, training on diversity and inclusivity for both staff and researchers, as well as concerted efforts to involve people from all walks of life in a variety of group activities in camp.


*Figure 2. Kinkela Vicich, SEDC technician, recording soil properties (moisture and temperature) for a remote access MS project on examining the importance of moisture on the greenness of mosses and how that influences landscape greenness indices. Photo courtesy of Amanda Young.*

*Figure 3. Cézanna Semnacher and Dave Wesolowski, SEDC Technicians, measuring stream discharge for the Arctic LTER research group along the Kuparuk River. Photo courtesy of Kela Vicich.*

The remote access support mentioned above was provided to researchers who could not come to Toolik. The term remote access has been borrowed from the INTERACT programin which the researchers themselves do not visit but have staff from a research station perform the sampling or data collection for them. Toolik Field Station Staff provided 2,344 hours of remote access from April through September 2020 to 29 funded projects, including: large long-term monitoring projects such as Arctic LTER, NEON, and ITEX-AON; as well as smaller short term projects such as Team Vole, Arctic RIOS, and a variety of INTERACT projects. Projects' activities varied from ice fishing and snow measurements in April/May, to water sampling and plant phenology in June/July, to permafrost probing and soil sampling in August/September, and met station downloads throughout. Due to the limited number of hands-on field seasons that go into students' degrees, a concerted effort was made to support post-docs, graduate students, and undergraduate projects. Some of these projects were within larger projects while others were standalone projects. Support was directly provided within these projects to four post-docs, 12 PhD students, four MS students, and at least six undergraduate researchers. These post-doc and student supported projects encompassed roughly one-third of the remote access provided.

With winter upon us, the Toolik Field Station is continuing to enforce quarantining and testing prior to any visits to the field station. The station will host fewer researcher groups than in years past this winter, however, projects will continue to be supported through remote access with increased staffing. If you have any questions about Toolik Field Station's COVID-19 policies or remote access please reach out to uaf-iab-toolik@alaska.edu.

## About the Authors

Faustine Bernadac (fcbernadac@alaska.edu) is the Toolik Field Station Facility Supervisor/Station Manager. She has worked in support of science in the Arctic and sub-Arctic regions since moving from her home country France to Alaska in 2008, managing projects all over Alaska, the Canadian High Arctic, Greenland, Svalbard, and Russia. Photo courtesy of Seth Adams.

Amanda B. Young (ayoung55@alaska.edu) is the Spatial and Environmental Data Center Manager for Toolik Field Station. She is a plant enthusiast and is particularly interested in how tools from dendrochronology and ecophysiology are used to address questions in biogeography and community ecology. In her position at TFS, her focus has expanded to include: data stewardship for both short- and long-term projects, remote access to a field research station, and many aspects of how to continue facilitating science during a pandemic. Photo credit: Amanda B. Young.

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# Arctic Data Center's New Feature Supports Registration of Dataset Citations and Usage

*By: Maya Samet, Data Science Fellow with the Arctic Data Center and Erin McLean, Community Engagement and Outreach Coordinator with the Arctic Data Center*

Journals, funding agencies, and researchers are increasingly acknowledging the importance of making data publicly available (For a general discussion of the landscape, see: Open Data Metrics: Lighting the Fire). Benefits of open data practices include visibility of research, reproducibility of results, prevention of effort duplication, and the possibility to conduct new, innovative types of high-quality research with aggregate datasets. In such an open science landscape, data citation practices are crucial for giving data creators credit for their work. The Make Data Count initiative additionally encourages researchers to cite data for the purposes of increased research discovery by driving traffic between data and articles, and generation of reliable open data metrics for use by all research stakeholders (Lowenberg et al. 2019). According to the Scholix interoperability initiative, the role of data repositories in this process should be to generate usage and citation metrics for the datasets they host, and share them with community "hubs" such as OpenAIRE, CrossRef, and DataCite (Cousijn et al. 2019). Per these recommendations by the larger data citation research community, Arctic Data Center has taken multiple steps towards producing data citation information for all datasets in our collection, including a new feature enabling dataset owners to directly register citations to their datasets.

## Supporting Data Citation at the Arctic Data Center

Using the scythe R package developed by our team, we regularly query journal publishers for citations that include the DOI of any Arctic Data Center dataset and register those connections as dataset citations. We've also conducted a programmatic text search for citation mentions over all of our dataset abstracts, since some researchers use the abstracts to refer to publications affiliated with their data.

Though we've made progress with these programmatic methods, tracking all dataset use in publications is a very difficult task to complete programmatically, since in many cases, data that are used in a publication are not formally cited. According to a paper by Belter (2014), oceanographic datasets were more often informally mentioned in the body of an article rather than formally cited in the Acknowledgments or Reference sections. Another study by Zhao et al.

(2017) found that datasets used in science publications were only cited 6% of the time and referred to using their DOI 9% of the time, with the rest of the references using language that is less standardized, traceable, or permanently identifiable. Data use is difficult to track in this landscape, and we know formal data citations aren't telling the full story of how often data is relied on in scientific publications.

Individual researchers and data owners can help us with this. That is why we recently implemented a "Register Citation" feature allowing researchers to register known citations to their datasets. *Researchers may register a citation for any occasions where they know a certain publication uses or refers to a certain dataset,* and the citation will be viewable on the dataset profile within 24 hours.


*Figure 1. Screenshots of the register citation feature. Image courtesy of the Arctic Data Center.*

# Moving forward

We plan to integrate our data citation systems with DataCite, which would make Arctic Data Center data citations available through CrossRef and DOI.org, two DOI registration systems connected with many major publishers worldwide that enable cross-publisher citation linking. We're also looking to continue developing our programmatic search for citations with different text mining techniques that would identify citations in varied contexts, and to expand the pool of publications we search across (Currently, we query SCOPUS, Elsevier, and PubMed for citations).

We hope that this information is helpful to you. Our goal with this initiative is to foster the growth and improvement of data citation practices in the Arctic science community. You are welcome to reach out to us at support@arcticdata.io with any feedback or questions about these new features.

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# About the Authors

Maya Samet is a Data Science Fellow at the NCEAS Arctic Data Center and a Teaching Assistant at the UC Berkeley Data Analytics Bootcamp. She holds a BS from UC Santa Barbara in Statistical Science and has experience applying this education to research in various fields, including people analytics, psychology, and informatics. Her fellowship at NCEAS ends January 2021, she will be seeking new opportunities starting then. Contact her via email (samet@nceas.ucsb.edu).

Erin McLean is the Community Engagement and Outreach Coordinator with the Arctic Data Center, headquartered at NCEAS in Santa Barbara. She holds a bachelor of arts from Boston University in marine science and English literature and a master of science from the University of Rhode Island in biological and environmental sciences. A scientist, educator, and writer, she has built her career on making science more accessible to all. Contact her via email (mclean@nceas.ucsb.edu).

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Originally published on the Arctic Data Center blog

# Winterberry: Understanding the Dynamics of Fleshy Fruit Loss in Fall and Winter

*By: Christa P.H. Mulder, Katie V. Spellman, and Elena Sparrow, University of Alaska Fairbanks.*

In the far north, many plant species retain their fruits into the fall and throughout the winter. Fleshy fruits provide a high-quality food source at a time when few other resources are available and are an important component of the late fall, early winter, and spring diets of Arctic and boreal animals such as voles, foxes, bears, geese, and grouse. Fleshy fruits ("berries") are also of great cultural and nutritional importance to rural and Indigenous communities across the Arctic. Warmer springs are leading to earlier flowering and fruiting (e.g., Parmesan and Yohe 2003, Mulder and Spellman 2019). Will earlier fruit ripening combined with longer falls result in earlier loss of fruits to consumers? Will a greater proportion of fruits be lost to decomposers? These questions, and the lack of basic natural history on fruit retention, drove the establishment of Winterberry, an Alaska-wide citizen science network funded by the National Science Foundation and supported by the Bonanza Creek Long Term Ecological Research Site.


*Figure 1. The importance of winter fruits. (A) Two ripe and one rotten fruits of Viburnum edule (highbush cranberry) in fall. (B) Highbush cranberry plant in early November. (C) Highbush cranberry fruits in May, after snowmelt. (D) A highbush cranberry cache made by an unidentified animal (possibly a vole). (E) Bear feces full of highbush cranberry seeds. (F) The contents of the crop of a ptarmigan in mid-winter filled with Vaccinium vitis-idaea (lingonberry) fruits. Photo courtesy credits: (A) A. Ruggles. (B&C) C. Mulder (D) R. Kovacs; (E) T. Martin; (F) KC*

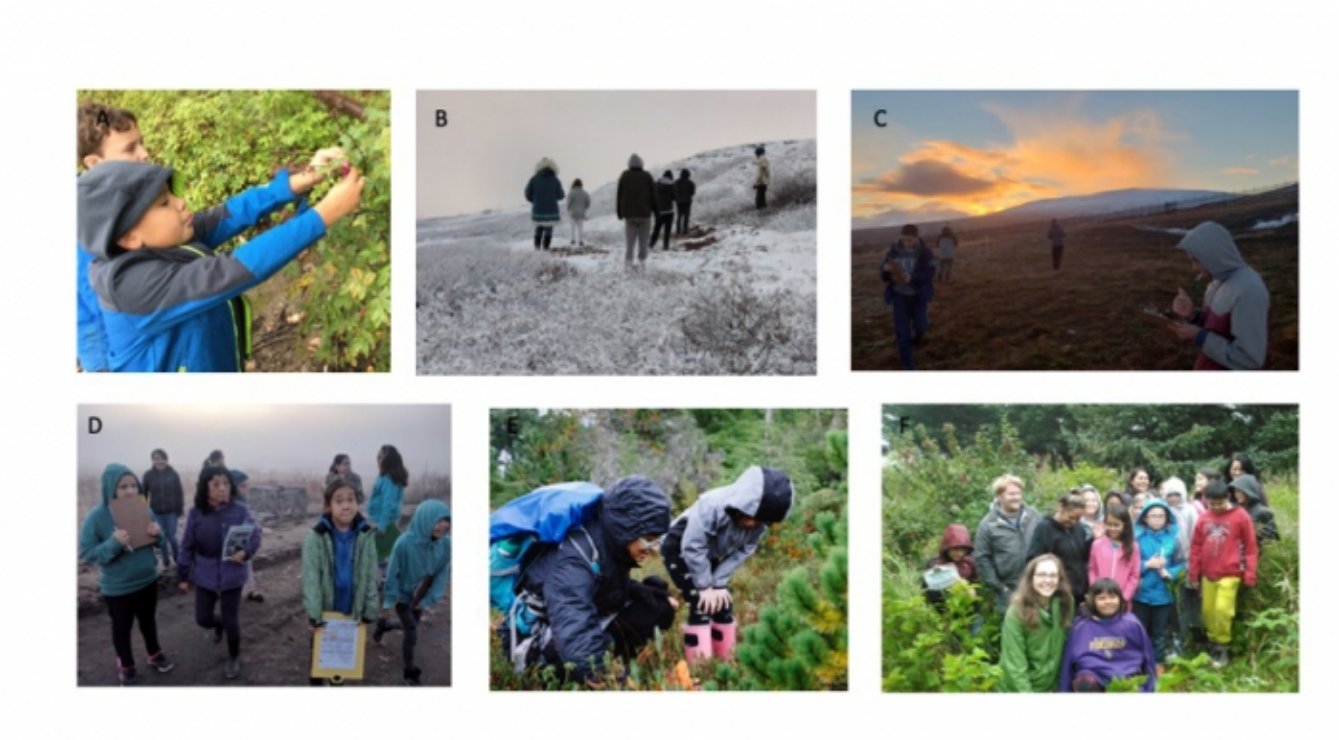


*Figure 2. Youth participating in data collection in (A) Fairbanks, (B) Anaktuvuk Pass, (C) Scammon Bay, (D) Bethel, (E) Sitka, and (F) Nanwalek. Photo collection courtesy of the Winterberry Project.*

Over 1,500 volunteers (primarily youth in schools or after-school programs plus some adult volunteers) in 45 sites in 25 communities across six ecoregions of Alaska collected data on fruit retention. Each group focused on one of four species: Rosa acicularis (prickly rose), Viburnum edule (highbush cranberry), Vaccinium vitis-idaea (lingonberry or lowbush cranberry) and Empetrum nigrum (crowberry). We selected these four species because they are abundant, widely distributed, and important to the people and animals of the far north. Participants monitored approximately 20 plants and counted the number of unripe, ripe, rotten, dry and damaged fruits throughout the fall until snowfall, and again following snow melt. Youth analyzed their data during "data jams" with scientists; they also participated in a range of activities like making berry treats that they shared with elders, expressing what berries meant to them via community storytelling nights and story landscapes, and using their data to imagine possible futures for berry stewardship (Figure 3).


*Figure 3. A felt landscape (A) and story depiction of data (B). Image courtesy of the Winterberry Project.*

We have evaluated data from four years (fall 2016–spring 2020) for differences between ecoregions, changes in fruit loss over the course of the fall, and changes in the proportion of fruits that are "healthy" (not rotten or dry or damaged) between seasons. We found that, in general, fruit loss occurred earlier in the more northern ecoregions of Alaska (e.g., interior Alaska, and along the west coast) than in the regions further south (e.g., south of the Alaska range, including the Aleutians and coastal rainforest). By the time of snowfall, most sites had lost 50–75% of their fruits, though in the coastal rainforest sites losses were generally lower. Over the course of the fall, the number of fruits lost per week declined but the proportion of fruits lost was constant. Rates of fruit loss (% fruits per unit time) were similar for fall and spring but much lower in winter; despite this, some fruits continued to be lost throughout the winter. As expected, the two species that were not completely covered by snow, prickly rose and highbush cranberry, showed a bigger difference between fall and winter than the short-statured crowberry, but for short-statured lingonberry the differences were similar to those of the taller species. Fruits that were rotten or dry were lost from plants at higher rates than "healthy" fruits.

The high retention rate and constant loss rates per fruit in fall and winter suggest that fruit retention is a component of the life history strategy of these species, analogous to the retention of leaves in evergreen plants. Fruit retention may reduce competition for fruit dispersers, which may be especially important in regions where due to the short growth season, fruits of many species ripen during the same short time period. Our results suggest that earlier ripening in a warming climate will lead to a lower proportion of fruits on the plants at the time of snowfall, reducing winter and spring fruit availability. However, the finding that a portion of fruits are still on the plant in the spring suggests that animals migrating north in the springtime may be able to move seeds of genotypes adapted to warmer conditions to higher latitudes, which may be beneficial as Arctic and boreal regions continue to warm. Next, we plan to look at the extent to which interannual variation can be explained by environmental conditions across the landscape, and predict what will happen to fruits under continued climate change.

More information about the Winterberry project and out how to join our efforts is on the Winterberry website. Or, contact Christa Mulder, (cpmulder@alaska.edu) or by phone (+1 907-474-7703).

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# About the Authors

Christa Mulder is a Professor of Ecology in the Department of Biology and Wildlife and the Institute of Arctic Biology at the University of Alaska Fairbanks. She is interested in plant phenology in the context of climate change, including changes in plant-animal interactions. She is also passionate about involving underrepresented groups, especially youth, in science.

Katie Spellman is an Assistant Professor at the International Arctic Research Center at the University of Alaska Fairbanks. She is a life-long Alaskan who splits her research evenly between plant ecology and education research, with a focus on citizen science in a rapidly changing climate as a focus area at the interface of the two disciplines. She is dedicated to empowering diverse youth to address climate issues in their community through science.

Elena Bautista Sparrow, PhD, is Director of Education and Outreach at the International Arctic Research Center and a Research Professor of Soil Microbiology in the Department of Natural Resources and Environment at the University of Alaska Fairbanks. In a project exploring the impacts and feedbacks of a warming Arctic, she and her team (including co-authors) engage youth, educators, youth leaders, and community members in braiding multiple ways of knowing and observing climate change from Elders, satellites, and on-the-ground observations using GLOBE and methods developed in this winterberry project.

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# Update from the NSF Arctic Sciences Section

**Updated Solicitation for Navigating the New Arctic (NNA)**

Navigating the New Arctic is part of NSF's "Big Ideas", 10 bold, long-term research and process ideas that identify areas for future investment at the frontiers of science and engineering. The Big Ideas represent unique opportunities to position our Nation at the cutting edge of global science and engineering leadership by bringing together diverse disciplinary perspectives to support convergence research. As such, even though proposals must be submitted to the Directorate for Geosciences when responding to this solicitation, once received, the proposals will be managed by a cross-Directorate team of NSF Program Directors.

This solicitation requests proposals that fall within one of three tracks: NNA Planning Grants, dedicated to developing convergence research questions and teams to tackle projects of larger scope in the future; NNA Research Grants, aimed to support creative projects on fundamental research that address convergent scientific and engineering challenges related to the rapidly changing Arctic; and NNA Collaboratory Grants, designed to support collaborative teams undertaking research and training initiatives on critical themes of a broad scope related to the New Arctic. This solicitation is the third of what is envisioned to be at least a five-year agency-wide program to support the research and dissemination of new knowledge needed to inform the economy, security, and resilience of the Nation, the larger Arctic region, and the globe with respect to Arctic change.

Read the full solicitation here

**The National Science Foundation has released a solicitation for Arctic Natural Sciences; Arctic Social Sciences; Arctic System Science; Arctic Observing Network; Polar Cyberinfrastructure; Arctic Research Coordination and Policy Support**

The National Science Foundation (NSF) invites investigators at US organizations to submit proposals to the Arctic Sciences Section, Office of Polar Programs (OPP) to conduct research about the Arctic region. The goal of this solicitation is to attract research proposals that advance a fundamental, process, and/or systems-level understanding of the Arctic's rapidly changing natural environment, social and cultural systems, and, where appropriate, to improve our capacity to project future change. The Arctic Sciences Section supports research focused on the Arctic

region and its connectivity with lower latitudes. The scientific scope is aligned with, but not limited to, research priorities outlined in the Interagency Arctic Research Policy Committee (IARPC) five-year plan. The Arctic Sciences Section coordinates with programs across NSF and with other federal and international partners to co-review and co-fund Arctic-related proposals as appropriate. The Arctic Sciences Section also maintains Arctic logistical infrastructure and field support capabilities that are available to enable research.

Read the full solicitation here

**NSF Office of Polar Programs Antarctic Sciences Section welcomes Dr. Allen Pope**

Dr. Allen Pope has joined OPP's Antarctic Sciences section as the new Program Director for Polar Cyberinfrastructure. Prior to NSF, Allen has many years of experience working as a polar scientist and as a service leader within the polar community. Dr. Pope most recently served as the Executive Secretary of the International Arctic Science Committee based in Akureyri, Iceland, and was formerly a Research Scientist at the National Snow and Ice Data Center (part of CIRES at the University of Colorado Boulder), the University of Washington's Polar Science Center, and Dartmouth College. He received his PhD at Cambridge University in Polar Studies, where he also completed an MPhil in Polar Studies. Previously, Allen completed a Bachelor of Arts at Harvard University in Chemistry and Earth & Planetary Sciences, with a citation in French.

Allen's research background is in using satellite data to study snow and ice around the world—most recently tracking lakes on the surface of the Antarctic and Greenland Ice Sheets, studying ultra-cold surface temperatures in Antarctica, tracking ice shelf velocities and fractures, contributing to a glacier inventory of the Mongolian Altai, and researching and teaching on the undergraduate-focused Juneau Icefield Research Program. As a researcher, Allen also helped coordinate the NSF-funded Polar-Computing Research Coordination Network, participated in the Geoscience Paper of the Future project, and was a fellow of the Software Sustainability Institute in the UK. Allen also has extensive experience in community service and outreach. He has participated in the inaugural Scientific Community Engagement Fellows Program (formerly with AAAS, now with CSCCE) and has spent a month as the Sitka Science Center's Researcher in Residence. He has also served in various volunteer leadership roles with the American Geophysical Union, International Glaciological Society, the Interagency Arctic Research Policy Committee, and the Association of Polar Early Career Scientists.

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# U.S. Department of Energy Reestablishes its Arctic Energy Office

*Editor's note: content for this article is excerpted from the Arctic Energy Office website*

The US Department of Energy has announced the reestablishment of its Arctic Energy Office, headquartered at the University of Alaska Fairbanks. The Arctic Energy Office (AEO) serves as the principal advisor to the Under Secretary on all domestic Arctic issues, including energy, science, and national security and leads the Department's domestic energy Administration priorities as well as cross-cutting opportunities and priorities on the Arctic region, strategic analysis, assessment of equities and energy resources in Alaska, cutting edge initiatives, and innovative activities including microgrids and integrated energy systems.

The Office will have three primary areas of focus: Energy, Science, and National Security. While it will not provide funding opportunity announcements, it will coordinate and streamline existing research, development and deployment activities in the Arctic. This includes work by the Office of Science to measure solar radiation, work by Fossil Energy on modular gasification applications in challenging environments, work by the Office of Electricity on deployment of microgrid technologies in Alaska, and work by Energy Efficiency and Renewable Energy on next generation river power systems. The Office will build on this work to define a focused research agenda based on these activities.

Additionally, the Office will engage and collaborate with other governmental agencies with equities in the Arctic region, including the Departments of Defense and State. AEO will also support the International Affairs Office with international engagement obligations, such as the Arctic Council and will help design and launch new initiatives and programs in the Arctic and other emerging topics.

The Office leadership team includes:

George Roe, Director, Arctic Energy Office.

Matt Heavner, Senior Advisor.

Michael McEleney, Senior Advisor.

Matt Manning, Advisor

Further information is found on the Arctic Energy Office website and from the Department of Energy's news release.

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# Interagency Arctic Research Policy Committee Releases Annual Report and Looks Ahead to the Future

*By: The Interagency Arctic Research Policy Committee Staff*

The Interagency Arctic Research Policy Committee (IARPC) brings together researchers from all over the US and around the world to work together on pressing issues facing the Arctic. Though the research world looked different this year amidst a global pandemic, IARPC collaboration teams came together to further the goals of the Arctic Research Plan (2017–2021). A complete summary of IARPC's accomplishments this year are now available in the 2020 Annual Report.

Throughout the year, all of the IARPC collaboration teams have navigated the challenges posed by COVID-19. Beginning in May 2020, the Environmental Intelligence Collaboration Team began working with the Alaska Ocean Observing System to compile and share information regarding the monthly status of planned research vessel activities in the Bering Strait and Chukchi and Beaufort seas region. Several other teams also held meetings on how to best protect both Arctic residents and researchers during the pandemic.

At the same time, the Environmental Intelligence, Marine Ecosystems, Coastal Resilience, and Sea Ice teams addressed changes in the Bering Sea. They brought together researchers, Indigenous Knowledge holders, resource managers, and policymakers to identify knowledge gaps and respond to concerns voiced by Arctic residents about unusual mortality events and the potential for harmful algal blooms.

Throughout the year, the Arctic Observing Systems Sub-Team supported development of a new National Science Foundation-supported research networking activity on coordinated observation of rapid Arctic change that launched in July 2020. The project lays the foundation for a food security-oriented information product integrating different types of coordinated observations, and includes Alaska Indigenous scholars as key leaders in the work.

The Modeling, Atmosphere, Glaciers & Sea-Level, Sea Ice, and Marine Ecosystems teams also came together to advance model development and analyses of sea ice, land ice, marine biogeochemistry, and the Arctic atmospheric system. These efforts have been facilitated through studies supported by US federal interagency funding.

Additionally, teams formed by the IARPC Collaborations community have continued working to

support Arctic research. The STEM Education Working Group has put forth a strategy for supporting science, technology, engineering, and mathematics education within the Arctic, while the Diversity & Inclusion Working Group welcomed several new team leaders to help support equity and inclusion within IARPC Collaborations. The new Physical Oceanography Self-Forming Team held meetings on a variety of topics, including on the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) expedition. IARPC Collaborations has also welcomed two more new teams, the Polar Technology Community Forum and the International Cooperative Engagement Program for Polar Research (ICE-PPR) Self-Forming Team.


*Figure 1. This graphic shows the policy drivers, priority areas, and foundational activities of the next Arctic Research Plan (2022–2026).*

Looking ahead, IARPC Collaborations teams will continue their work while IARPC also develops the next Five-Year Arctic Research Plan (2022–2026). After a public comment period on the structure and contents of the plan, IARPC held a plan development workshop in September. Federal drafting teams are now writing the first draft of the plan, informed by both the workshop and input received during the public comment period. A public comment period on a draft of the plan will be held from February to June 2021, and we look forward to hearing from you then. If you have questions about the Arctic Research Plan, please contact plan@iarpccollaborations.org. You can also sign up for our monthly plan development newsletter.

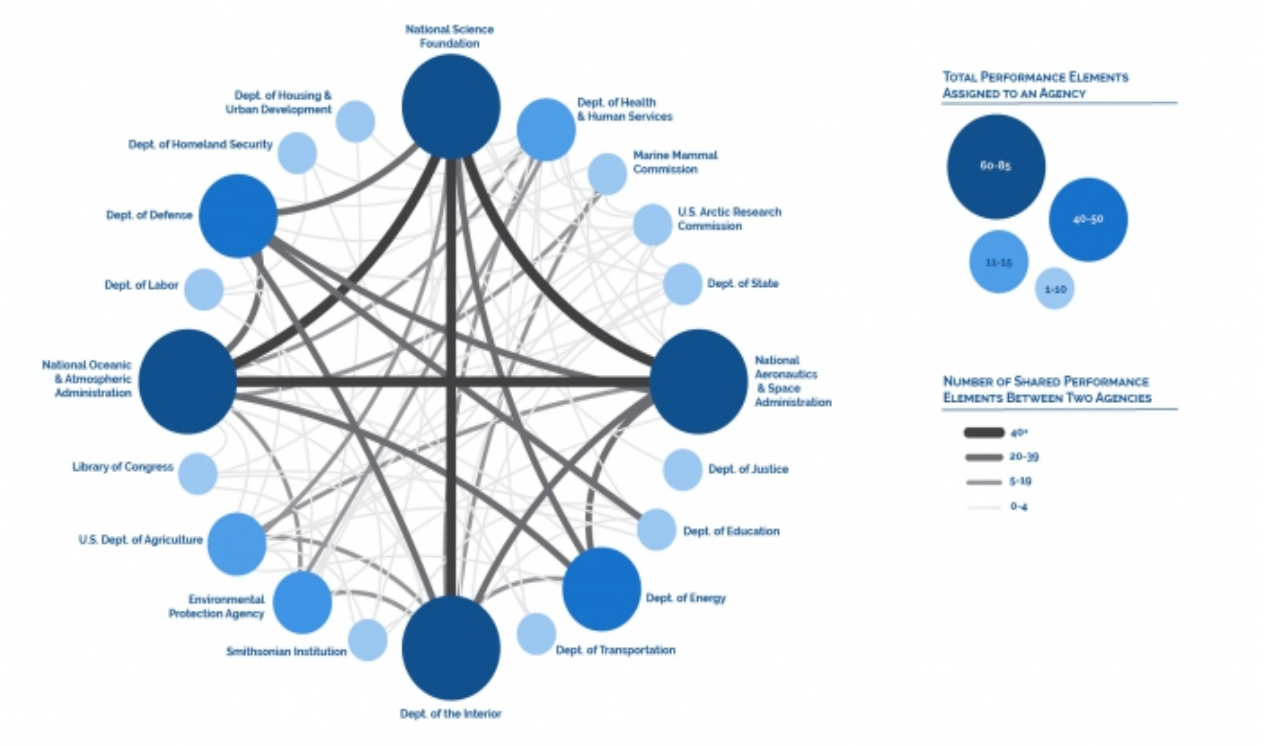


*Figure 2. IARPC brings together many different federal agencies to work together with one another and non-federal agencies on performance elements (similar to benchmarks) within the Arctic Research Plan.*

# About IARPC

The Interagency Arctic Research Policy Committee (IARPC) brings together leaders from 16 agencies, departments, and offices across the US federal government to enhance research on environmental issues in the Arctic. IARPC supports the IARPC Collaborations website, which serves as a forum that connects federal government researchers, non-federal researchers, and other stakeholders—including those overseas—to work together on pressing Arctic research issues.

IARPC Collaborations is free and open to anyone who wishes to engage, regardless of their role in Arctic research. The website has supported an unprecedented degree of interagency communication, coordination, and collaboration that has advanced Arctic science. Our member space includes more than 2,500 members of the Arctic research community, including those from federal, state, academic, non-profit, industry, Indigenous, and international organizations. Twelve collaboration teams and sub-teams and additional self-formed teams meet regularly via Zoom to advance research priorities and connect scientists across boundaries. You can sign up for an account and join teams at iarpccollaborations.org.

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# Understanding and Responding to Global Health Security Risks from Microbial Threats in the Arctic: Workshop Proceedings from the National Academies of Sciences, Engineering, and Medicine

*By: The National Academies Staff*

A rapidly warming climate is leading to widespread thawing of permafrost and ice across Arctic and sub-Arctic regions. Among the many concerns this raises are growing questions about bacteria and viruses that could possibly emerge from these thawing environments, raising infectious microbial risks for animal and human populations. Studies have shown that bacteria and viruses frozen in the environment can remain viable for thousands and even millions of years; and this raises questions about whether permafrost may harbor microbes that are human pathogens, and for which modern immune systems have no protection. Given the very limited studies to date, it is difficult to characterize the magnitude and nature of these potential risks; yet understanding and preparing for "low-probability, high-consequence" events is one of the hallmarks of a robust public health protection strategy. The National Academies of Sciences, Engineering, and Medicine (NASEM) in collaboration with the InterAcademy Partnership (IAP) and the European Academies Science Advisory Committee (EASAC) held a workshop in November 2019 that brought together researchers and public health officials from several countries and across many relevant disciplines to explore what is known—and what critical knowledge gaps remain—regarding existing and possible future risks of harmful infectious agents emerging from thawing permafrost and melting ice in the Arctic region.

PROCEEDINGS OF A WORKSHOP

# Understanding and Responding to Global Health Security Risks from MICROBIAL THREATS IN THE ARCTIC

*The National Academies of*
SCIENCES • ENGINEERING • MEDICINE

INTERACADEMY PARTNERSHIP

EUROPEAN ACADEMIES SCIENCE ADVISORY COUNCIL

The NASEM Polar Research Board (PRB) conducted and provided institutional oversight for this project together with the Board on Life Sciences (BLS) and the Board on Global Health (BGH). The workshop included a wide range of experts and stakeholders from 15 countries, including representatives from Indigenous Arctic communities. The workshop examined case studies such as the specific case of Arctic region anthrax outbreaks, as a known, observed risk as well as other types of human and animal microbial health risks that have been discovered in snow, ice, or permafrost environments, or that could conceivably exist. The workshop primarily addressed two sources of emerging infectious diseases in the Arctic: (1) new diseases likely to emerge in the Arctic as a result of climate change (such as vector-borne diseases), and (2) ancient and endemic diseases likely to emerge in the Arctic specifically as a result of permafrost thaw. Participants also considered key research that could advance knowledge, including critical tools for improving observations, surveillance to advance understanding of these risks, and to facilitate and implement effective early warning systems. Lessons learned from efforts to address emerging or re-emerging microbial threats elsewhere in the world were also discussed.

Published in September 2020, a detailed workshop summary outlines presentations and discussions of the workshop. Recordings of talks and presentation files are also available on the PRB website. In addition, IAP and EASAC released a workshop booklet that highlights their perspectives on Arctic warming and microbial threats. Sponsors of the NASEM activity include the US Agency for International Development Emerging Pandemic Threats Program, the US Centers for Disease Control and Prevention National Center for Emerging and Zoonotic Infectious Diseases, the Tides Center Ending Pandemics Project, the Heising-Simons Foundation, the Gordon and Betty Moore Foundation, the National Academies endowment funds.

For further information, please see:

- Project Website
- Proceedings
- Recordings
- Presentations
- IAP Booklet

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# PAN-ARCTIC OPTIONS: Holistic Integration for Arctic Coastal-Marine Sustainability

*Submitted by: Paul Arthur Berkman, coordinator of the Pan-Arctic Options and Arctic Options projects, on behalf of the Pan-Arctic Options Team representing holistic collaboration with Canada, China, France, Norway, Russia, and the United States*

PAN-ARCTIC OPTIONS: Holistic Integration for Arctic Coastal-Marine Sustainability is a Belmont Forum project involving national science agencies in Canada, China, France, Norway, Russia, and the United States from 2015–2021. This holistic (international, interdisciplinary and inclusive) project evolved directly from Arctic Options: Holistic Integration for Arctic Coastal-Marine Sustainability supported by France and the United States from 2013—2019. The interlinked goal, objectives, and logistics of these two projects are reflected in Table 1.

**TABLE 1: Intertwined Projects Involving "*Holistic Integration for Arctic Coastal-Marine Sustainability*"[1]**

| ASPECTS | PROJECT NAME | |
|---|---|---|
| | *Arctic Options* | *Pan-Arctic Options* |
| **Duration** | **2013-2019** | **2015-2021** |
| **Conceptual Scope** | Decision-support process to integrate stakeholder perspectives, evidence and governance mechanisms to reveal options that contribute to informed decision-making for sustainable infrastructure development in the Arctic Ocean | |
| **Geographic Scope** | Arctic High Seas, Barents Sea Region (BaSR), Bering Strait Region (BeSR) | Pan-Arctic (defined as north of the Arctic Circle + Bering Strait Region) |
| **Options** | Governance Mechanisms | Governance Mechanisms and Built Infrastructure |
| **Funding Nations** | United States, France | United States, Russian Federation, Norway, France, China, and Canada |
| **Funding Program** | **ArcSEES** *(Arctic Science, Engineering, and Education for Sustainability)* www.nsf.gov/pubs/2012/nsf12553/nsf12553.htm | **Belmont Forum** *(Arctic Observing and Research for Sustainability)* www.belmontforum.org/announcements/2015/belmont-forum-announces-collaborative-research-awards-arctic-observing |
| **Funding** | $2,000,000+ | €1,000,000 |

[1] **Goal** Design, develop, and demonstrate a holistic process to enhance the effectiveness of governance with build infrastructure for sustainable development in Arctic coastal-marine systems. **Objective 1** Aggregate Arctic coastal-marine data from the natural and social sciences in an efficient and flexible manner for diverse decision-making purposes. **Objective 2** Apply analytical tools and strategic planning concepts to reveal plausible scenarios about Arctic coastal-marine development over diverse spatial and temporal scales. **Objective 3** Generate infrastructure and policy options through international, interdisciplinary, and inclusive dialogues responding to Arctic coastal-marine opportunities and risks. **Objective 4** Share the options resulting from Objectives 1-3 with members of the policy community in view of current Arctic governance issues.

*TABLE 1: Intertwined Projects Involving Holistic Integration for Arctic Coastal-Marine Sustainability*

A major activity of the Arctic Options and Pan-Arctic Options projects (operating with synergies through the Science Diplomacy Center they have been supporting since 2017) involves production of the book series, Informed Decisionmaking for Sustainability, that is being published by Springer with Arctic Options/Pan-Arctic Options team members as series co-

editors. With informed decisions operating across a "continuum of urgencies"—as characterized with science and technology advisors to Foreign Ministers (See PDF here)—this book series evolved from the 2017 paper in Science, The Arctic Science Agreement Propels Science Diplomacy. The theory, methods, and skills of informed decisionmaking as the engine of science diplomacy (See: Science Diplomacy and Its Engine of Informed Decisionmaking: Operating through Our Global Pandemic with Humanity) now are being applied, trained, and refined with the: (1) joint video-conferencing semester course between institutions in the United States and Russian Federation; (2) University of the Arctic (UArctic) Science Diplomacy Thematic Network; (3) diplomatic academies through Ministries of Foreign Affairs; and (4) United Nations Institute for Training and Research (UNITAR).

Volume 1. Governing Arctic Seas: Regional Lessons from the Bering Strait and Barents Sea was published in January 2020 and launched at Arctic Frontiers 2020 in Tromsø, Norway. As noted on the website for this book:

"Governing Arctic Seas introduces the concept of ecopolitical regions, using in-depth analyses of the Bering Strait and Barents Sea Regions to demonstrate how integrating the natural sciences, social sciences and Indigenous knowledge can reveal patterns, trends and processes as the basis for informed decisionmaking. This book draws on international, interdisciplinary and inclusive (holistic) perspectives to analyze governance mechanisms, built infrastructure and their coupling to achieve sustainability in biophysical regions subject to shared authority. Governing Arctic Seas is the first volume in a series of books on Informed Decisionmaking for Sustainability that apply, train and refine science diplomacy to address transboundary issues at scales ranging from local to global. For nations and peoples as well as those dealing with global concerns, this holistic process operates across a 'continuum of urgencies' from security time scales (mitigating risks of political, economic and cultural instabilities that are immediate) to sustainability time scales (balancing economic prosperity, environmental protection and societal well-being across generations). Informed decisionmaking is the apex goal, starting with questions that generate data as stages of research, integrating decisionmaking institutions to employ evidence to reveal options (without advocacy) that contribute to informed decisions. The first volumes in the series focus on the Arctic, revealing legal, economic, environmental and societal lessons with accelerating knowledge co-production to achieve progress with sustainability in this globally-relevant region that is undergoing an environmental state change in the sea and on land.

In support of the Springer contracts with the book series editors and the Arctic Options / Pan-Arctic Options project, a Memorandum of Understanding was established with the Science Diplomacy Center and Arctic Frontiers to produce Volumes 2 and 3 of Informed Decisionmaking for Sustainability. With the abstract submission portal for Arctic Frontiers 2020, sixty abstracts were submitted for inclusion in Volume 2. Building Common Interests in the Arctic Ocean with Global Inclusion, which is being co-edited by Arctic Options/Pan-Arctic Options team members along with a former United States Ambassador and the former Director of Arctic Frontiers for publication in 2021 and launch at Arctic Frontiers 2022, when Volume 3. Pan-Arctic Implementation of Coupled Governance and Infrastructure will commence. This new book series builds on the Baseline of Russian Arctic Laws that was published by Springer in 2019, representing the "first comprehensive and authoritative translation into English of national and

international laws of Russia that relate to the Arctic from the early 19th century to the present, revealing the historical and current context of sovereignty, sovereign rights and jurisdiction across nearly half of the north polar region."

With holistic integration, the books above represent the co-production of knowledge with natural sciences and social sciences as well as Indigenous knowledge, all of which reveal patterns, trends, and processes (albeit with different methods) that become the bases for decisions. Triangulation between research, education, and leadership is evolving from the Arctic Options/Pan-Arctic Options projects, considering local-global scalability with informed decisionmaking to operate from security to sustainability time scales for the benefit of all on Earth across generations.

## About the Author

Professor Paul Arthur Berkman, Associated Fellow, United Nations Institute for Training and Research (UNITAR) and Faculty Associate, Program on Negotiation (PON) at the Harvard Law School (Associate Director of Science Diplomacy, Harvard-MIT Public Disputes Program) is the coordinator of the Pan-Arctic Options and Arctic Options projects.

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# ARCUS Member Research Updates

In preparation for the 2020 ARCUS Annual Meeting, held on 29 October, ARCUS members shared updates with us on their latest activities, products, and events. Full reports are available on the 2020 ARCUS Annual Meeting webpage under the Member Reports tab. Here are some of the highlights from our members!

The University of Alaska Fairbanks shared information on their role as America's Arctic University, including opportunities to collaborate and connect on interdisciplinary and high-impact research.

The University of Alaska Anchorage shared their 2020 Arctic research and scholarship highlights, including administrators and faculty in new leadership roles, new Arctic research projects, and recent publication highlights.

Sandia National Laboratories has worked on a variety of Arctic research activities. They shared their 2019 Arctic Initiative report and links to the webpages for many Arctic programs, such as their Arctic science and security Program, Arctic energy and infrastructure, and more.

ABR, Inc. shared updates on their Arctic projects with caribou, habitat and landscape changes, seabirds, and subsistence fisheries. ABR also shared a dozen new Arctic publications from 2020.

UiT: The Arctic University of Norway shares information on seven of their main projects in the past year, including Arctic Voices in Art and Literature in the Long 19th Century, The Nansen Legacy Program (www.nansenlegacy.org), and more.

Arizona State University provided an update on the Navigating the New Arctic-funded Arctic Robust Communities – Navigating Adaptation to Variability (ARC-NAV) project.

The University of Washington is home to many Arctic researchers studying oceanography, sea ice, atmospheric sciences, ecology, land ice, and social sciences. This update shared many of their recent Arctic publications.

Rutgers University Arctic researchers are working on social systems, atmosphere, ocean, microbiology, hydrology, and glaciers. Their report shared a variety of examples of their recent work in the Arctic.

Texas A&M University shared recent work on polar and saffron cod, and two new papers on Arctic oceanography, including particulate matter and trace metal cycling topics.

The University of Virginia shared an update on an integrated sensor network for understanding the changing natural-built landscape in an Arctic community.

The Norwegian Polar Institute shared updates on their Arctic Ocean Programme, Svalbard Programme, and Ny-Ålesund Programme.

The George Washington University shared updates on Arctic PIRE – Promoting Urban Sustainability in the Arctic, Circumpolar Active-Layer Monitoring (CALM), and updates on wildland fires, cruise ship tourism, and COVID-19 impacts in Juneau.

The Arctic Studies Center at the National Museum of Natural History, Smithsonian Institution shared two new publications, Arctic Crashes: People and Animals in the Changing North and Applied Ecological Knowledge: Indigenous Arts from Natural Materials.

Pan-Arctic Options shared information from their Arctic Conference held 7-8 February 2020 and other work. Read more about them in this issue of Witness the Arctic HERE.

The Arctic Centre, University of Lapland in Finland shared examples of recent research projects, including WOLLIE: Live, work, or leave? Youth wellbeing and the viability of (post) extractive Arctic industrial cities in Finland and Russia; CHARTER – Drivers and feedbacks of changes in Arctic terrestrial biodiversity; and JUSTNORTH – Towards just, ethical, and sustainable Arctic economies, environments, and societies.

The report from Kawerak, Inc. highlighted their work on Knowledge Sovereignty and the Indigenization of Knowledge. Their work to promote positive relationships between Indigenous communities and research includes a variety of broadly relevant activities.

The Cold Climate Housing Research Center shared updates on a new partnership with the National Renewable Energy Laboratory; a new affordable, high-efficiency housing design; a project improving the health of homes in Buckland, AK; and cold-climate energy incentives. Read more about them in this issue of Witness the Arctic HERE.

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# Comments from the Executive Director

*By: Helen Wiggins, Executive Director, ARCUS*

Since the last Witness the Arctic issue published in July, we have continued to run our programs and foster collaborations in the Arctic research and education communities—all virtually, of course. Keeping in mind the anxiety that we are all under, we are focusing on opportunities that make it easy for you to network and collaborate. Below are a few highlights of recent and upcoming activities. We hope you find a way to connect with us and with each other!

**ARCUS Annual Meeting** – We held our open 2020 Annual Meeting in late October, which gathered 128 participants to meet one another and discuss issues ranging from interdisciplinary research, to co-production of knowledge, to Arctic STEM education, and others. It was a great opportunity to hear from our community —established and newcomers—and the group came up with some exciting ideas for follow-up activities, which we will report on shortly. We kept it as fun and casual as we could, with Halloween costumes, fun hats, and door prizes. Several ARCUS member organizations provided updates on their activities, and we invite you to read a summary of those here.

**ARCUS Community Coffee Chat** – Please join ARCUS staff, Board members, and Institutional Member representatives on Friday, 11 December from 10–11am AK/11–12pm PT/12–1pm MT/1–2pm CT/2–3pm ET for a virtual coffee chat (tea, cocoa, &/or other beverages of your choice also welcome!). This online social hour will be an opportunity for members of the wider Arctic research community to share news, ask one another questions, and to explore next steps for some of the projects and ideas raised during the 2020 ARCUS Annual Meeting.

**AGU Fall Meeting** – We are gearing up for the virtual AGU Fall Meeting in December (as I'm writing this, I just finished uploading a pre-recorded talk with hours to spare until deadline!) In addition to several ARCUS talks and posters (we'd love to see you there), we've also compiled

online lists of Arctic sessions and presentations focused on Arctic Indigenous/Traditional Knowledge and co-production.

**Early Career Conference Funding Award** – In early October, we launched an Early Career Conference Funding Award. This award program supports attendance to conferences by early career researchers and students, especially Black, Indigenous, and People of Color. For this first round of funding, we supported attendance to virtual conferences and will announce winners soon. We will run the program again in spring/summer 2021, so keep an eye out for the opportunity next year!

**Other Online Products** – We've developed several other Arctic research and education resources, including a website featuring information about the projects that have been supported through NSF's Navigating the New Arctic (NNA) program, virtual educational resources from the PolarTREC program, a meeting report from the Polar Technology Conference, a post-season Sea Ice Outlook report from the Sea Ice Prediction Network (SIPN2), an archived webinar on "Bridging Arts and Science in the Arctic"—and don't forget our gallery of virtual meeting backgrounds!

**Get Involved** – Please get in touch and get involved—join us at one of our AGU sessions or the ARCUS Community Coffee Chat, contribute a future Witness the Arctic or Witness Community Highlights article, give an Arctic research webinar, or become a member. Just email me or any ARCUS staff and we can help find a way for you join the community!

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# Comments from the ARCUS Board President

ARCUS recently convened its first exclusively virtual Annual Membership Meeting. This meeting serves as an opportunity for the Arctic research community to come together every year to discuss issues that we face in advancing the understanding of the Arctic system. This year was particularly exciting because of the number of people that attended the meeting. We had more people in attendance (128) than at any other ARCUS Annual Meeting that I can remember! It was a chance for me to see old friends and remember what it is about our community that is so exciting. We are a community. We talk to each other. We read each other's work. And most importantly, we value the insight that each of us bring to the understanding of the truly important issues that we work on. ARCUS does a fantastic job of cultivating this interaction and keeping us all connected.

I hope that after this year's meeting you all walked away wanting more interaction. In the coming year, ARCUS will strive to continue providing opportunities for collaboration and the exchange of ideas. I encourage all of you to take advantage of these opportunities. Spread the word to your colleagues about what ARCUS does. Take the time to interact with the ARCUS staff and board (they are fantastic!). Become an individual member of ARCUS to help us continue to bring our community together. Encourage your institutions to become institutional members. All of these things will benefit the community and help advance our understanding of the Arctic.

I look forward to the coming year and the challenges that we will face and the discoveries that will be made. Most of all, I look forward to doing all of this with you, the ARCUS community!

David M. Cairns
President, ARCUS Board of Directors

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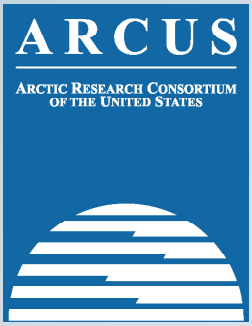


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