

Witness The ARCTIC

Chronicles of the NSF Arctic Science Section

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Sitka Sound Science Center

Introduction

Sitka Sound Science Center (SSSC) (<https://sitkascience.org/>), located in Sitka, Alaska, is a non-profit organization dedicated to increasing understanding and awareness of terrestrial and aquatic ecosystems of Alaska through education and research. Since its inception in 2007, SSSC has developed strong community, state, and national partnerships and created significant educational and research opportunities.

As a biological field station, connected to both the [Organization for Biological Field Stations](https://www.obfs.org/) (<https://www.obfs.org/>) and the [National Association of Marine Laboratories](http://www.naml.org/) (<http://www.naml.org/>), SSSC's collaborative research

includes work on salmon, marine mammal/commercial fisheries interactions, ocean acidification, geophysical studies, landslides, bioacoustics, abalone, and kelp. SSSC research collaborators include the [RAND Corporation](https://www.rand.org/) (<https://www.rand.org/>); [Alaska Department of Fish and Game](http://www.adfg.alaska.gov/index.cfm?adfg=home.main) (<http://www.adfg.alaska.gov/index.cfm?adfg=home.main>); [National Park Service](https://www.nps.gov/index.htm) (<https://www.nps.gov/index.htm>); [U.S. Forest Service](https://www.fs.fed.us/) (<https://www.fs.fed.us/>); [University of California Santa Cruz](https://www.ucsc.edu/) (<https://www.ucsc.edu/>); [University of San Francisco](https://www.usfca.edu/) (<https://www.usfca.edu/>); [University of California Irvine](https://uci.edu/) (<https://uci.edu/>); [University of Alaska Fairbanks](https://www.uaf.edu/uaf/) (<https://www.uaf.edu/uaf/>); [U.S. Geologic Survey](https://www.usgs.gov/) (<https://www.usgs.gov/>); [University of Alaska Southeast](http://www.uas.alaska.edu/) (<http://www.uas.alaska.edu/>); and [Moss Landing Marine Lab](https://www.mlml.calstate.edu/) (<https://www.mlml.calstate.edu/>). SSSC is funded by a variety of sources including the National Science Foundation (NSF) (<https://www.nsf.gov/>), National Oceanic and Atmospheric



**SITKA SOUND
SCIENCE CENTER**

Administration ([NOAA](https://www.noaa.gov/)) (<https://www.noaa.gov/>), U.S. Geologic Survey, the [State of Alaska](http://alaska.gov/) (<http://alaska.gov/>), [U.S. Department of Agriculture](https://www.usda.gov/) (<https://www.usda.gov/>), private foundations, individual memberships, and corporate sponsorships. Additional support to the Science Center includes, memberships, research contracts, rentals, hatchery contracts, admissions during the visitor season, and retail operations.



The Sage Building was built in 1929 as part of the Sheldon Jackson Campus and since 2007, when the campus closed its doors, it has been the home of Sitka Sound Science Center. Photo courtesy of the Sitka Sound Science Center.

The Science Center operates the [Molly O. Ahlgren Aquarium](https://sitkascience.org/visit/aquarium) (<https://sitkascience.org/visit/aquarium>) and the [Sheldon Jackson Salmon Hatchery](https://sitkascience.org/visit/hatchery) (<https://sitkascience.org/visit/hatchery>), both of which are used as educational tools for K-12 and university level students, as well as the 18,000 visitors who come annually to the facility from cruise ships. SSSC has a formal partnership with the [University of Alaska Southeast Fisheries Technology Program](http://www.uas.alaska.edu/career_ed/fisheries) (http://www.uas.alaska.edu/career_ed/fisheries) which utilizes the hatchery to train students in aquaculture and fisheries management. SSSC facilitates field courses for several colleges outside of Alaska including Stanford, University of Exeter, John Hopkins, Williams College, University of California Santa Cruz, and the University of San Francisco.

SSSC staff includes 19 year-round, full time employees and 15 additional seasonal employees during the summer. The seasonal staff lead guided interpretive tours, work in the summer camps, and conduct field work.

SSSC and its partners across the community contribute to the culture of science that encourages science

engagement among Sitka's students and the general population. The success of Sitka Sound Science Center is due in large part to the community's enthusiasm for scientific research and education.

Research Highlights

Research at the Sitka Sound Science Center is generally done in collaboration with other agencies and entities. SSSC values locally-relevant research that impacts the residents of Sitka and Southeast Alaska as a region. SSSC actively promotes researchers conducting research that is important to the community. While the non-profit attracts researchers, it also provides critical local support and guidance in how to operate in rural Alaska, requiring all scientists who utilize the facility to receive science communication training from SSSC staff and then facilitating community engagement activities. Some of the high-profile research projects currently underway at SSSC include:

Landslide Studies

In response to a deadly landslide in 2015, the RAND Corporation, a nonprofit research organization whose purpose includes developing solutions to make communities safer and more secure, is working with Sitka Sound Science Center, the University of Oregon, the University of Southern California, Sitka Tribe of Alaska, and the Alaska State Division of Geological and Geophysical Surveys in the development of a landslide warning system (LWS). In collaboration with the U.S. Geological Survey, U.S. Forest Service, National Weather Service, and National Oceanic and Atmospheric Administration, this three-year long project aims to develop a new geoscience sensor network and create communication channels to disseminate landslide risk in Sitka, Alaska.



U.S. Forest Service Soil Scientist Jacquie Foss gives a description of layers of volcanic ash exposed in a debris flow channel. Photo courtesy of the Sitka Sound Science Center.

Funded by the National Science Foundation (NSF) Smart and Connected Communities (S&CC) flagship program, this interdisciplinary LWS research has three major components: geoscience, social science, and risk management. We see information science at its most innovative here, collecting data from historical records and imagery, hydrologic sensors, and social networks; organizing it into useful information; and helping community members improve their safety, security, and overall quality of life.

Ocean Change Studies

Because Alaska is experiencing faster rates of climate warming than anywhere else in the U.S., and because the Gulf of Alaska has a high rate of ocean acidification, Sitka is an important place to study the effects of ocean warming and acidification. Sitka has one of the highest rates of ocean acidification in Alaska.



The research team headed by Dr. Kristy Kroeker set up a mesoclimate in the wet lab at SSSC to investigate how ocean acidification and warming may affect the development of Pacific Herring embryos. Photo courtesy of the Sitka Sound Science Center.

Headed by Dr. Kristy Kroeker at University of California Santa Cruz, one study is looking at the effects of warming temperatures and changing ocean chemistry on herring, abalone, kelp, and other intertidal invertebrates. Kroeker's research requires diving in kelp forests and her lab has set up a mesoclimate in the SSSC wet lab. (Editor's note: a mesoclimate models characteristics of a relatively small region.)

Another team of researchers is simulating conditions that might be found in tide pools in the year 2100 to analyze the effects of stressors on the local fauna and flora. By raising water temperatures and increasing the input of CO₂, scientists will be able to assess and predict how tide pool communities will react to our warming world. Previous studies have looked at only one species or just manipulated one factor of climate change. This NSF-funded project is unique in that it measures the effects of multiple stressors at once. The University of California Irvine (Dr. Matthew Bracken, Dr. Cascade Sorte), San Diego State University (Dr. Luke Miller), and the University of California Santa Cruz (Dr. Kristy Kroeker) are joining forces to explore the consequences of warming waters and ocean acidification on local coastal communities.



Researchers working on the Climate Change in the Intertidal project check salinity, temperature, pH and dissolved oxygen of 20 tidepools during a monthly survey. Photo courtesy of the Sitka Sound Science Center.

Every month, biodiversity surveys are conducted and water samples are collected to monitor any changes that may be occurring with the increased water temperature and decreased pH.

Hatchery Wild Chum Interaction Project

Because of the value of hatchery production to industry's harvest, and the mandate that hatchery production be compatible with sustainable productivity of wild stocks, the Alaska Department of Fish and Game (ADF&G) and private hatchery operators have recognized the need for a research program addressing concerns about straying salmon, and genetic and ecological interactions between hatchery and wild fish. ADF&G organized a science panel composed of current and retired scientists from ADF&G, University of Alaska, aquaculture associations, and National Marine Fisheries Service. Panel members have broad experience in salmon enhancement, management, and wild and hatchery interactions. The Sitka Sound Science Center, in partnership with Prince William Sound Science Center, is part of a \$4.5 million, five-year study on interactions between hatchery fish and wild salmon in streams around southeast and Prince William Sound.



Field technicians sample spawned chum salmon to look at genetic and ecological interactions between hatchery and wild stocks. Photo courtesy of the Sitka Sound Science Center.

For more information visit the [Sitka Sound Science Center website](https://sitkascience.org/) (<https://sitkascience.org/>) or contact Executive Director, Lisa Busch by email (lbusch@sitkascience.org) or phone: 907-747-8878.



Lisa Busch is the Sitka Sound Science Center's Executive Director. Photo courtesy of the Sitka Sound Science Center.

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Bering Sea Conditions During the Sea Ice for Walrus Outlook (SIWO) 2019 Season

By: Matthew Druckenmiller, National Snow and Ice Data Center; and Olivia Lee, Hajo Eicken, and Rick Thoman, International Arctic Research Center, University of Alaska Fairbanks

The Sea Ice for Walrus Outlook ([SIWO](https://www.arcus.org/siwo/overview)) (<https://www.arcus.org/siwo/overview>), now in its tenth year, provides Alaska Native subsistence hunters and Bering Strait coastal communities with weekly reports on spring sea ice and weather conditions. In turn, SIWO community observers share weekly observations about sea ice, marine hazards, wildlife sightings, and hunting activity. Together, this platform for sharing, which is also supported by an active Facebook page, provides a framework for tracking sea ice conditions and their implications at both the local and regional scales. Weekly SIWO reports integrate scientific and Indigenous knowledge into a resource that is valuable to both local communities and scientists.

The unprecedented low winter sea ice in the Bering Sea during 2018 (McFarland et al. 2018) quickly raised broad concerns regarding whether the Bering Sea had entered a new regime and the potential impacts on the ecosystem, Indigenous communities, and fisheries. The role of a program like SIWO in sharing information is becoming increasingly valuable in assisting to understand how rapid environmental change and variability are experienced within communities as they pursue the abundant walrus, whales, seals, fish, crabs, and other marine life from the Bering Sea. The local community reports also provide valuable information on the behavior of marine mammals and other wildlife in relation to changing sea ice habitat – a critical observing contribution as there is currently no surveying effort in spring 2019 for marine mammals in the Bering Strait region. A video of walrus just offshore of Gambell, Alaska, created by SIWO Observer Clarence Irrigoo, Jr., can be viewed [here](https://youtu.be/YoJExh9W4R4) (<https://youtu.be/YoJExh9W4R4>).

As we entered 2019, few expected that the Bering Sea would see another winter like that of last year as described in the [2018 March SIWO archive](https://www.arcus.org/siwo/2018-03-23) (<https://www.arcus.org/siwo/2018-03-23>). Yet, this assessment did not hold for long. After a record low ice extent in November, a sustained colder weather pattern was established during December and early January and this allowed for significant ice extent growth. However, even during this time there were reports that nearshore ice was not as thick as expected, given the temperatures. Between mid-January through early March, the Bering Sea experienced an astonishing decline in sea ice coverage (see Figure 1), and by late February had dropped below the record low ice levels of 2018. At this time of year, the Bering Sea ice cover is typically still advancing and building towards maximum coverage, which usually occurs in mid to late March. The winter of 2019, however, was marked by the same large fluctuations in ice coverage and storm activity that defined 2018, though the timing differed between the two years.

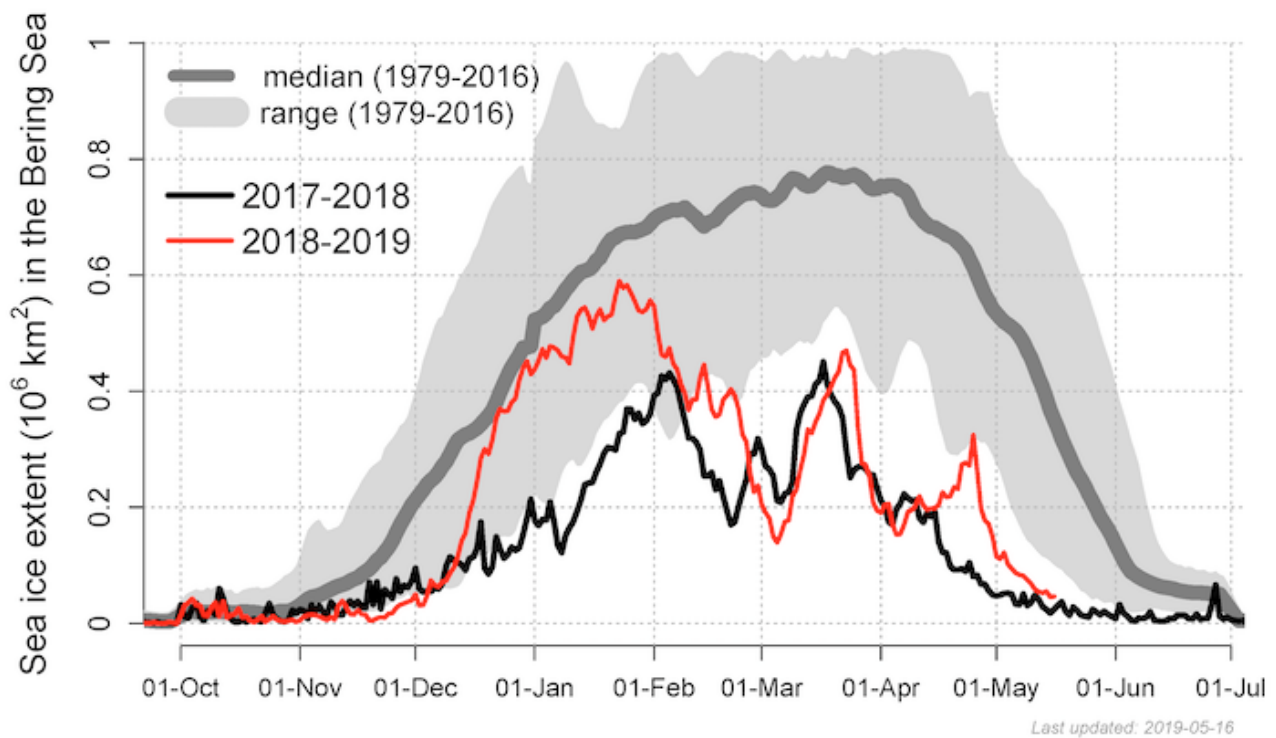


Figure 1. Sea ice extent in the Bering Sea in millions of square kilometers for the last two winters (2017/18 and 2018/19) compared to the long-term (1979-2016) average and range. Data through 16 May 2019. Image data source: Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data & Near-Real-Time DMSP SSM/I-SSMIS Daily Polar Gridded Sea Ice Concentrations; Data at 25 x 25 km resolution; Accessed from the National Snow and Ice Data Center.

Given recent and overall warming in the western Arctic, sea ice in 2019 was thinner than the ice of past decades, which means that today's thin sea ice is more susceptible to regional-scale shifts in its distribution by winds. Large ice floes and shorefast ice are also more likely to break up in response to wave action. During February, there was pronounced low pressure over the central and western Bering Sea and high pressure over the North American continent (see Figure 2), which brought warm southern air into the region, slowing ice growth and pushing sea ice far to the north. All total, more than a dozen distinct storms and weather fronts impacted the Bering Strait region between late January and early March. The month of February saw the most ice pushed northward to reveal vast stretches of open water. Between the last week in February through to the second week in March, the Bering Strait region was almost entirely ice free, as evident by the photos shown below.

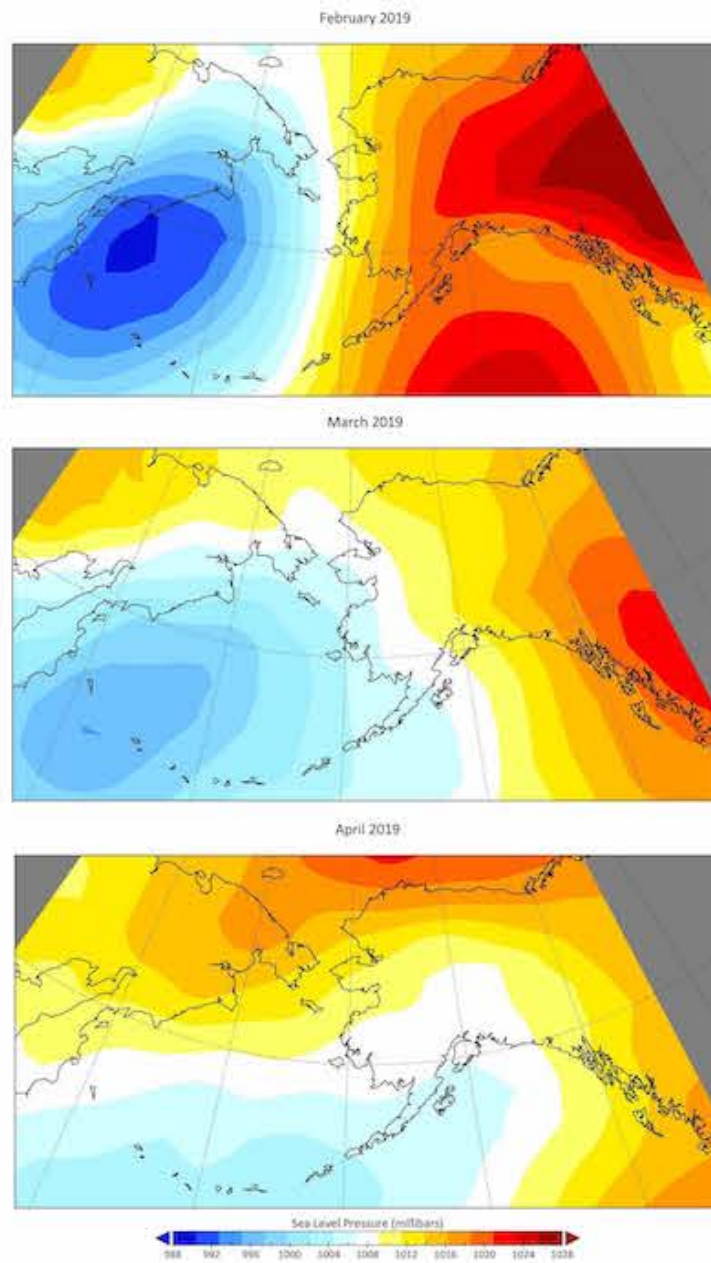


Figure 2. Monthly mean surface sea level pressure across the Bering Sea in February, March, and April 2019. Figure source: NCEP/NCAR Reanalysis.

Little Diomed, Alaska

March 01, 2019

Photo credit: E. Soolook



Photo of Little Diomed and the Bering Strait Region on 1 March 2019. Photo courtesy of E. Soolook.

**Bering Strait and Little Diomedede
March 14, 2019
Photo credit: S. Ozenna**



Photo of Little Diomedede and the Bering Strait Region on 14 March 2019. Photo courtesy of S. Ozenna.

Editor's note: Photos accessed from [Alaska Climatologist Rick Thoman's Twitter feed](https://twitter.com/AlaskaWx) (<https://twitter.com/AlaskaWx>).

At Wales, for example, the community lost their shorefast ice on or around 4 March. Robert Tokeinna Jr. posted his observation and a series of photos to the Local Environmental Observers (LEO) Network (<https://www.leonetwork.org/en/#lat=48.572431330472504&lng=-123.36108388379216&zoom=7>). (Editor's note: See in this issue of Witness, [The LEO Network, Addressing Climate Change One Event at a Time](#) (<https://www.arcus.org/witness-the-arctic/2019/1/article/29380>)). In his 5 March posting (Tokeinna and Lee 2019), Robert observed that:

"Usually, Wales has shore fast ice until June or so in more recent years though it has been shorter; but for some reason and warming of the ocean, we lost all the shore fast ice. I rode up the beach to find all the ice not intact, but crushed and broken up. This is a very unusual event for Wales as many of our hunters rely on great ice conditions for whale and other sea mammal catch for food."

A photo from Robert is shown below, alongside a historical photo from the Wales Sea Ice Dictionary (Weyapuk and Krupnik 2012), which shows June shorefast ice at Wales. Five to ten years ago, shorefast ice thickness at Wales in early March was measured at around three feet, growing to four feet or more by May, before spring shorefast ice break-up. Current conditions in the Bering Sea guarantee that such past stable, thick shorefast ice conditions into late May or early June will not be observed this year, and there is no indication that current atmosphere-ocean warming trends will reverse to allow the buildup of thicker ice over coming years.



A mostly ice-free coastline at Wales on 4 March 2019. Photo courtesy of Robert Tokeinna Jr.



Wales hunting crew with its large whaling skin-boat (umiak) at the edge of the shore-fast ice on June 16, 1922. BA-21-327

Wales hunters camped on the shorefast sea ice on 16 June 1922. Photo by Alfred Bailey.

Editor's note: The 1922 photo is sourced from the [Wales Sea Ice Dictionary](https://jukebox.uaf.edu/site7/sites/default/files/documents/Preserving-our-Knowledge--Wales-Dictionary.pdf) (https://jukebox.uaf.edu/site7/sites/default/files/documents/Preserving-our-Knowledge--Wales-Dictionary.pdf).

Kotzebue Sound and much of the southeastern Chukchi Sea north to Kivalina were also almost entirely ice free during the 2019 mid-winter period (approx. 24 Feb. to mid-March), which emphasizes that the changes observed during such extreme winters are not confined to the Bering Sea but are reaching further north. By the first week in March, sea ice extent in the Bering Sea was the lowest in the satellite record (1979-2019).

Sea surface temperatures throughout the winter were very warm (up to 3°C or 5°F above normal), which impeded sea ice formation and thickening throughout winter. Figure 3 shows that on 5 March, the day of the lowest ice extent in March of this year, there was a band of extremely warm water extending from the western Bering Sea into Bristol Bay, as well as "hotspots" in the northern Bering Sea and at the entrance to Norton Sound. In past years, growth and movement of ice into such areas of warm water would have consumed much of the heat.

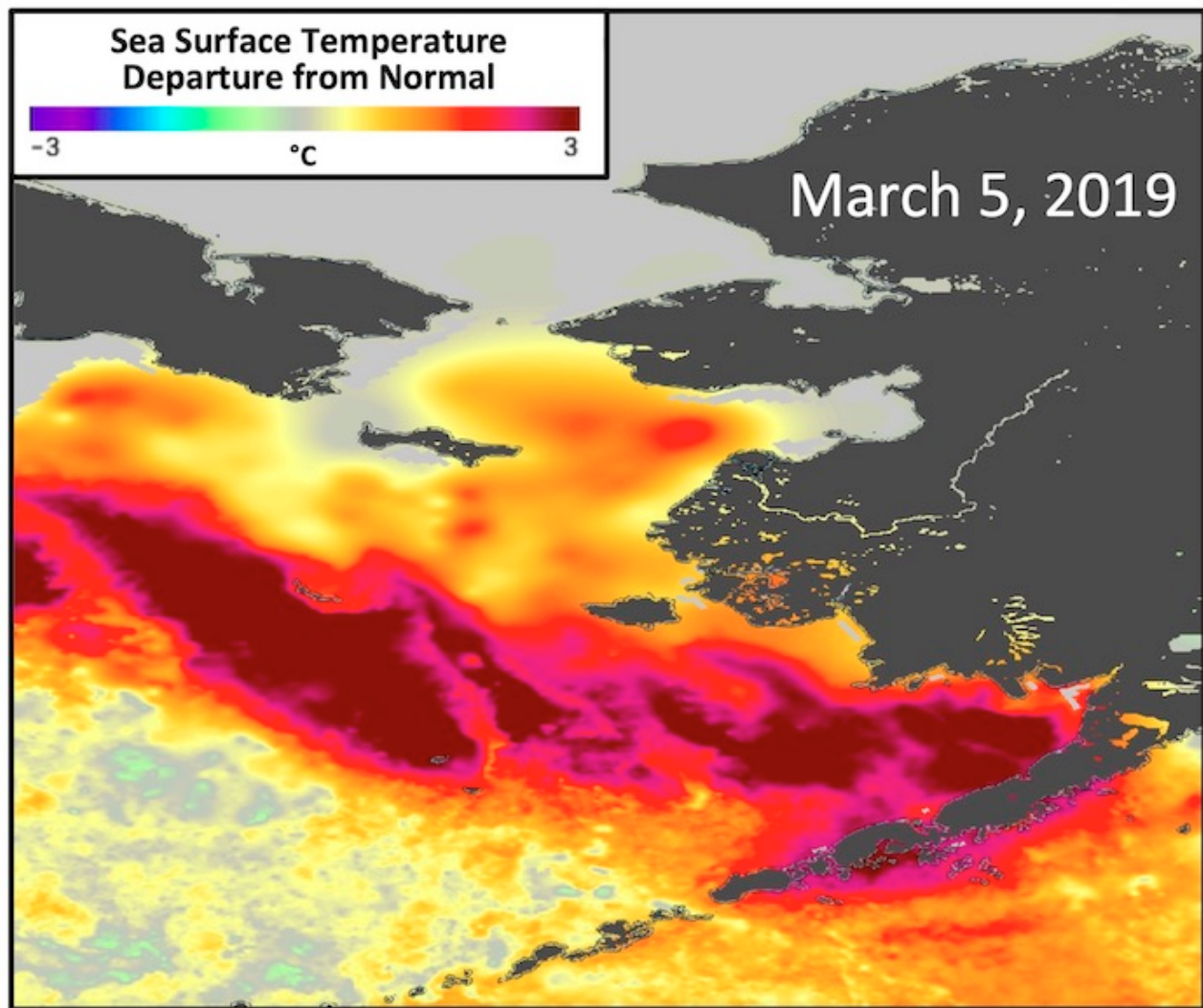


Figure 3. Sea surface temperature (SST) departure from normal (anomaly) on 5 March 2019, which is the date of the lowest sea ice coverage in the Bering Sea in March of 2019 (see Figure 1). The normal or average SST condition is defined over years 2003–2014. Image Source: Daily, 1km SST anomalies based on the GHRSSST Multiscale Ultrahigh Resolution SST dataset, accessed from the PO.DAAC at the NASA Jet Propulsion Laboratory.

Ice coverage increased substantially throughout the middle of March, more so as a result of shifting winds rather than new ice growth. By the third week in March, ice extent in the Bering Sea rose slightly above last winter's level. With much thinner ice, the region continued to see substantial variability in ice extent, as the ice readily responded to shifts in wind and air temperature. Also, the thinner and weakly anchored shorefast ice near communities was also highly vulnerable to pack ice being blown in and breaking it up, as well as offshore winds causing ice to detach from the coast.

At Port Clarence and Brevig Mission, [SIWO Observer Marcus Barr observed on 12 April](https://www.arcus.org/siwo/2019-04-12) (<https://www.arcus.org/siwo/2019-04-12>) that:

"Strong north winds and strong current broke up ice faster. One day of south wind brought shorefast ice back in but went back out after another strong northerly wind. More variety of sea birds started to show up. More beluga was spotted but not within the last few days. None of the locals caught walrus yet but still get bearded seals."

During April, higher pressure over the Chukchi Sea relative to lower pressure over southwest Alaska and the southern Bering Sea (see Figure 2) brought north winds that were responsible for a late-season partial recovery in ice coverage. During this time, SIWO observers reported on conditions that allowed for successful hunting.

From Nome, [Boogles Johnson reported on 19 April](https://www.arcus.org/siwo/2019-04-19) (https://www.arcus.org/siwo/2019-04-19) that:

"There currently is pack ice south of Cape Nome which is good ice. We found Oogruk "bearded seal" and were successful and are now done Oogruk hunting for this season. The walrus have been to the west of Nome by Sledge Island making their migration north with their babies. The season is approx. 1 month early from previous years but the advantage is that we have snow for natural refrigeration and cold temps to preserve the catch. It has been a successful season for my crew I'm with this year and I hope all hunters are able to bring home catch to their families and community."

From the village of Gambell, [Clarence Irrigoo, Jr. noted on 18 April](https://www.arcus.org/siwo/2019-04-19) (https://www.arcus.org/siwo/2019-04-19) that:

"The whalers landed a 57-foot whale on the 13 April 19. Lots of ice still around and the weather is very windy."

By early May, the Bering Sea was mostly ice-free, more than one month ahead of schedule (see Figure 1), with the main ice edge well into the Chukchi Sea (See: [Sea Ice Extent, 29 May 2019](https://nsidc.org/data/seaice_index/images/daily_images/N_daily_extent_hires.png) (https://nsidc.org/data/seaice_index/images/daily_images/N_daily_extent_hires.png)). On the pan-Arctic scale, sea-ice extent in mid-May is well below normal. (See: [Arctic Sea Ice Extent, February—May 2019](http://nsidc.org/data/seaice_index/images/daily_images/N_stddev_timeseries.png) (http://nsidc.org/data/seaice_index/images/daily_images/N_stddev_timeseries.png)). Warm water from the Bering Sea, due in large part to the conditions of winter 2019, is expected to contribute to another low summer sea-ice cover in the Arctic Ocean.

The Arctic summer sea-ice minimum continues to serve as one of the most highly visible indicators of a changing Arctic. However, some of the most transformative environmental changes and the most warming (e.g., Walsh et al. 2018) are taking place during the Arctic winter. Continued information sharing within

SIWO may help to further elucidate what information local communities find useful as they respond by adapting their hunting and other food harvesting strategies in the changing Bering Sea.

References

McFarland, H.R., H. Eicken, R. Thoman, Z. Labe, M. Druckenmiller, and G. Sheffield. 2018. Bering Strait: An overview of winter 2018 sea ice conditions. International Arctic Research Center, University of Alaska, Fairbanks.

Tokenna, R. and O. Lee. 2019. Wales Loses Shore Fast Ice. LEO Network (leonetwork.org). Posted 5 March 2019; Accessed 19 May 2019.

Walsh, J.E., R.I. Thoman, U.S. Bhatt, P.A. Bienick, et al. 2018. The High Latitude Marine Heat Wave of 2016 and its Impact on Alaska (Chapter 8). In: Explaining Extreme Events of 2016: From a Climate Perspective. Special Supplement to the Bulletin of the American Meteorological Society, Vol. 99, No. 1, January 2018.

Weyapuk, Jr. W., and I. Krupnik, compilers. H. Anungazuk, I. Krupnik, and M.L. Druckenmiller, editors/contributors. 2012. Kifikmi Sigum Qanuq Ilitaavut – Wales Iñupiaq Sea-Ice Dictionary. Arctic Studies Center, Smithsonian Institution, Washington, D.C., 112 p.

- This article was adapted from an original contribution to the Sea Ice for Walrus Outlook (SIWO) in March 2019 as a summary of the "State of the Ice at Season's Start" (<https://www.arcus.org/siwo/2019-03-22>).

About the Authors

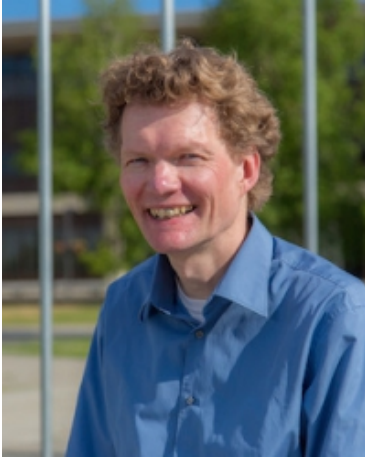


Matthew Druckenmiller is a research scientist at the National Snow and Ice Data Center and a member of the Study of Environmental Arctic Change (SEARCH) Sea Ice Action Team. His research is focused on how Arctic Indigenous communities use and rely on changing environments and communicating the societal implications of Arctic sea ice loss.



Olivia Lee is an Assistant Professor in the International Arctic Research Center (IARC) at the University of Alaska Fairbanks. Her research focuses on the integration of community observations and remote sensing imagery of sea ice to assess walrus and ice seal habitat in northern Alaska. She also works on participatory scenarios projects that aim to broaden our understanding of the socio-economic and biophysical drivers affecting the

future of the Arctic.



Hajo Eicken is Professor of Geophysics and Director of the International Arctic Research Center at the University of Alaska Fairbanks. His research focuses on sea ice geophysics, Arctic coastal processes, and their importance for human activities and ecosystems. In Alaska he has helped lead efforts to advance collaborative research with Indigenous knowledge holders and to enhance use of scientific data by Arctic communities and government agencies. This work draws on a number of different approaches, including participatory scenarios and community-based monitoring. For more than a decade, he has worked with colleagues to establish a sea-ice observatory at Utqiagvik/Pt. Barrow. Other

collaborative efforts include his involvement in helping launch the Arctic Sea Ice Outlook and Sea Ice Prediction Network, his co-leadership of the Arctic Observing Summit, and service as Chair of a National Academies Standing Committee on Offshore Science and Assessment.



Rick Thoman works as a climate specialist with the Alaska Center for Climate Assessment and Policy at the University of Alaska Fairbanks where he focuses on providing Alaskans with timely and relevant information. He has worked in Alaska weather and climate for more than 35 years, including more than 30 years with the National Weather Service in Nome and Fairbanks.

Study of Environmental Arctic Change (SEARCH) Update Arctic Futures 2050 Conference

By: Brendan Kelly, SEARCH Executive Director and Brit Myers, ARCUS Project Manager

Responding to rapid environmental change in the Arctic requires the combined efforts of Arctic scientists from many disciplines, diverse Indigenous perspectives, and policy makers from all levels of government. The [Arctic Futures 2050](https://www.searcharcticscience.org/arctic-2050/conference-2019) (https://www.searcharcticscience.org/arctic-2050/conference-2019) Conference—convened by the Study of Environmental Arctic Change (SEARCH) (https://www.searcharcticscience.org/)—will be an international conference designed to enhance collaboration between those groups.



The conference will be held 4-6 September 2019 at the National Academies of Sciences in Washington, D.C.

Invited speakers and participants will include Arctic scientists; Indigenous Peoples; policy makers; natural resource managers; and military, industrial, and other operators in the Arctic.

Background Resources - Pre-conference resources that are currently available include:

- **Scenarios** - A SEARCH-led scenarios workshop helps frame the Arctic Futures 2050 conference. Participants are invited to prepare for the conference by reviewing and considering the scenarios [here](https://www.searcharcticscience.org/arctic-2050/conference-2019/background/intro) (https://www.searcharcticscience.org/arctic-2050/conference-2019/background/intro).
- **Knowledge and Policy Interplay Diagrams** - Arctic Futures 2050 participants are invited to complete an optional four-question [Knowledge-Policy-Interface survey](https://www.searcharcticscience.org/arctic-2050/conference-2019/background/survey) (https://www.searcharcticscience.org/arctic-2050/conference-2019/background/survey) to inform conference planning and post-conference products. Learn more and complete the survey [here](https://www.searcharcticscience.org/arctic-2050/conference-2019/background/survey) (https://www.searcharcticscience.org/arctic-2050/conference-2019/background/survey).
- **Reading List:** A background document [reading list](https://www.searcharcticscience.org/files/page/documents/29249/intersection_of_arctic_science_policy_resources.pdf) (https://www.searcharcticscience.org/files/page/documents/29249/intersection_of_arctic_science_policy_resources.pdf) is also available to help conference participants learn more about the intersection of Arctic Science and Policy.

Conference Agenda - The [current draft agenda](https://www.searcharcticscience.org/arctic-2050/conference-2019/program) (https://www.searcharcticscience.org/arctic-2050/conference-2019/program) includes talks, panels, and sessions on:

- past and future Arctic environments
- Indigenous knowledge approaches to informing policy
- how predictions and models inform the future
- melting ice, thawing permafrost, and changing ecosystems
- case studies on fisheries, conservation, and subsistence whaling, and
- other topics integrating science, Indigenous knowledge, and policy.

Research, Indigenous perspectives, and policy programs from around the Arctic will be presented in posters.

Conference Registration: Registration is now open. Early-bird registration rates are available through 10 July 2019. Register [here](https://www.searcharcticscience.org/civicrm/event/register?reset=1&id=239) (https://www.searcharcticscience.org/civicrm/event/register?reset=1&id=239).

Hotel Reservations: Information on making hotel reservations with a special Arctic Futures 2050 conference rate can be found [here](https://www.searcharcticscience.org/arctic-2050/conference-2019/logistics) (https://www.searcharcticscience.org/arctic-2050/conference-2019/logistics). The group hotel rate will be available on a first come, first served basis through 2 August 2019.

For questions, contact: Brendan Kelly, SEARCH Executive Director, by email (bpkelly@alaska.edu) or by phone (907-209-6531).

Catastrophic Lake Drainage in the Arctic System

By: The Catastrophic Arctic Lake Drainage Research Team: Chris Arp, Ben Jones, Mikhail Kanevskiy, Amy Breen, Christopher Larson, and Louise Farquharson, University of Alaska, Fairbanks; Andy Parsekian, Nori Ohara, and Rodrigo Correa Rangel, University of Wyoming; Ken Hinkel and Ian Nichols, Michigan Technological University.

Lakes are abundant in the Arctic, providing important fish and wildlife habitat and water supply for villages and industry. The lakes also interact with permafrost and the carbon it stores, with potential global-scale climate feedbacks. Lake-rich Arctic landscapes are particularly dynamic as the lakes located here are susceptible to catastrophic drainage (Yoshikawa and Hinzman, 2003; Smith et al., 2005; Jones and Arp, 2015; Nitze et al., 2018). Taken together, lakes and drained lake basins cover up to 80% of Arctic lowland regions, making understanding their response to ongoing climate and land use change essential for providing insights into how Arctic lowland landscapes may change and evolve in the coming decades to centuries.

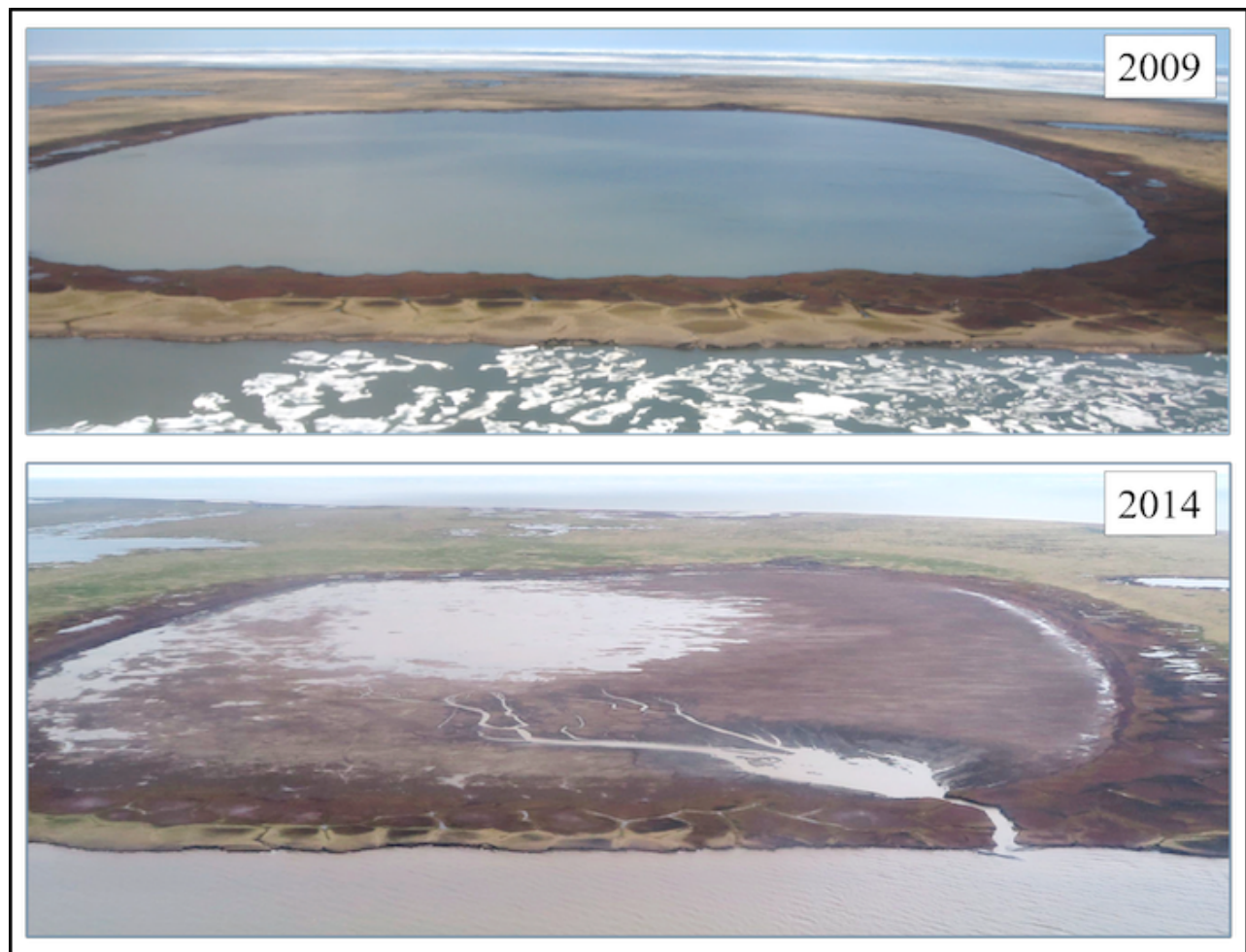


Figure 1. Example of a lake that drained on the North Slope of Alaska in early July 2014. Photo courtesy of Benjamin M. Jones.

The National Science Foundation recently awarded a new grant to the University of Alaska Fairbanks (UAF), University of Wyoming, and Michigan Technological University, funding the [Triple C – Permafrost Region Drained Lake Basins](http://arcticlakedrainage.org/about) (<http://arcticlakedrainage.org/about>) project that focuses on better understanding the causes, consequences, and feedbacks between permafrost-region lake dynamics and lake drainage with an eye towards predicting future lake drainage and the myriad linkages in the Arctic System. The multi-disciplinary UAF team involves researchers from the Institute of Northern Engineering (Jones, Arp, and Kanevskiy), the Geophysical Institute (Farquharson and Larsen), and the International Arctic Research Center (Breen). Colleagues from the University of Wyoming (Parsekian, Ohara, and Rangel) and Michigan Technological University (Hinkel) round out the interdisciplinary team.



Figure 2. A frosty team of researchers following a long day of winter fieldwork on the North Slope of Alaska. Photo courtesy of Benjamin M. Jones.

The [research team](http://arcticlakedrainage.org/team/) (<http://arcticlakedrainage.org/team/>) recently returned from a 1,000-mile snowmachine-based expedition on the North Slope of Alaska. Six scientists began their studies in Utqiagvik (formerly known as Barrow) on 14 April and then traversed to the east, south, and west across the Arctic Coastal Plain before returning to Utqiagvik on 4 May. The focus of the first field season for the project involved instrumenting lakes and drained lake basins for water level studies, coring permafrost in drained lakes to assess permafrost aggradation following lake drainage, near-surface geophysics to quantify snowpacks and

upper permafrost characteristics, and unmanned aerial vehicle (UAV)-surveys to construct three-dimensional models of the snow-covered lakes, drained lakes, and interstitial tundra environments.



Figure 3. Conducting snow and near-surface geophysical surveys at a drained lake basin outlet. Photo courtesy of Benjamin M. Jones.

The second field campaign will occur in August 2019 where the team will be downloading field instrumentation, conducting vegetation surveys, acquiring high-resolution imagery to develop summertime digital surface models of the focus study sites, and ground-truthing a potential lake drainage product developed using geographic information systems (GIS) and remote sensing datasets (Jones et al., In Review). The team will also focus on collecting baseline data for a lake drainage manipulation experiment slated for the summer of 2020 that will provide a mechanism for observing a lake drainage event in real-time and also provide a site with which to gauge geomorphic and ecologic succession for years to come.



Figure 4. Remote arctic camp located in the arctic foothills in northern Alaska. Photo courtesy of Benjamin M. Jones.

Data collected in this study will feed into future model development to enhance predictive capacity of hydrologic hazards and landscape responses to climate and land use change in the Arctic (Arp et al. In Press). The understanding of hazards and environmental processes gained from this research will advance the interests of industry, land managers, and subsistence users on the Arctic Coastal Plain of northern Alaska.

Acknowledgements

Funding for this research is provided by the National Science Foundation Arctic Systems Science program. The team thanks [UIC Science](https://uicalaska.com/) (<https://uicalaska.com/>) and [CH2MHill Polar Field Services](http://cspolar.com/) (<http://cspolar.com/>) for providing field logistics support for the project.

Further information about the project, the study design and methodological approach, related products, and members of the Catastrophic Arctic Lake Drainage Research Team is available on the [Project Website](http://arcticlakedrainage.org/about) (<http://arcticlakedrainage.org/about>).

References

- Arp, C. D., B. M. Jones, K. M. Hinkel, D. L. Kane, M. S. Whitman, R. Kemnitz. In Press. Recurring outburst floods from drained thermokarst lake basins: an emerging hazard with arctic climate and land-use change. *Frontiers in Ecology and the Environment*.
- Jones, B. M. and C. D. Arp. 2015. Observing a catastrophic thermokarst lake drainage in northern Alaska. *Permafrost and Periglacial Processes* 26(2):119-128. doi:10.1002/ppp.1842.
- Jones, B.M., C.D. Arp, G. Grosse, I. Nitze, M.J. Lara, M.S. Whitman, L.M. Farquharson, M. Kanevskiy, A.D. Parsekian, A.L. Breen, N. Ohara, R.C. Rangel, and K.M. Hinkel. In Review. Identifying historic and future potential lake drainage events on the western Arctic Coastal Plain of northern Alaska. *Permafrost*

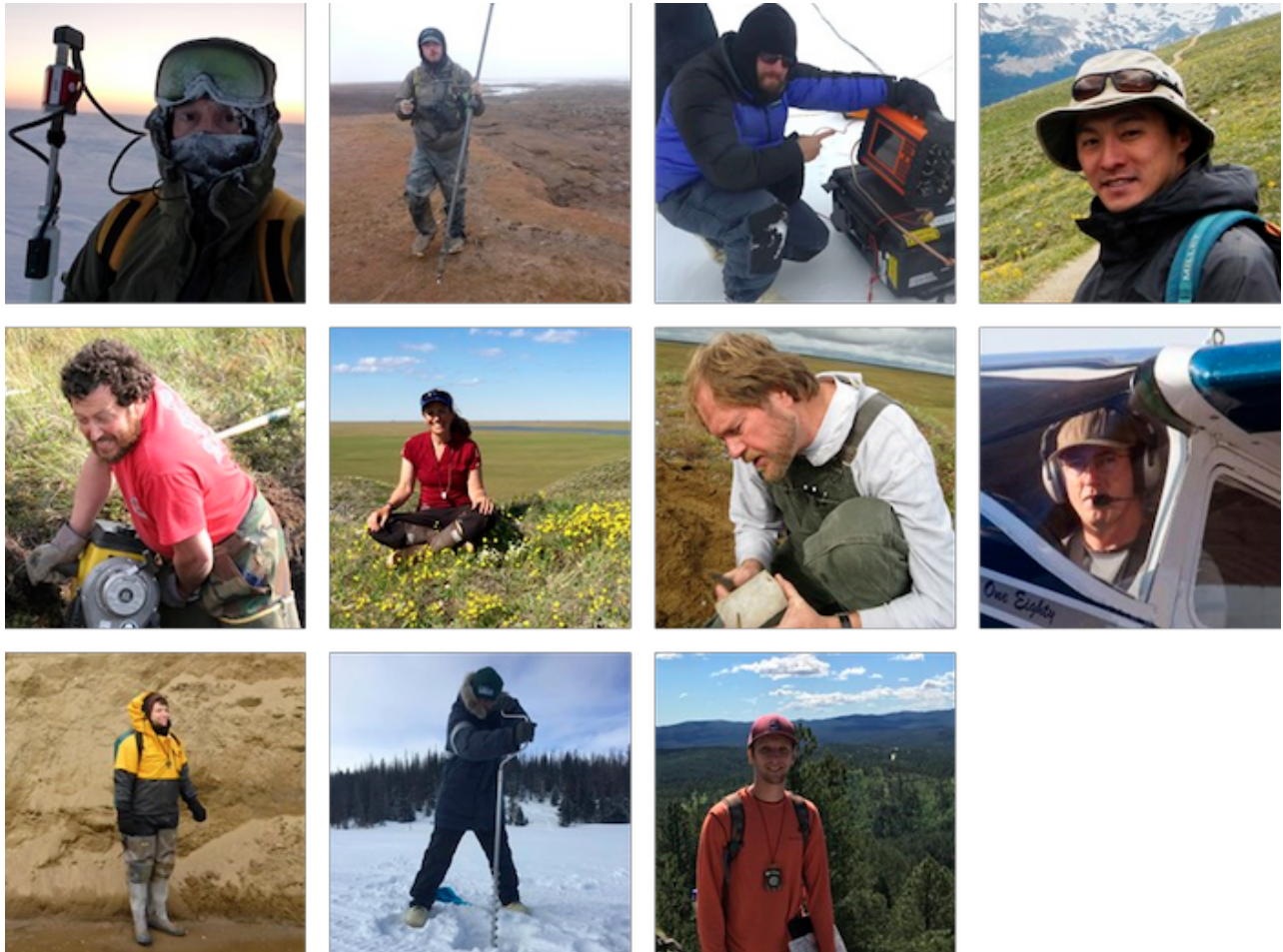
and Periglacial Processes.

Nitze, I., Grosse, G., Jones, B.M., Romanovsky, V.E. and Boike, J., 2018. Remote sensing quantifies widespread abundance of permafrost region disturbances across the Arctic and Subarctic. *Nature Communications*, 9(1), p.5423.

Smith, L.C., Sheng, Y., MacDonald, G.M. and Hinzman, L.D., 2005. Disappearing arctic lakes. *Science*, 308(5727), pp.1429-1429.

Yoshikawa, K. and Hinzman, L.D., 2003. Shrinking thermokarst ponds and groundwater dynamics in discontinuous permafrost near Council, Alaska. *Permafrost and Periglacial Processes*, 14(2), pp.151-160.

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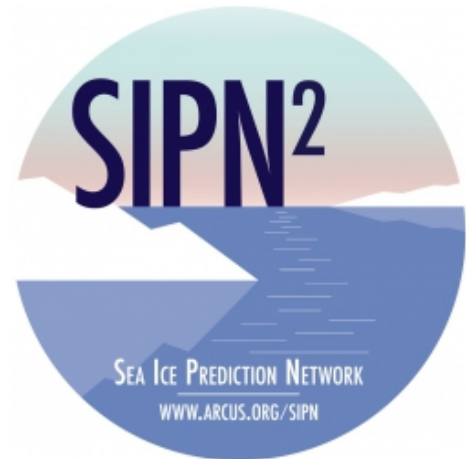
Rodrigo Correa Rangel is a PhD student, geophysics, in the Department of Geology and Geophysics, University of Wyoming.

Ian Nichols is a MS student, hydrology, at Michigan Technological University

Sea Ice Prediction Network–Phase 2 (SIPN2) — Advancing Understanding of Sea Ice Forecasting

By: Betsy Turner-Bogren, ARCUS Project Manager

The Sea Ice Prediction Network–Phase 2 (SIPN2) (<https://www.arcus.org/sipn>) is a network of U.S. and international members working to advance research on the processes driving sea ice predictability, the production of operational products, and the communication of findings to interested stakeholders. With funding provided by [NSF-Arctic Sciences Section](https://www.nsf.gov/geo/opp/arctic/index.jsp) (<https://www.nsf.gov/geo/opp/arctic/index.jsp>) and the U.K. Natural Environment Research Council (NERC) (<https://nerc.ukri.org/>) and additional support and in-kind contributions by several organizations, SIPN2 efforts commenced in early 2018 and will continue through 2022.



Recent SIPN2 Activities

2018 Sea Ice Outlook Reports

The Sea Ice Outlook (SIO) provides an open process for those interested in Arctic sea ice to share ideas. It is a community network activity led by the Sea Ice Prediction Network-Phase 2 (SIPN2) Project Team with contributions from key partners.

The [2018 Interim SIO Post-Season Report](https://www.arcus.org/sipn/sea-ice-outlook/2018/interim) (<https://www.arcus.org/sipn/sea-ice-outlook/2018/interim>) was published in early October 2018. This report provided a quick post-season update to summarize how the outlooks did in comparison to the observed minimum extent. The September monthly averaged sea ice extent was 4.71 million square kilometers, based on the [National Snow and Ice Data Center \(NSIDC\) Sea Ice Index](https://nsidc.org/data/seaice_index/) (https://nsidc.org/data/seaice_index/). The median extent of the 39 Outlook contributions for June, July, and August were 4.60, 4.70, and 4.57 million square kilometers, respectively.

The [2018 Full SIO Post-Season Report](https://www.arcus.org/sipn/sea-ice-outlook/2018/post-season) (<https://www.arcus.org/sipn/sea-ice-outlook/2018/post-season>) was published in mid-March 2019. This report included an in-depth analysis of factors impacting sea ice this season. It centered around forecasts of pan-Arctic September minimum sea ice extent, while also including information about forecasts of sea ice probability and a synthesis of observed Arctic conditions from June to September 2018. It also included a review of forecasts for the Alaskan sector; an evaluation of the SIO

forecast skill; discussions about Antarctic maxima sea ice extent forecasts; the Sea Ice Drift Forecast Experiment; an overview of sea ice forecasting needs of the Alaska marine shipping industry; and ideas of how to continue efforts to understand sea ice predictability and how to create information products that are accessible to stakeholders so that the science can be used in decision making to improve outcomes.

SIO 2019 season launched with the [Call for Contributions for the 2019 June report](https://www.arcus.org/sipn/sea-ice-outlook/2019/june/call) (https://www.arcus.org/sipn/sea-ice-outlook/2019/june/call). Pan-Arctic and Regional Sea Ice Extent Outlooks and any additional figures and gridded fields will be accepted for the 2019 June Outlook. We particularly encourage submissions for the Alaska region (i.e., Bering, Chukchi, and Beaufort seas). For those interested, submissions for Hudson Bay are also accepted. Submissions that include spatial forecast maps are encouraged.

Outreach Activities

SIPN2 convened an [Open Community Meeting](https://www.arcus.org/sipn/meetings/2018/agu) (https://www.arcus.org/sipn/meetings/2018/agu) on 11 December during the 2018 Fall Meetings of the American Geophysical Union. This meeting was organized to promote knowledge exchange and collaboration among members of sea ice research community. Meeting participants were invited to share brief updates about their projects/efforts related to sea ice prediction and/or observations. A brief overview of the 2018 Arctic sea ice/Sea Ice Outlook season was also provided.

The first event of the 2019 SIPN2 webinar series was held on 25 April 2019. The presentation entitled "ICESat-2 over Sea Ice: Early Results" featured Ron Kwok, NASA Jet Propulsion Laboratory and ICESat-2 Team. The presentation focused on one of NASA's science objectives for the ICESat-2 altimetry mission—to provide observations to quantify changes and to add to previous satellite and airborne records of freeboard, thickness, and sea surface height of the ice-covered Arctic and Southern Oceans. Webinar presentations are archived on the [SIPN2 website](https://www.arcus.org/sipn/meetings/webinars) (https://www.arcus.org/sipn/meetings/webinars).

Further information about SIPN2 and the Sea Ice Outlook (SIO) is available on the [SIPN2 Meetings/Webinars website](https://www.arcus.org/sipn) (https://www.arcus.org/sipn).

For questions, contact Betsy Turner-Bogren, ARCUS (betsy@arcus.org).

About the Author



Betsy Turner-Bogren is a Project Manager at ARCUS who provides staff support to the SIPN2 project and its team members. She also manages the NSF-supported publications *Witness the Arctic* and *Witness Community Highlights*.

Emotions, Desires, and Arctic Data Portals

By: *Vanessa Raymond, Founder of Convene North*

What might a highly desirable Arctic data portal look like? To answer this question, my research project, "Desire and Arctic Data Portals: A Qualitative Comparison" examines what Arctic data portals provide their users today. This research focuses on the implementation of 25 Arctic data portals and any data or metadata management practices they may support using comparative qualitative analysis. This research is funded by [Convene North](https://www.convenenorth.com/) (<https://www.convenenorth.com/>).

Data portals may house or reference data and metadata. Portals may have a variety of objectives. A data portal may be designed to visualize data, to showcase data, to encourage data play and manipulation, to find new audiences for data, to preserve and store data, or serve as a vehicle for downloading data. These objectives may have been identified by the software development team creating the portal, the research funder's data requirements, the portal funder, a principal investigator, the data needs of the research discipline, community members where the data was collected, or by any number of other stakeholders. More often than not, the portal design reflects the desires of multiple stakeholders.

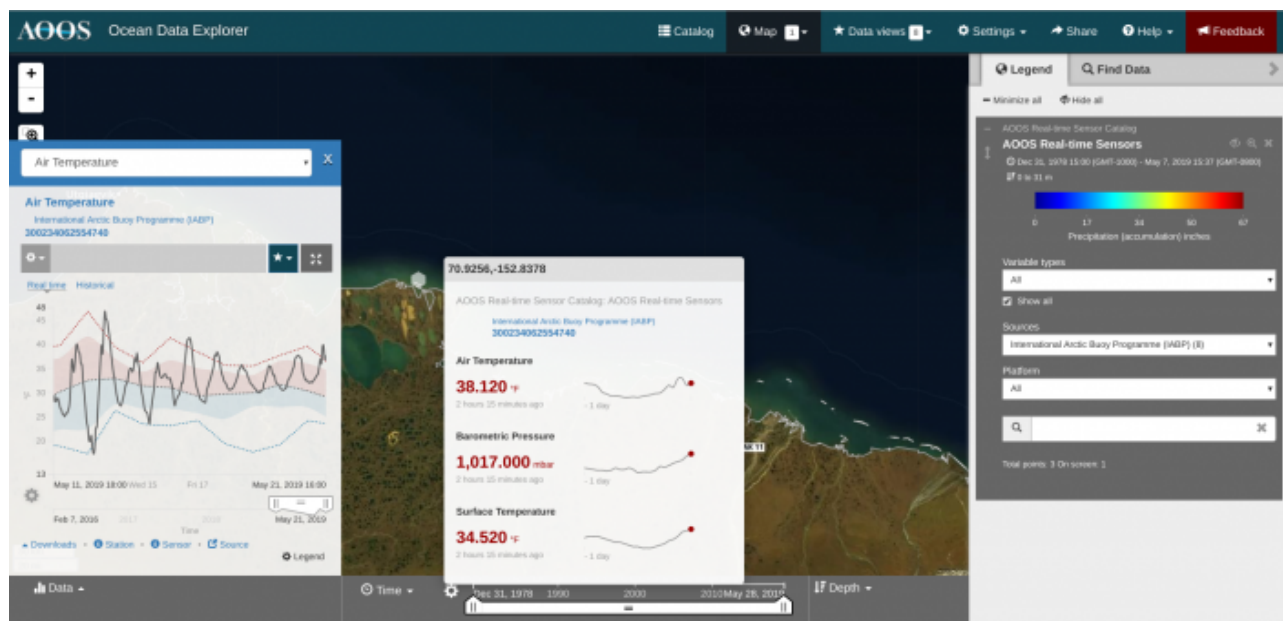


Figure 1. AOS' Ocean Data Explorer's data visualizations include real time data visualizations and time sliders that allow portal users to view data over time. Captured here is a view of real time sensor data and historical data from the same sensor, part of the International Arctic Buoy Programme Air Temperature dataset. Image courtesy of the AOS Ocean Data Explorer.

Data is Emotional

Research data grows increasingly prolific and comprehensive, serving as an emerging source of power and knowledge. Some researchers celebrate the proliferation of research data, its increased precision, and the

speed with which it is collected, processed, and manipulated. As a result of this proliferation of research data, data management and data portals become increasingly important for researchers and research communities.

Yet, as research data grows in scale and significance, researchers may grow weary, overwhelmed, or fearful about the management of their research data. At times, researchers may feel resentful, confused, uncertain, or frustrated about data management requirements from funders. Conversely, a researcher may feel joy or pride in sharing what they view as quality or highly prized data. When faced with new guidelines, researchers may feel left out or left behind by changes in data management standards, data processing techniques, or other expectations about data. Research, and research data, are emotional.

The desires and emotions that researchers have about their data carryover to the user's experience of Arctic data portals. Does the portal frustrate the researcher, or is it easy to use? Does the portal help the researcher meet important funder requirements? Does the portal help researchers publish their research, or hinder? Can the portal help the researcher to improve the quality of their data and metadata? Does the portal facilitate the sharing of a researcher's data in a way that all contributors can receive appropriate credit? What solutions does the portal provide for the researcher or Arctic data consumer?

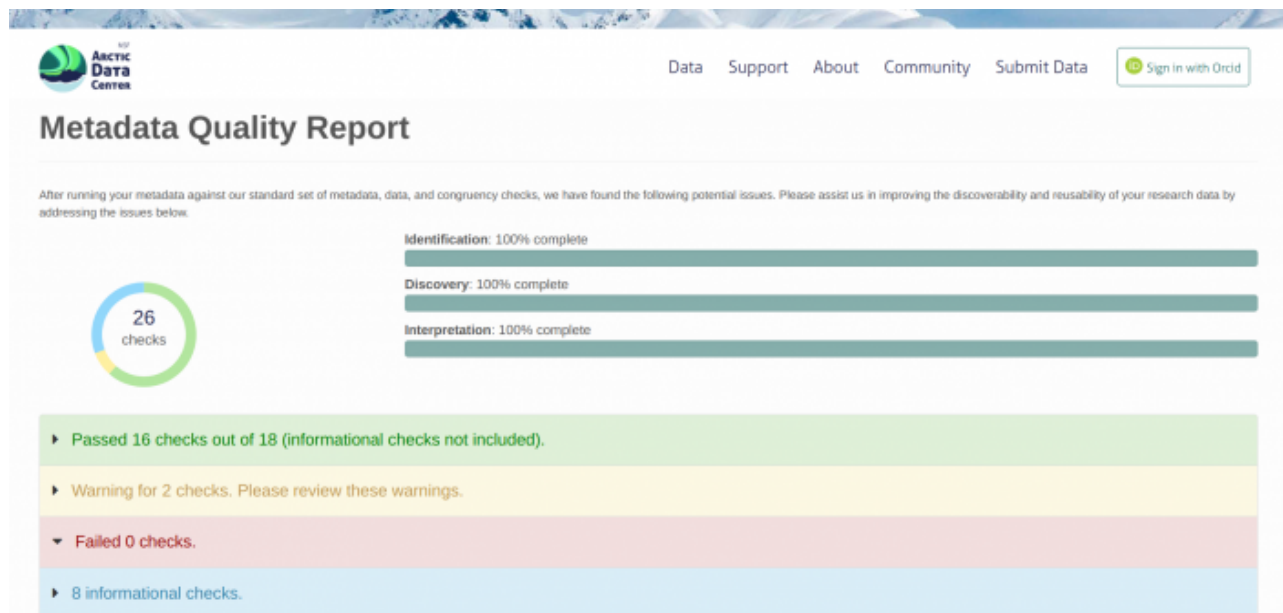


Figure 2. The NSF Arctic Data Center's enthusiasm for metadata shines in the portal's metadata quality report which performs 20+ checks to help researchers improve their metadata quality before submitting to the portal. Image courtesy of the Arctic Data Center Metadata Quality Report.

Arctic Data Portals Today

This research, still in progress, examines 25 Arctic data portals using 65 points of comparison. The comparison points were sourced through grounded theory, an analytical process by which concepts and categories are sourced from the dataset. Results are not finalized for this work, however [ongoing work](https://docs.google.com/spreadsheets/d/1RfzdzQHvMN5yWuqbV4sg84uYRt2v1EQu13DPISTQXM) (<https://docs.google.com/spreadsheets/d/1RfzdzQHvMN5yWuqbV4sg84uYRt2v1EQu13DPISTQXM>

/edit#gid=1149117193) is available for those curious to see the comparison-in-progress and add comments.

One important question that this analysis brings to light concerns Arctic data portals and the desire Arctic researchers have for open access and open data. While many portals have some components of open data—for example where data is downloadable by any visitor to the portal—many of the supporting components for open data and open science are not present in the Arctic data portals examined. These supporting components such as data versioning, data citation suggestions, digital object identifiers, downloadable metadata, downloadable processing scripts, and/or software components for reproducibility are mostly absent from Arctic data portals today.

Another question that this ongoing research brings forward is about the future of Arctic data portals. While most portals note their funders, no portal analyzed in this research publicizes the duration of their funding, future funding plans, or details about how the portal will be sustained and maintained going forward. This information could be important to Arctic researchers who may consider preserving their data with a portal, however the sustainability and longevity of a portal has broader implications within the Arctic research community. Some of this uncertainty can be alleviated by data and metadata sharing with other repositories, however this practice is not widely adopted in the portals examined.

A third question that is raised in the process of this research is about Arctic data portals' capacity to preserve and share Indigenous knowledge and traditional knowledge from Arctic Indigenous communities. This is a complex situation with much historical and cultural nuance. However, Indigenous data sovereignty efforts and Indigenous data management practices that are being adopted by non-Arctic Indigenous groups do not appear to be in use in Arctic data portals examined at this time.

The screenshot shows the CAFF Arctic Biodiversity Data Service (ABDS) portal. At the top, there is a search bar with 'back to home' and navigation links for 'Previous' and 'Next'. The main heading is 'A Global Audit of the Status and Trends of Arctic and Northern Hemisphere Goose Populations', updated 4 months ago. A summary text states: 'This report attempts to review the abundance, status and distribution of natural wild goose populations in the northern hemisphere. The report comprises three parts that 1) summarise key findings from the study and the methodology and analysis applied; 2) contain the individual accounts for each of the 68 populations included in this report, and 3) provide the datasets compiled for this study which will be made accessible on the Arctic Biodiversity Data Service.' Below this is a 'Download and links' section with three rows: 'Goose Populations web-page' with an 'Open link' button; 'A1 Western Taiga Bean Goose Anser fabalis fabalis - data' with a 'Download' button; 'A2 Western Tundra Bean Goose Anser fabalis rossicus - data' with a 'Download' button; and 'A3 Eastern Taiga Bean Goose Anser fabalis middendorffi - data' with a 'Download' button. On the right, there is an 'Overview' section with a thumbnail image of geese and the text: 'A Global Audit of the Status And Trends of Arctic and Northern Hemisphere Goose Populations (Component 2: Population accounts)'. The CAFF logo is also visible.

The CAFF's Arctic Biodiversity Data Service provides all datasets used in the Conservation of Arctic Flora and Fauna (CAFF) reports to be downloaded by any user of the portal. Image courtesy of the CAFF Arctic Biodiversity Data Service (ABDS) .

Next Steps

The next steps for this research include refining the concepts and categories for analysis and potentially expanding the comparison to include additional Arctic data portals. Further effort will be required to ascertain future funding information and to get more detail on software components used in Arctic data portals that are a part of this comparison. The research is expected to be finalized in 2020.

For further information, contact Vanessa Raymond (vanessa@convenenorth.com).

About the Author



Vanessa Lee Raymond is a sociotechnologist interested in data ethics and technology for social good. She holds a M.A. in Arctic Governance with a focus on Arctic Security from University of Alaska Fairbanks, and a B.A. in Cultural Studies from Hampshire College. Vanessa is an IT project manager and founder of Convene North, an organization connecting Northern communities and environments to technological solutions. Prior to founding Convene North, Vanessa worked at the UAF Geographic Information Network of Alaska and the NSF Arctic Data Center.

Educators Embark on Polar Research Experiences

By: Janet Warburton, ARCUS Project Manager

You know it's summer in the Arctic when educators start heading into the field with researchers! Beginning in June 2019, educators will be embedded as research team members in authentic scientific expeditions in the Arctic and Antarctica. They will be working in research locations from the Arctic Ocean to the South Pole in Antarctica, as part of the NSF-funded project entitled [STEM at the Poles! Research Experiences for Formal and Informal Educators in the Polar Regions](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1918637&HistoricalAwards=false) (https://www.nsf.gov/awardsearch/showAward?AWD_ID=1918637&HistoricalAwards=false).

The Arctic Research Consortium of the U.S. (ARCUS) was recently awarded three years of funding from the [National Science Foundation's Office of Polar Programs](https://www.nsf.gov/div/index.jsp?div=OPP) (<https://www.nsf.gov/div/index.jsp?div=OPP>) to support STEM at the Poles. This program utilizes ARCUS' signature education program, [PolarTREC](https://www.polartrec.com/about) (<https://www.polartrec.com/about>), to provide cutting-edge field research opportunities for U.S. Science, Technology, Engineering, and Mathematics (STEM) (<https://www.ed.gov/Stem>) educators from both formal and informal learning environments. Through these unique research experiences, participants will connect to the polar focused research community and develop Next Generation Science Standards (NGSS) (<https://www.nextgenscience.org/>) resources with the goal to change how they teach STEM in both informal and formal learning environments.



The 2019 PolarTREC Cohort and project management team pose for a photo outside the Syun-Ichi Akasofu Building on the University of Alaska Fairbanks campus during program orientation that was held in March 2019. The orientation is the only time the educators meet one another face to face. During the orientation, they learn about the program, discuss how to communicate their experience and the science to the public, and learn more about the polar regions. Photo courtesy of Joed Polly, ARCUS.

In the current program year, twelve STEM educators will spend three to six weeks working with research teams in the Arctic or Antarctic. Arctic expeditions take place during the summer, beginning in June 2019. The Antarctic field season begins in October and continues through the winter of 2019–2020. With the continuing grant award, an additional 36 educators (eighteen U.S. middle and high school teachers and eighteen U.S. informal science educators) will also have the opportunity to participate in the program.

While on field expeditions, they will be working with the researchers to share their experiences with the public through the use of the [PolarTREC website](https://www.polartrec.com/) (<https://www.polartrec.com/>), creating online journals, photo albums, videos, and online learning resources. While in the field, the participants often share their experience and science in real-time (via online video platforms) with a variety of audiences. After the field experience, the teams continue to share their experiences with the public by creating instructional activities to transfer scientific data, methodologies, and technology to classrooms and other learning settings. One of the main goals of *STEM at the Poles!* is to allow for greater co-creation and collaboration between educators that work in classrooms and those that work outside the classroom, with the hopes of sharing polar science to larger audiences and across a variety of learning settings. Former PolarTREC alumni also have an important role in the program as mentors to new participants.

The first expedition departs 3 June 2019 with David Walker from Austin, Texas, as he heads to [Toolik](#)

[Field Station](https://toolik.alaska.edu/) (<https://toolik.alaska.edu/>) in Alaska for four weeks. David will be working with Dr. Rose Cory, Dr. Byron Crump, and Dr. George Kling on an NSF-funded project: [Collaborative Research: Coupled Biological and Photochemical Degradation of Dissolved Organic Carbon in the Arctic](https://www.polartrec.com/expeditions/carbon-in-the-arctic) (<https://www.polartrec.com/expeditions/carbon-in-the-arctic>). By mid-June multiple teachers will be heading to Alaska.

Researchers who might be interested in hosting a STEM educator on a future field research project are encouraged to contact ARCUS Project Managers, Janet Warburton and Judy Fahnestock at info@polartrec.com or visit the [PolarTREC website](http://www.polartrec.com/) (<http://www.polartrec.com/>).

About the Author



Janet Warburton is a Project Manager at ARCUS whose primary focus is developing and implementing education related projects that help ARCUS meet its mission. For over a decade, she has administered ARCUS' signature education program, PolarTREC - Teachers and Researchers Exploring and Collaborating. She is also currently working with The Arctic in the Classroom, a program that focuses on citizen science projects in the Arctic. She is currently ARCUS' representative for University of the Arctic. Prior to joining ARCUS, she worked and lived in the Arctic in Kotzebue, Alaska. She has worked both with the federal government and local school districts developing and revamping science education programs to be more place-based as well as focus on both natural resource management and local knowledge.

IARPC Collaborations: Communicating Across Boundaries and Delving into Critical Issues

By: IARPC Secretariat Executive Secretary Sara Bowden, Web Manager / Communications Officer Jessica Rohde, and Project Analyst Meredith LaValley

The Interagency Arctic Research Policy Committee (IARPC) Collaborations is changing the way Arctic researchers communicate and collaborate. Our open, online platform on the [IARPC Collaborations website](https://www.iarpcollaborations.org/) (<https://www.iarpcollaborations.org/>), brings together over 2000 members from the research community in the United States and internationally to share resources, form connections, and team up to address new and emerging science questions.

IARPC consists of principals from 16 agencies, departments, and offices across the U.S. federal government and is charged with enhancing both the scientific monitoring of and research on local, regional, and global environmental issues in the Arctic. IARPC Collaborations was created by IARPC to connect federal government and non-federal government researchers and other stakeholders, including those overseas, to work together to solve the hard problems laid out in the [IARPC Arctic Research Plan 2017—2021](https://www.iarpcollaborations.org/uploads/cms/documents/arctic-research-plan-brochure-20161201.pdf) (<https://www.iarpcollaborations.org/uploads/cms/documents/arctic-research-plan-brochure-20161201.pdf>).



IARPC Collaboration Teams provide an opportunity for members of the Arctic research community to participate in implementation of federal research policy. Image courtesy of IARPC Collaborations.

To better support the Arctic research community, the [IARPC Collaborations Teams website](https://www.iarpcollaborations.org/members/teams/index.html) (https://www.iarpcollaborations.org/members/teams/index.html) includes a "self-forming team" feature. Self-forming teams are organized around a topic not covered in the existing set of Collaboration Teams and sub-teams. If members of the research community identify an emerging topic or need webspace to communicate and collaborate at any stage of a research effort, they may create a page on the site for community members to join and share their ideas. Currently the website supports six self-forming teams. Participation in the teams is open to anyone in the research community. Team meetings are posted as events on the [IARPC Collaborations events website](https://www.iarpcollaborations.org/members/events/index.html) (https://www.iarpcollaborations.org/members/events/index.html).

To join a team, please [request an account](https://www.iarpcollaborations.org/request-account.html) (https://www.iarpcollaborations.org/request-account.html) on the IARPC Collaborations member space.

The recently created [Diversity and Inclusion Self-forming Working Group](https://www.iarpcollaborations.org/members/people/teams/3862) (https://www.iarpcollaborations.org/members/people/teams/3862) recognizes the value of diversity and inclusiveness in Arctic science and encourages open conversations on how to facilitate inclusion and equity in scientific research to enhance problem solving and generate innovative solutions. This team is focusing its early efforts on sharing diversity and inclusion policies of federal funding agencies and other entities and holding open conversations via webinars to share experiences and ideas for ways to ensure diversity in the current and future generations of researchers.

[The Field Operations Working Group](https://www.iarpcollaborations.org/members/people/teams/1985) (https://www.iarpcollaborations.org/members/people/teams/1985) facilitates coordination and collaboration among organizations supporting field operations and campaigns to collect Arctic data. Each year federal members of the team compile a vessel and aircraft matrix that is made available early in the field season so that local communities as well as researchers know which vessels will be operating in the Bering, Chukchi, and Beaufort seas. A recent Field Operations Working Group meeting featured a thorough [overview of the logistics involved in the Multidisciplinary Drifting Observatory for the Study of Arctic Climate \(MOSAIC\) project](https://www.iarpcollaborations.org/members/documents/13347) (https://www.iarpcollaborations.org/members/documents/13347). This team is also a forum for sharing information and good practices around topics of common interest such as environmental compliance, managing risk in field settings, and implementing the Principles for Conducting Research in the Arctic.

[The Arctic STEM Education Working Group](https://www.iarpcollaborations.org/members/people/teams/3584) (https://www.iarpcollaborations.org/members/people/teams/3584), chaired by NSF and the National Oceanic and Atmospheric Administration (NOAA), was initially formed in 2018 to coordinate federal Science, Technology, Engineering, and Math (STEM) education activities in the Arctic. Initially a federal agency-only group, this team is now open to anyone who wishes to join. Its first open meeting convened on 31 May 2019. The group will connect STEM education organizations in order to leverage Arctic science. Its early work will be focused on bringing together STEM educators to discuss best practices and share ideas for expansion of STEM activities in the Arctic.

[The Science Communications Forum](https://www.iarpcollaborations.org/members/people/teams/3573) (https://www.iarpcollaborations.org/members/people/teams/3573) provides an online space for members to share resources for communicating Arctic science across disciplines and to the public. This forum, run by the IARPC Collaborations Web Manager and Communication Officer, also supports an online course in interdisciplinary science communication for early career scientists. Students and forum members use this space to share and receive feedback on their individual science communication projects as well as network and share other resources.

Two of the self-forming teams use IARPC Collaborations to disseminate and receive information. The Arctic Domain Awareness Center ([ADAC](http://arcticdomainawarenesscenter.org/)) (http://arcticdomainawarenesscenter.org/) has a team which uses the space to share information about upcoming events, research, and activities of the ADAC. The [U.S. Forum for the International Arctic Science Committee \(IASC\)](https://www.iarpcollaborations.org/teams/U-S-Forum-for-the-International-Arctic-Science-Committee-IASC-) (https://www.iarpcollaborations.org/teams/U-S-Forum-for-the-International-Arctic-Science-Committee-IASC-) has a self-forming team where U.S. representatives to IASC keep the U.S. research community informed about [IASC](https://iasc.info/) (https://iasc.info/) activities.

Through IARPC Collaborations we open our work to non-Federal Arctic researchers and stakeholders.

IARPC Federal only

IARPC Collaborations
Federal & non-Federal

We welcome you to join one or more of our nine thematic Collaboration Teams

- Marine Ecosystems
- Health & Well-being
- Glaciers & Sea Level
- Coastal Resilience
- Environmental Intelligence
- Terrestrial Ecosystems
- Sea Ice
- Atmosphere
- Permafrost

IARPC Collaborations welcomes federal and non-federal Arctic researchers and stakeholders to join a collaboration team. Image courtesy of IARPC Collaborations.

It is easy to join any of these teams. Use the [online form](https://www.iarpcollaborations.org/request-account.html) (https://www.iarpcollaborations.org/request-account.html) to request an account on the member space, then simply click the "join" button on the ["Teams" page](https://www.iarpcollaborations.org/members/teams/index.html) (https://www.iarpcollaborations.org/members/teams/index.html) and you will be added to the distribution list for upcoming meetings and for posting by members. If you have a need for space to communicate with fellow federal and non-federal researchers about a topic or issue, contact the IARPC Secretariat and fill out an application for a self-forming team. New teams may be from any sector, but each

team must have at least one federal co-sponsor. For more information about any of the self-forming teams or to request a new team, please contact IARPC Web Manager and Communications Officer Jessica Rohde at jrohde@arcus.org.

About the Authors



Sara Bowden is Executive Secretary to the IARPC Secretariat. In 2011, Sara joined the IARPC secretariat and contributed to the drafting of the first 5-year research plan. She has worked with the IARPC Executive Director, Staff Group, and Principals to put in place the implementation and collaboration team structure and assisted with the development of the IARPC Collaborations website for sharing and communicating U.S. Arctic research undertakings. She began her career as a Presidential Management Intern in the Department of Commerce and from there held positions in the International Trade Administration and the Office of the United States Trade Representative. She served for five years in as a senior policy analyst for international affairs in the White House Office of Science and Technology Policy before beginning her science management and administration career in the Arctic. She has served as the Executive Secretary for the Arctic Ocean Sciences Board (AOSB) and the International Arctic Science Committee (IASC).



Jessica Rohde joined the IARPC Secretariat in 2014 to manage the newly launched website, IARPC Collaborations. As the Web Manager and Communications Officer, she performs many functions for IARPC including managing the IARPC Collaborations website and its community of over 1200 users, outreach materials and campaigns, and the IARPC Public Webinar Series. In addition to her research background in fisheries science and science communication, she has developed websites for science-based organizations since 2008.



Meredith LaValley is a Project Analyst for the IARPC Secretariat. She recently completed her Master's in Environmental Policy at Bard College, where she focused much of her independent studies on Arctic issues, and her thesis focused on understanding knowledge exchange within IARPC Collaboration Teams. She recently relocated to Anchorage, Alaska, where she will work closely with the Alaska-based IARPC Collaborations community.

The LEO Network, Addressing Climate Change One Event at a Time

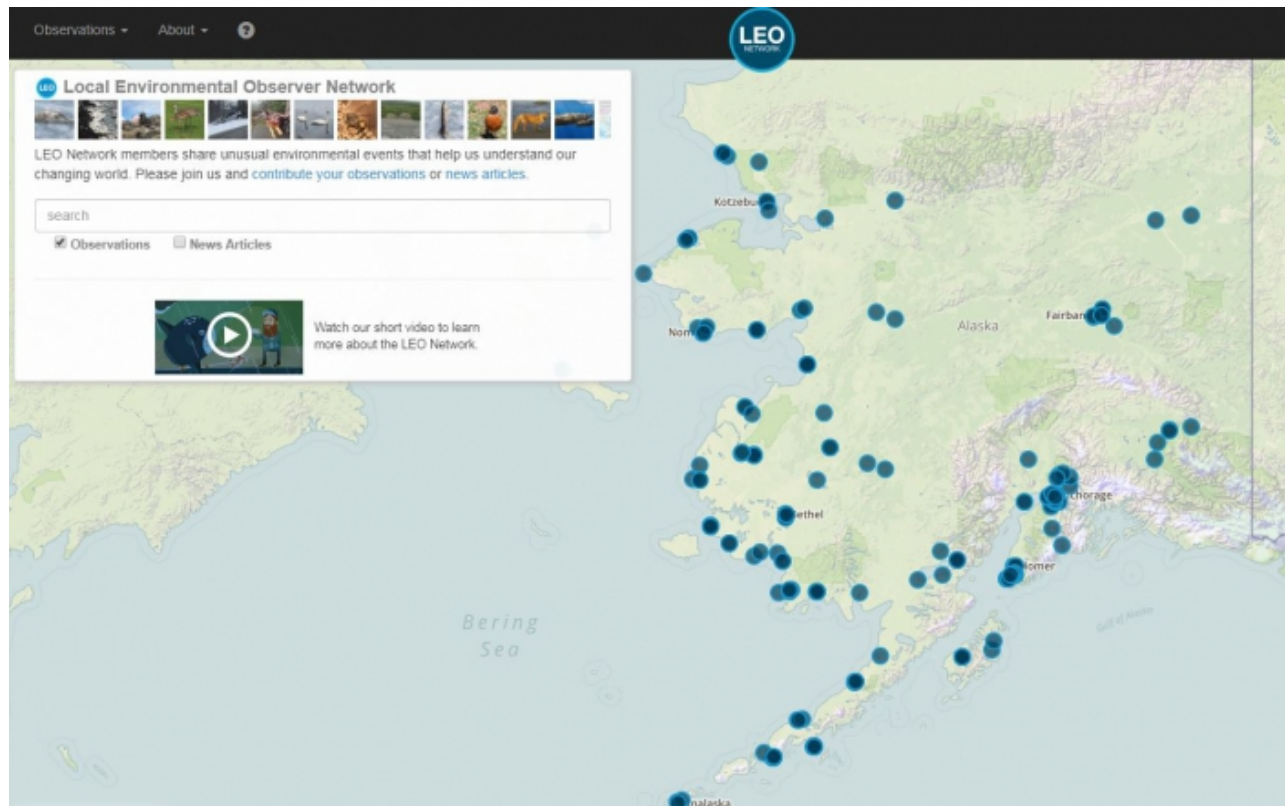
By: Michael Brubaker, Director, Department of Community Environment and Health, Alaska Native Tribal Health Consortium; Erica Lujan, LEO Network Coordinator Alaska Native Tribal Health Consortium; Desirae Roehl, Tribal Capacity and Training Program Manager, Alaska Native Tribal Health Consortium; and Michael Brook, Senior Software Architect, Alaska Native Tribal Health Consortium

Arctic residents are experiencing the impacts of climate change every day. It is affecting people's homes and their ability to travel, access clean water, and harvest healthy foods. With temperatures outside of normal, landscapes altered, and seasons unhinged, the impacts of climate change are being expressed by specific events that are unusual or unprecedented. Over the past decade, the Alaska Native Tribal Health Consortium (ANTHC) (<https://anthc.org/>) has been developing a conversation with Arctic residents to share our experiences, better understand these event-based symptoms, and describe relationships between climate change, environmental impacts, and health effects. The goal is to improve understanding about climate change and to find healthy ways to adapt. (See ANTHC's [Center for Climate and Health](https://anthc.org/what-we-do/community-environment-and-health/center-for-climate-and-health/). (<https://anthc.org/what-we-do/community-environment-and-health/center-for-climate-and-health/>)) We have found no easy answers, but have come up with a simple strategy: address the impacts of climate change, one event at a time.



Sea Ice Break at Diomedede, 26 January 2017. Photo courtesy of Opik Ahkinga, Native Village of Diomedede, Alaska.

To do this we needed an easy way to share information about climate-related events, and a tool to connect observers with other knowledge and topic experts. This was the framework for the [Local Environmental Observer \(LEO\) Network](https://anthe.org/what-we-do/community-environment-and-health/leo-network) (<https://anthe.org/what-we-do/community-environment-and-health/leo-network>). The LEO Network is an online platform for documenting the symptoms of environmental change (not just climate related) as described by people who are experiencing the impacts first hand. LEO is an almanac of first-person accounts of unusual environmental events, which are often the first signals of significant and systemic change. This approach works because people who have intimate knowledge about their local environment share their observations on the platform, and by doing so, share information with people in other communities and countries. The purpose is two-fold: first, to raise awareness about climate and environmental change through description of specific events; and second, to connect people who can explore these events and develop specific adaptation strategies.



Locations of local environmental observations in Alaska provided by members of the LEO Network. Image courtesy of the Alaska Native Tribal Health Consortium.

The LEO Network began in 2012 as an effort by the tribal health system to understand and address emerging environmental health threats. It was patterned after the Alaska telemedicine system, used to connect medical specialists with health care providers in rural villages. With primary funding from the Environmental Protection Agency (EPA), the Commission for Environmental Cooperation (CEC), and the Bureau of Ocean Energy Management (BOEM), the network has grown across Alaska and expanded nationally and internationally. Today, LEO Network has approximately 3,600 members in 700 communities globally. The platform is available in fifteen languages including French, Portuguese, Norwegian, Iñupiaq, and Northern Sámi.

The LEO Network itself is part observation system, part social and consultation network, and part publishing platform. LEO welcomes anyone interested in environmental change to become a member, learn from the content, make observations, and share their expertise. Observers often connect by email with other subject matter experts to share information about an event and collaborate as co-authors on a LEO Network post. Typical observations describe seasonal change, unusual weather, natural disasters, and changes in wildlife health or behavior. The posts are often supplemented with links to webpages, related news articles, and relevant weather data or satellite images. Looking at collections of observations can help identify local and regional trends and inform community planning, research activities, and policy. Members can also use the system to do analysis and create their own mapping projects. These projects are personally curated collections of articles and observations which can be shared or kept private.



Permafrost Thaw Along the Koyukuk River, 10 August 2017. Photo courtesy of Jonathan Henzie, Allakaket Village Council, Alaska.

Climate change, when taken as a whole, is complex, confusing, even overwhelming. But at the local level, the circumstances and impacts can be described, questions can be raised, and strategies and interventions explored. The LEO Network approach is just this: focus at the local level and address environmental change one event at time.

Further information, including how join the LEO Network, is available on our [website](https://www.leonetwork.org/) (<https://www.leonetwork.org/>) and by viewing an informational video, "[About the LEO Network](https://leovideos.blob.core.windows.net/asset-56c8c3ef-f3f7-48ae-87b6-b388abdf7b96/LEO%20Network_English_640x360_650.mp4?sv=2012-02-12&sr=c&si=4abe98d8-d2e3-42d9-9c73-906051992c20&sig=8FQZJHuCNNkf0mZUGNI8OXSk2NEMUaSssFecgC2KR0%3D&st=2016-09-09T02%3A19%3A02Z&se=2116-09-09T02%3A19%3A02Z)" (https://leovideos.blob.core.windows.net/asset-56c8c3ef-f3f7-48ae-87b6-b388abdf7b96/LEO%20Network_English_640x360_650.mp4?sv=2012-02-12&sr=c&si=4abe98d8-d2e3-42d9-9c73-906051992c20&sig=8FQZJHuCNNkf0mZUGNI8OXSk2NEMUaSssFecgC2KR0%3D&st=2016-09-09T02%3A19%3A02Z&se=2116-09-09T02%3A19%3A02Z)

About the Authors

Michael Brubaker, Director, Department of Community Environment and Health Alaska Native Tribal Health Consortium, has been working in the Alaska Tribal Health System for over twenty years. His work focuses on environmental health, health impact assessments, climate change, and achieving safe, healthy,



sustainable communities. He was born in Juneau and raised in Anchorage. He earned a BS in Biology from St. Lawrence University and a MS in Environmental Management from the University of San Francisco. He spent ten years as Community Services Director at the Aleutian Pribilof Islands Association, a regional tribal non-profit health consortium serving the Unangan population in Southwestern Alaska. He has spent the past ten years working for the statewide arm of the tribal health system where he directs environmental health services. Mike co-founded and directs the Local Environmental Observer (LEO) Network and is managing editor of the weekly e-journal, *The Northern Climate Observer*. He is associate faculty at Alaska Pacific University where he directs the Center for Climate and Health. Mike lives in Anchorage with his wife and four children.



Erica Lujan, LEO Network Coordinator, Alaska Native Tribal Health Consortium (ANTHC) is a member of the Tribal Capacity and Training Program at ANTHC, and works to help Alaskan communities document, and plan for, the impacts of climate change. Prior to coming on board with ANTHC, Erica worked as a Graduate Intern for the Division of Subsistence at the Alaska Department of Fish and Game and as a Research Associate at the University of Alaska Anchorage Institute for Circumpolar Health Studies.



Desirae Roehl, Tribal Capacity and Training Program Manager, Alaska Native Tribal Health Consortium, is the Senior Program Manager for the Tribal Capacity and Training Program at ANTHC. She has over 14 years of experience working with tribal organizations on environmental and sustainability issues.



Michael Brook, Senior Software Architect, Alaska Native Tribal Health Consortium, is a software engineer who has worked in the tribal health system since 2015. His work focuses on developing software that helps communities better monitor and address health conditions. He is the primary software architect for LEO Network.

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The U.S. Arctic Research Commission Releases its Goals and Objectives for Arctic Research 2019-2020

By: Cheryl Rosa, U.S. Arctic Research Commission Deputy Director

The U.S. Arctic Research Commission (USARC) (<https://www.arctic.gov/>) released their [2019-2020 Report on the Goals and Objectives for Arctic Research](https://www.arctic.gov/reports_goals.html) (https://www.arctic.gov/reports_goals.html) on 8 May at their 111th Commission Meeting in Anchorage, Alaska. Dedicated to USARC's late Commissioner, Mary Pete, the "Goals Report" outlines recommendations for research in a rapidly changing Arctic. The report outlines five priority research areas and lists recommendations and examples for each.



Illustrated cover of the 2019-2020 Report on the Goals and Objectives for Arctic Research. Image courtesy of USARC.

Priority One: Advance Arctic Infrastructure

Functional Arctic infrastructure is a prerequisite for human activity in the north. A changing climate damages essential infrastructure, making it costly to maintain, repair, and replace—especially in remote areas. USARC recommends preventative measures based on a well-informed understanding of

environmental conditions in order to reduce infrastructure damage and costs. USARC specifically seeks support for demonstration projects to address infrastructure engineering and design, as well as decision-support tools that are regularly updated to plan, design, and construct infrastructure in a rapidly changing environment.

Priority Two: Assess Arctic Natural Resources

As the Arctic becomes increasingly accessible, and as global demand for Arctic resources grows, decision-makers need information that helps them to make informed choices on resource use. We recommend support for assessment of oil and gas potential on Alaska's North Slope, mineral distribution in the Arctic (Responsible agency: [United States Geological Survey](https://www.usgs.gov/) (<https://www.usgs.gov/>)), and trawl surveys of fish stocks from the Bering Sea northward (Responsible agency: [National Oceanic and Atmospheric Administration](https://www.noaa.gov/) (<https://www.noaa.gov/>)). We also encourage agencies, such as the Department of Energy, to fully implement their 10-year Arctic renewable energy plan.

Priority Three: Observe, Understand, and Forecast Arctic Environmental Change

Monitoring the rapid and unprecedented changes in the Arctic, and their impacts on wildlife and humans, is critically important. Our report mentions the stunning declines in migratory bird numbers, the majority of which spend critical parts of their lives in the Arctic. Another focus is the "cold pool"—or lack thereof—in the Bering Sea. Marine heatwaves are changing spawning habitat and egg survival, larval development, and fish growth rates, impacting the ecosystem as a whole.



Fish drying near Tooksook Bay. Photo courtesy of Jimmie Lincoln.

Priority Four: Improve Community Health and Well-Being

This "goal" used to be two separate priorities—one called Arctic Human Health and another having to do with culture, languages, and resiliency. Through feedback from community members, they were combined into one cohesive goal that underscores their inter-relatedness. Our recommendations range from how to perform research—emphasizing early and frequent collaboration with local communities on research questions, approach, and conduction—to specifics regarding the provision of mental health care, clean and adequate amounts of water in rural Alaska, and the emergence and expansion of diseases that can affect humans and wildlife.

Priority Five: Enhance International Scientific Cooperation in the Arctic

Increasing demands for information and interdisciplinary research results create a challenge for Arctic states and stakeholders. Enhanced cooperation among Arctic states and non-Arctic states can build synergies between national programs and create efficiencies for the best use of limited resources to address

Arctic scientific challenges that often extend beyond the jurisdiction of any one nation. Recommendations include implementation of the Central Arctic Ocean Fisheries Agreement and the Arctic Science Cooperation Agreement, and strengthening of bilateral and multilateral research cooperation.

The report also covers emerging topics in Arctic research, its collaboration with the Interagency Arctic Research Policy Committee, and addressing federal and state priorities.

For further information, read the [2019-2020 Report on the Goals and Objectives for Arctic Research](https://www.arctic.gov/reports_goals.html) (https://www.arctic.gov/reports_goals.html).

About the Author



Dr. Cheryl Rosa, Deputy Director and Anchorage-based Alaska Director of the United States Arctic Research Commission (USARC), is trained as a wildlife veterinarian and wildlife biologist and has worked with subsistence communities on the North Slope and in the Russian Far East on a wide range of studies involving wildlife health and zoonotic disease, marine mammal stranding response, subsistence food safety, and oil spill/offshore discharge research. She is a member of the International Whaling Commission's Scientific Committee, as well as numerous other federal and non-federal boards and steering committees. Presently, she is involved in running USARC's Alaska Rural Water and Sanitation Working Group, the Arctic Renewable Energy Working Group, and the Arctic Mental Health Working Group.

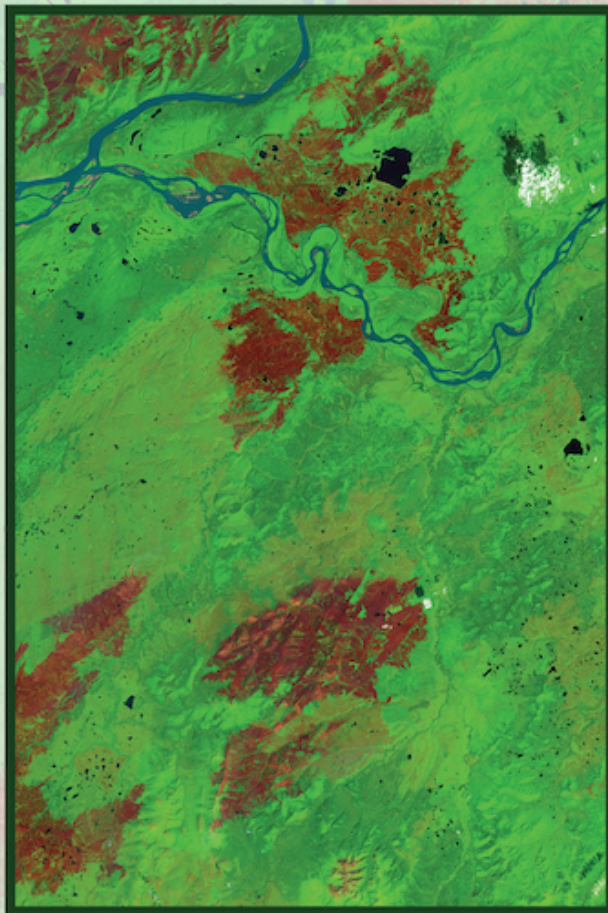
Drivers and Implications of Arctic Vegetation Browning and Greening Trends—Proceedings from a Recent Workshop by the National Academies of Sciences, Engineering, and Medicine

By: April Melvin, Program Officer, Polar Research Board, National Academies of Sciences, Engineering, and Medicine

The [Polar Research Board](http://www.dels.nas.edu/prb) (<http://www.dels.nas.edu/prb>), in collaboration with the [Board on Life Sciences](https://www.nap.edu/author/BLS/division-on-earth-and-life-studies/board-on-life-sciences) (<https://www.nap.edu/author/BLS/division-on-earth-and-life-studies/board-on-life-sciences>) of the [National Academies of Sciences, Engineering, and Medicine](http://www.nationalacademies.org/) (<http://www.nationalacademies.org/>), convened a workshop in December 2018 to discuss vegetation greening and browning in tundra and boreal ecosystems.

PROCEEDINGS OF A WORKSHOP

UNDERSTANDING NORTHERN LATITUDE VEGETATION GREENING AND BROWNING



The National Academies of
SCIENCES • ENGINEERING • MEDICINE

The Proceedings from a workshop, "Understanding Northern Latitude Vegetation Greening and Browning," was published by the National Academies of Sciences, Engineering, and Medicine. Image courtesy of the National Academies.

Vegetation change has been observed across Arctic and boreal regions

Studies have often documented large-scale greening trends (i.e. increased plant productivity and measured "greenness") but they have also identified areas of browning (decreased productivity) or shifts between greening and browning over varying spatial extents and time periods. At the same time, there are large portions of these ecosystems that have not exhibited measurable trends in greening or browning. These findings have fueled many questions about observed trends and identified drivers, implications of vegetation change, and methods and tools for evaluating changes and their uncertainties. These topical areas formed the primary themes of the workshop that were discussed by experts representing remote sensing and field-based research communities from U.S. and international institutions.

Drivers of greening and browning trends

Drivers discussed at the workshop included climate change and a variety of disturbance types, including many that are commonly linked to warming. Warming has been shown to contribute directly to greening trends in tundra by stimulating plant growth and shifting the landscape toward increased plant (including shrub) cover. Fire is a major disturbance in boreal forest that has increased in extent and severity with warming and has been linked to browning trends, and there is increasing concern that fires will also become more frequent in tundra. Insect infestations also cause browning as trees are either killed or defoliated. Harvest of high-productivity tree species, particularly in Canada, was also discussed as a common disturbance that decreases forest cover and can contribute to browning.

Implications

The potential implications of vegetation change and related greening and browning patterns extend from local to global scales. The Earth's surface energy balance is strongly affected by albedo (reflectance), which varies with the color of vegetation and the presence of snow on the vegetation surface. Shifts in plant species composition that often occur following a disturbance were also discussed. Areas often exhibit browning initially, followed by greening as the ecosystem recovers either to a state similar to pre-disturbance, or to a new state in which plant-soil-microbial feedbacks are altered, with implications for carbon and nutrient cycling and storage, permafrost thaw, and greenhouse gas release, among other processes.

Vegetation change can also affect wildlife and hunting and have other societal impacts. Researchers are currently investigating linkages between migratory caribou, preferred food sources, and trends in greening and browning. Vegetation change, particularly increasing shrub cover, was also discussed as a possible hindrance to hunters' ability to visually find animals and as a negative impact on travel to hunting areas. A benefit of increasing shrub abundance around villages at high latitudes may be the increased use of shrubs as a fuel source.

Methods to evaluate greening and browning

Commonly used methodologies include remote sensing platforms (satellites, airborne campaigns, drones, etc.) and field-based approaches that measure plant growth, percentage cover, leaf greenup and senescence, as well as eddy covariance (a micro-meteorological method used to directly observe the exchanges of gas, energy, and momentum between ecosystems and the atmosphere). Remote sensing is a useful tool because it can capture information across vast regions that are largely inaccessible over land. Many remote sensing platforms also provide relatively long records that can be analyzed to determine trends. A tradeoff, however, is that these datasets are often at coarse spatial and temporal resolution and therefore may be unable to detect smaller-scale changes that are observable when using field-based methods. Field measurements allow for fine-resolution evaluation of productivity drivers and may identify changes that are only discernible at a local scale. Field-collected data are also important for validating findings of remote sensing studies.

The importance of the scale at which data are collected was a recurrent theme throughout the workshop. Participants emphasized that moving toward increased collection of data at finer spatial and temporal scales, with improved bridging of information across scales, would help to address observable inconsistencies that currently exist when comparing greening and browning patterns and trends across datasets. Expanded efforts to integrate new technologies and tools that have become available could also advance understanding.

Further information is available in the [Workshop Proceedings](https://www.nap.edu/catalog/25423/understanding-northern-latitude-vegetation-greening-and-browning-proceedings-of-a) (<https://www.nap.edu/catalog/25423/understanding-northern-latitude-vegetation-greening-and-browning-proceedings-of-a>) that summarize presentations and discussions at the workshop, released on 18 April 2019. Additionally, a public webinar was held on 14 May 2019.



April Melvin is an environmental scientist and policy professional with experience studying the impacts of climate change and air pollution on society and the environment. She is currently a Program Officer at the National Academies of Sciences, Engineering, and Medicine where she coordinates the development of consensus reports and workshops for the Board on Atmospheric Sciences and Climate and the Polar Research Board.

Addressing Priority Needs for Arctic Research Support & Collaboration with ARCUS Members

By: Brit Myers, ARCUS Project Manager

The Arctic Research Consortium of the U.S. (ARCUS) is a 501c3 not-for-profit consortium of leading [Arctic research institutions and individual members](https://www.arcus.org/arcus/members) (https://www.arcus.org/arcus/members) that share the belief that a well-connected and highly collaborative Arctic research community is the most effective way to advance knowledge about the circumpolar Arctic and the many connections it has to lower latitudes. ARCUS programs are dedicated to increasing the capacity of Arctic researchers to undertake productive collaborations, bridge knowledge systems, and promote greater community inclusivity.



In small groups, community members discussed priority needs for Arctic research support and coordination during the 2018 ARCUS Annual Meeting. Photo courtesy of Joed Polly, ARCUS.



In separate table discussions, ARCUS community members shared ideas about how to identify Arctic research gaps and how best to collaborate. Photo courtesy of Joed Polly, ARCUS.

At the [2018 ARCUS Annual Meeting](https://www.arcus.org/annual-meetings/2018) (<https://www.arcus.org/annual-meetings/2018>), 80 [institutional member representatives](https://www.arcus.org/arcus/members/representatives) (<https://www.arcus.org/arcus/members/representatives>) as well as other active participants in the Arctic research community came together to discuss priority needs for Arctic research support and coordination. As outlined in the [meeting report](https://www.arcus.org/files/page/documents/28632/2018annualreportc.pdf) (<https://www.arcus.org/files/page/documents/28632/2018annualreportc.pdf>), an emphasis was placed on creating programming that would:

- Bring people together for proposal and early project development
- Identify opportunities to share resources
- Facilitate networking across disciplines or sectors
- Develop opportunities for greater inclusion of Indigenous community members
- Improve ways for research groups to communicate with each other
- Improve the research community's ability to share information with decision-makers
- Help with broader impacts by communicating research findings with relevant stakeholders and communities and/or assisting with outreach plans
- Improve Arctic educational opportunities for K-16 students
- Increase involvement of teachers in Arctic research
- Increase capacity for education and citizen science in northern communities

Over the past few months, [ARCUS staff](https://www.arcus.org/arcus/staff) (<https://www.arcus.org/arcus/staff>), our [Annual Meeting Task Force](https://www.arcus.org/arcus/committees) (<https://www.arcus.org/arcus/committees>) team, and the [ARCUS Board of Directors](https://www.arcus.org/arcus/committees)

(<https://www.arcus.org/arcus/board-of-directors>) have been working together to develop a handful of new ARCUS project ideas inspired by the priorities outlined above. As they continue to develop, ARCUS members will receive priority invitations to help inform, take part, and lead in these new activities and initiatives.

ARCUS members are individuals and organizations that want to join with a larger community to tackle Arctic research challenges, respond collaboratively to emerging opportunities, and explore both the frontiers and intricate interconnections of the Arctic system in an interdisciplinary way. If you or other Arctic researchers in your institution have any collaboration opportunities to discuss with the broader Arctic research community, we invite all interested parties to join us either in-person or virtually for the next ARCUS Annual Meeting, scheduled for December 2019 (date TBD) in San Francisco, CA. We also invite you take advantage of ARCUS' many communication channels (such as [ArcticInfo](https://www.arcus.org/arctic-info) (<https://www.arcus.org/arctic-info>), Witness the Arctic, our Member newsletter, or the [Polar Educators listserv](https://www.polarrec.com/about/education-list) (<https://www.polarrec.com/about/education-list>) to help bring your news and ideas to the attention of our subscribers throughout the year.

For additional information about current Arctic Research Consortium of the U.S. activities or how to get more involved as a member, please contact Brit Myers at brit@arcus.org.

About the Author



Brit Myers is a currently a [AAAS Community Engagement Fellow](https://www.aaas.org/programs/community-engagement-fellows/meet) (<https://www.aaas.org/programs/community-engagement-fellows/meet>) (#CEFP2019) and has been a Project Manager at ARCUS since 2015 , supporting both the SEARCH program and the ARCUS Board's membership and development activities. Connect with her on [LinkedIn](https://www.linkedin.com/in/britmyers/) (<https://www.linkedin.com/in/britmyers/>), Twitter (@quixoticroads), or in-person the next time you are in the Seattle area.

Arctic Indigenous Scholar, Rosemary Ahtuanguaruak: Educating, Communicating, and Affecting Change

By: Rosemary Ahtuanguaruak, Community Health Aide, Nuiqsut, Alaska and 2018 Arctic Indigenous Scholar

(Editor's note: The [Arctic Indigenous Scholar Program](https://www.arcus.org/indigenous-scholars) (<https://www.arcus.org/indigenous-scholars>), led by ARCUS and the Inuit Circumpolar Council (ICC) (<https://iccalaska.org/>) Alaska, and supported by the NSF Division of Arctic Sciences, creates a space for Indigenous scholars to educate and inform policy- and decision-makers engaged in Arctic issues from the nation's capital, Washington, D.C.)

The Indigenous Scholars Program has opened doors to subjects and people important to the Arctic. We have the opportunity to connect with decision-makers affecting us. We have the chance to open discussions with agency and nonprofit organizations about work in our lands and waters — from plans to actions. We have the chance to speak across dividing lines of those who sit on both sides of the table. We have the chance to educate others on our issues and concerns.

We have the chance to connect to the process that led to decisions that affect our daily life and bring concerns about our life, health, safety, and the importance of tradition and culture.

We can speak to many issues and we can answer questions that affect decisions. The work from our lands and waters is very important to educate others. We have generations of knowledge passed down and we must stand up to have our priorities included and to stay in our projects.

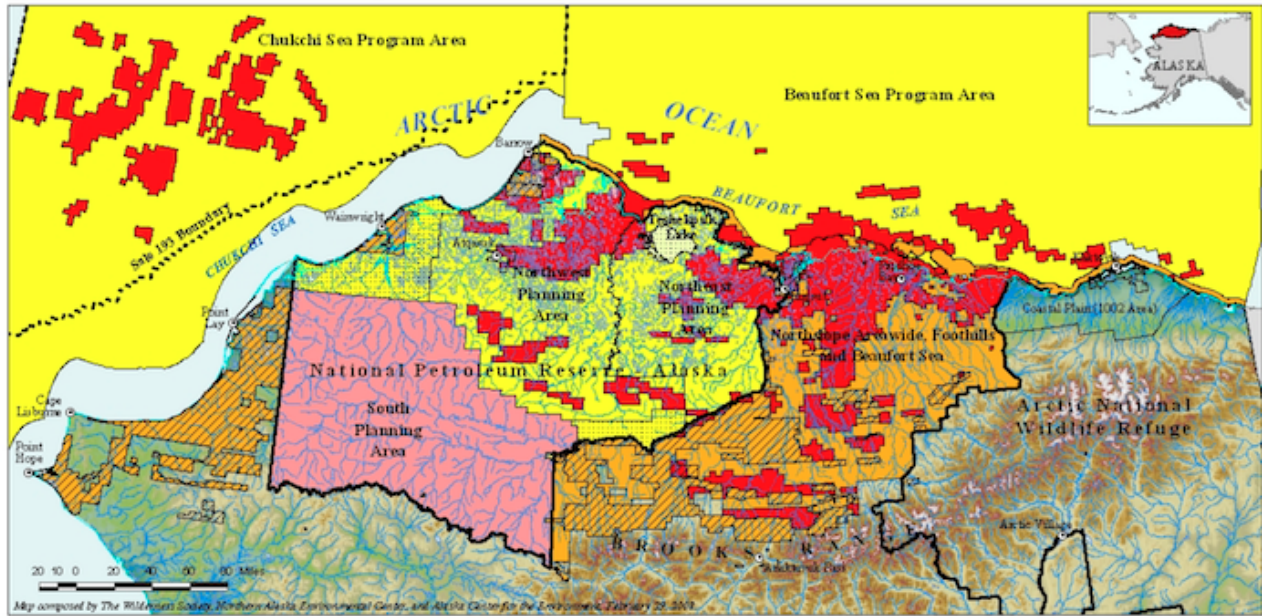
Our stories have meanings and learning that cross cultural lines. We bring the concerns we live, feel, react to, and prepare to prevent.

The work brings the teaching of our elders into the process. We come from our villages to educate, communicate, and affect change.

The individuals of the Indigenous Scholars Program have worked to engage to be pre-cautious, to prevent, to protect, and to be protective. We understand us, our lands and waters, and our future.

I work to protect our lands and waters. I live in the National Petroleum Reserve Alaska facing the national energy policy. I became a community health aide and saw respiratory illness increasing amongst our people. I began asking questions and saw natural gas flares and noticed more people had trouble when we had twenty or more. We saw thyroid disorders, cardiac disease, obesity, and diabetes also rise.

Current and Proposed Oil & Gas Leases on Alaska's North Slope

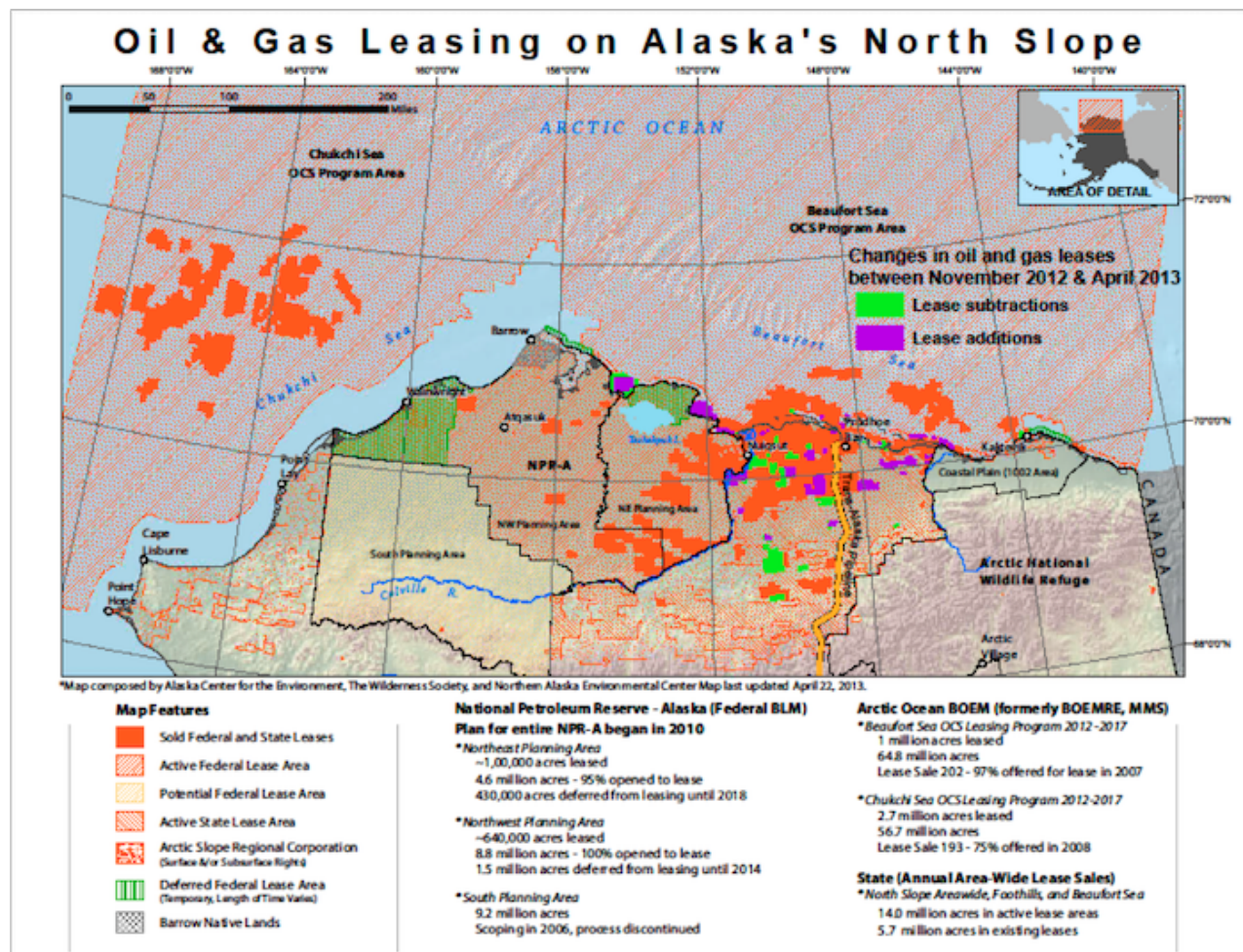


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|---|---|---|
| <ul style="list-style-type: none"> Sold Federal and State leases Active Federal Lease Area Proposed Federal Lease Plan Area Active State Lease Areas ASRC Surface and/or subsurface lands Barrow Native Lands | <p>National Petroleum Reserve - Alaska (Federal BLM)</p> <ul style="list-style-type: none"> * Northwest Planning Area
4.6 million acres - 100% opened to lease in 2006 Lease deferred for an unspecified amount of time
Supplemental DEIS released August 2007
Next lease sale in October 2008 * Northwest Planning Area
8.8 million acres - 100% opened to lease 2004 Open to exploration but deferred from development until 2014
Next lease sale in October 2008 * South Planning Area
9.2 million acres
Scoping completed 2006 | <p>Arctic Ocean (Federal MMS)</p> <ul style="list-style-type: none"> * Beaufort Sea Program Area 2007-2012
33.2 million acres (an increase from 9.4 million acres)
Lease Sale 202 - 97% offered for lease in 2007
Next Lease Sale (209) in 2009 * Chukchi Sea Program Area 2007-2012
39.3 million acres (an increase from 33.8 million acres)
Lease Sale 193 - 75% offered in 2008
Next Lease Sale (212) in 2010 <p>State</p> <ul style="list-style-type: none"> * Northlope Area-wide, Foothills and Beaufort Sea
14.4 million acres in active lease plan areas
4.0 million acres in existing leases |
|---|---|---|

*Rosemary Ahtuanguaruk comments, "This map shows how much work there is to do each red little box is a lease sale already for developing."
Image courtesy of Rosemary Ahtuanguaruk.*

The changes to our lands and waters effect our animals, how they use the lands and waters, and how they change. When change caused us to suffer hardships, we became more active.

(See: [Alaska Wilderness League Statement, 12 March 2019](http://www.alaskawild.org/wp-content/uploads/2019/03/Teacher-Scholar-Letter-BLM-DEIS-Statement-3-12-2019-FINAL.pdf) (<http://www.alaskawild.org/wp-content/uploads/2019/03/Teacher-Scholar-Letter-BLM-DEIS-Statement-3-12-2019-FINAL.pdf>) and [Congress Seizes New Opportunity to Restore Arctic Refuge Protections, 1 May 2019](http://www.alaskawild.org/wp-content/uploads/2019/05/Arctic-Refuge-Markup-Group-Statement-FINAL-5-1-2019.pdf) (<http://www.alaskawild.org/wp-content/uploads/2019/05/Arctic-Refuge-Markup-Group-Statement-FINAL-5-1-2019.pdf>))



Rosemary Ahtuanguaruak comments, "This map shows how the national outreach and responding comments changed the map." Image courtesy of Rosemary Ahtuanguaruak.

Our village elders sent elder women to encourage me to talk about our traditions and culture. I travel to educate others and affect these decisions. I work to build support for our concerns and work to prevent the continued impacts to our life, health, and safety, and to protect the importance of tradition and culture.

About the Author

Dr. Rosemary Ahtuanguaruak, (on the left in photo) is a community health aide from Nuiqsut, Alaska who has held a variety of local leadership positions and is an advocate of community rights in light of the oil development occurring in close proximity to her village. She speaks of dramatic health effects and impacts on subsistence activities that she has seen throughout her community, many of which correlate with emissions, pollution, and development. Located in the central North Slope of Alaska, Nuiqsut is close to the center of current development projects, including Alpine and Greater Moose's Tooth 1 and 2.



Dr. Rosemary Ahtuanguak

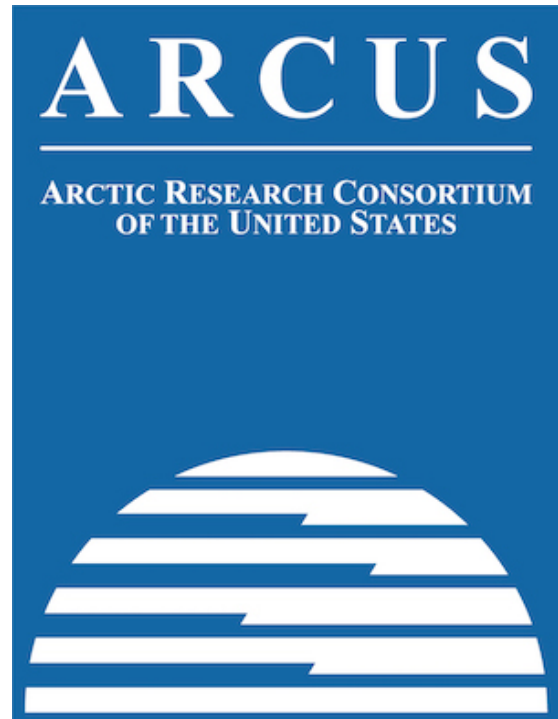
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ARCUS Highlights

By: Helen Wiggins, ARCUS Interim Executive Director, Director of Programs

I'm proud to highlight several activities below that have been keeping us very busy over the past months (a few also mentioned in the Note from the ARCUS President) (<https://www.arcus.org/witness-the-arctic/2019/1/article/29377>)—none of which would be possible without our many collaborators, contributors, participants, and funders. We also love to highlight interesting efforts and research of the broader community, and *Witness the Arctic*, with a reach of nearly 9,000 subscribers, is a great place to do this! If you'd like your work featured in a future issue, please email *Witness the Arctic's* editor, Betsy Turner-Bogren, at betsy@arcus.org.

- **PolarTREC funded:** We are thrilled to announce that NSF has awarded us a new three-year grant to support the highly successful [PolarTREC](https://www.polar trec.com/) (<https://www.polar trec.com/>) program! Funded by NSF's Office of Polar Programs, PolarTREC provides opportunities for U.S. STEM educators to participate in cutting-edge field research with polar scientists in both Arctic and Antarctic locations. More information is available in this issue [here](https://www.arcus.org/witness-the-arctic/2019/1/article/29389) (<https://www.arcus.org/witness-the-arctic/2019/1/article/29389>).
- **Indigenous Scholars Program 2019:** Four Indigenous Scholars have just returned from visits to Washington, D.C, where they discussed Arctic issues with a variety of policy- and decision-makers. An archive of a webinar from one of the scholars, Helen Aderman, on Bristol Bay Marine Ecosystem & Subsistence Resource needs, is available [here](https://www.arcus.org/indigenous-scholars) (<https://www.arcus.org/indigenous-scholars>). We also have [an article in this issue](https://www.arcus.org/witness-the-arctic/2019/1/article/29400) (<https://www.arcus.org/witness-the-arctic/2019/1/article/29400>) of *Witness* from 2018 Arctic Indigenous Scholar, Rosemary Ahtuanguaruak.
- **Meeting on "Culturally Responsive Outreach to Indigenous Alaska K-12 Students":** As part of our [The Arctic in the Classroom \(TAC\)](https://www.arcus.org/tac) (<https://www.arcus.org/tac>) project, ARCUS co-sponsored and participated in this meeting to review and adapt existing guidance about culturally responsive instructional strategies and/or to develop new guidance and resources.
- **Sea Ice Prediction Network- Phase 2 (SIPN2):** The collaborative SIPN2 project has published a [2018 post-season Sea Ice Outlook report](https://www.arcus.org/sipn/sea-ice-outlook/2018/post-2018) ([https://www.arcus.org/sipn/sea-ice-outlook/2018/post-](https://www.arcus.org/sipn/sea-ice-outlook/2018/post-2018)



season), held a [webinar on ICESat-2](https://www.arcus.org/sipn/meetings/webinars) (<https://www.arcus.org/sipn/meetings/webinars>), and launched the 2019 Sea Ice Outlook season with the [first call for contributions](https://www.arcus.org/sipn/sea-ice-outlook/2019/june/call) (<https://www.arcus.org/sipn/sea-ice-outlook/2019/june/call>).

- **Arctic Research/Seminar Series:** In 2019 we've organized webinars about marine mammals, community science, and public knowledge of the Arctic. Archives of past webinars are available [here](https://www.arcus.org/research-seminar-series/archive) (<https://www.arcus.org/research-seminar-series/archive>). Subscribe to the [ArcticInfo email list](https://www.arcus.org/arctic-info) (<https://www.arcus.org/arctic-info>) to receive notices of future webinars.
- **Anchorage Arctic Research Summit:** ARCUS was a partner for the 2019 Anchorage Arctic Research Summit, which brought together members of the Anchorage-area Arctic research community to share information around the themes: Transforming Research & Scholarship: Arctic Economic Security & Environmental Security. More information about the event is available [here](https://www.anchoragemuseum.org/the-lab/projects/nxn/anchorage-arctic-research-summit-details) (<https://www.anchoragemuseum.org/the-lab/projects/nxn/anchorage-arctic-research-summit-details>).
- **Sea Ice for Walrus Outlook (SIWO):** [SIWO](https://www.arcus.org/siwo) (<https://www.arcus.org/siwo>) provides weekly reports from April through May/June with information on weather and sea ice conditions relevant to walrus in the northern Bering Sea and southern Chukchi Sea regions of Alaska. The 2019 season is now winding down with summer approaching and very little sea ice remaining.

Other ongoing communication activities include managing the [ArcticInfo email list](https://www.arcus.org/arctic-info) (<https://www.arcus.org/arctic-info>), [Witness Community Highlights](https://www.arcus.org/witness-the-arctic/community-highlights) (<https://www.arcus.org/witness-the-arctic/community-highlights>) (Witness the Arctic's companion online publication), and the [Arctic Calendar](https://www.arcus.org/events/arctic-calendar) (<https://www.arcus.org/events/arctic-calendar>)—your one-stop-shop for Arctic meetings and events.

ARCUS Activities — Supporting our Members and the Research Community

Greetings all ARCUS members, supporters, and friends!

I'm writing this from sunny Anchorage, Alaska, where spring is returning with its complement of flowers, birds, and tourists. School is out and many on the ARCUS board and in the membership are likely headed to the field soon; I wish you the best of luck and an enjoyable and productive summer! We'll look forward to hearing how things went at our next annual membership meeting during AGU's Fall Meeting 2019.

On the ARCUS end, we have been busy as usual networking, communicating, educating, and facilitating Arctic research at its finest. We had a strong presence at the end of last year at the [American Geophysical Union's Fall Meeting](https://fallmeeting.agu.org/2018/) (https://fallmeeting.agu.org/2018/) in Washington D.C., where we held our annual member meeting and reception (open to all interested parties, not just members!) and an inaugural "Arctic Funder's Meet and Greet" event featuring program officers from six federal agencies that fund Arctic research: [NSF](https://nsf.gov/div/index.jsp?div=OPP) (https://nsf.gov/div/index.jsp?div=OPP), the National Oceanic and Atmospheric Administration ([NOAA](https://www.noaa.gov/)) (https://www.noaa.gov/), the Department of Energy ([DOE](https://www.energy.gov/)) (https://www.energy.gov/), the National Aeronautics and Space Administration ([NASA](https://www.nasa.gov/)) (https://www.nasa.gov/), the North Pacific Research Board ([NPRB](https://www.nprb.org/)) (https://www.nprb.org/), and the U.S. Arctic Research Commission ([USARC](https://www.arctic.gov/)) (https://www.arctic.gov/).



We used the ARCUS annual meeting as a chance to query the members and representatives present about: (1) specific opportunities ARCUS members could collaborate on, and (2) existing gaps in resources or support for the Arctic research community. The responses to these questions were documented in our annual meeting summary report. In case you missed it, the [2018 ARCUS Annual Meeting Summary Report](https://www.arcus.org/files/page/documents/28632/2018annualreportc.pdf) (https://www.arcus.org/files/page/documents/28632/2018annualreportc.pdf) is available on the ARCUS website.

So far this spring, ARCUS has had a successful board/staff retreat in Anchorage where we aligned current

and upcoming project ideas with our new strategic plan (finalized fall 2018) to facilitate a strong sense of shared priorities within our team. In early May, we co-hosted the [Anchorage Arctic Research Summit](https://www.anchoragemuseum.org/the-lab/projects/nxn/anchorage-arctic-research-summit-details) (<https://www.anchoragemuseum.org/the-lab/projects/nxn/anchorage-arctic-research-summit-details>). The summit is an annual event aimed at bringing together the large and diverse research community in the Anchorage area to share updates, findings, and ideas in a unique and engaging format. This year's theme was "Transforming Research and Scholarship: Re-envisioning Arctic Environmental and Economic Security Through Indigeneity and Gender."

Moving forward, we are hoping to connect more profoundly with our membership over the coming months since one of our goals as an organization is to be responsive to your concerns and needs. One way we are doing this is to include more member-focused content in the monthly ARCUS Member newsletter. We invite you to share any news or announcements related to the Arctic research taking place within your institution, as well as to use this forum to highlight opportunities for collaboration or community challenges. For details, please contact ARCUS staff member, Brit Myers (brit@arcus.org).

That's all from the President's corner for now...until we meet again, be well and do good work. ARCUS appreciates all that you do to further our collective knowledge of the Arctic!

Audrey Taylor

President, ARCUS Board of Directors

Meet the Board of Directors — Craig Fleener

Craig Fleener was elected to the ARCUS Board of Directors in 2018 and his term expires in 2021.

Craig is the Executive Director of the Alaska Ocean Cluster. His goal is to create value in Alaska's Blue Economy and discover new opportunities by connecting entrepreneurs, businesses, governments, universities, and knowledge in ocean and inland waters industries.

His background includes working in tribal and state government and the U.S. military. Early in his career, he worked on tribal and village corporation land issues. Then, at his regional tribal consortium, he worked on wildlife and



fisheries issues, environmental stewardship, climate change research, vocational training, and healthcare. From 2008–2018, Craig worked as the Director of the Division of Subsistence, then Deputy Commissioner of Wildlife, Subsistence, and Habitat Divisions at the Alaska Department of Fish and Game and ultimately serving as the Arctic Policy Advisor and Director of State and Federal Relations in Washington, D.C. Craig has served 32 years in the U.S. military. He enlisted in the U.S. Marine Corps in 1986, transitioning to the Alaska Air National Guard in 1991. He was enlisted for 16 years then received his commission in 2002. Currently, he holds the rank of Lt. Col. with the 176 Air Wing at Joint Base Elmendorf in Richardson, Alaska.

Craig holds a Bachelor of Science in Natural Resources Management from the University of Alaska Fairbanks (1999). His research focused on managing chronically low moose populations. In 2013, he earned a Master of Arts in Intelligence Studies from American Public University where his research was on developing a more effective U.S. Arctic Policy. In 2019, Craig completed Air War College at Air University with research that focused on resolving regional conflict in the South Atlantic.

Craig and his family currently live in southern Maryland, but he's originally from Fort Yukon, Alaska, and is a Gwichyaa Zhee Gwich'in Tribal member.

His priority areas include tribal self-determination, economic independence and diversification, Arctic Policy including Arctic sub-national leadership, collaboration, research, and infrastructure. Craig's ongoing interests include ensuring a better understanding of the Arctic including the needs of its residents, adaptation due to rapid climate changes, understanding the ocean, strong U.S. and Alaska leadership in developing Arctic Policy, and greater virtual storage, access to, and utilization of Arctic research that has

been conducted but is difficult to uncover.

Craig is honored to serve with ARCUS because of its cross-regional/dimensional nature working to create a holistic understanding of the Arctic in partnership with non-governmental organizations (NGOs), universities, tribes, government agencies, and research entities. ARCUS is perfectly situated to advance Arctic understanding and promote research findings for the benefit of humanity.

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Meet the Board of Directors - Jasper (Joe) Hardesty

Jasper (Joe) Hardesty, was elected to the ARCUS Board of Directors in 2018 and his term ends in 2021. He is also a member of the ARCUS Membership and Development Committee.

Joe works at Sandia National Labs, out of Albuquerque, New Mexico, where there is plenty of (non-Arctic) desert. He is the Assistant Manager of the Alaska Arctic facilities for the Department of Energy Atmospheric Radiation Measurements (ARM)

program with sites at Utqiagvik/Barrow, Atkasuk, and Oliktok Point, Alaska, and having assets that include controlled airspaces, unmanned aircraft, and tethered balloon systems. These sites and systems support instrumentation and field campaigns to provide Arctic atmospheric measurements and data used by climate modelers around the world.

Joe's degrees are in architecture and urban planning (University of Illinois) and chemical engineering (Stanford University). As an architect and planner, he has overseen all aspects of major institutional and commercial projects, with a focus on sustainable development, ecotourism, and responsible cultural tourism. As a researcher, he has contributed to Arctic projects for atmospheric study, building and infrastructure resilience, and renewable energy systems; as well as non-Arctic work with natural resource sustainability, biofuels, food security, international chemical/biological security, decontamination, and pollution remediation. In addition to his ARM work, Joe's current efforts are focused on expanding the repertoire of capabilities at Sandia Labs being applied to Arctic research, mentoring early career researchers, and planning for development of a comprehensive, permanent, year-round U.S. High Arctic Research Center and infrastructure network in Alaska.

A common thread in Joe's work is a desire to connect disparate perspectives to fulfill our responsibilities as stewards of the environment and communities around us. Having worked with private business, government institutions, and philanthropic organizations, he sees opportunities where the ARCUS vision for collaborative, interdisciplinary Arctic research and outreach can raise awareness of Arctic issues and



impacts of a rapidly warming Arctic on lower latitudes in order to garner greater national support for Arctic programs. He would like to see greater pan-Arctic research coordination, including integration of local knowledge, citizen science, and academic research to fill gaps in our understanding of changes in the Arctic to inform appropriate responses.

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Meet the Board of Directors — Victoria Herrmann

Victoria Herrmann was elected to the ARCUS Board of Directors in 2018 and her term expires in 2021. She also serves as a member of the Membership Development Committee.

Dr. Victoria Herrmann is the President and Managing Director of [The Arctic Institute](https://www.thearcticinstitute.org/)

(<https://www.thearcticinstitute.org/>), a nonprofit organization dedicated to Arctic security research. In her day-to-day work, she leads a team of 30 young scholars across North America, Europe, and Asia in research and capacity building projects on energy, climate, maritime, economic, and societal security issues. This type of transdisciplinary and

multidisciplinary Arctic research, that allows us to collaborate across so many boundaries, is why Victoria was first drawn to Polar Studies. Although fostering inclusivity in research communities is a continual pursuit, the Arctic research community's diversity of knowledges, generations, and geography means that being an Arctic researcher is to be a lifelong learner and listener. The collaboration, experiences, and friendships she has made over the past five years as part of the Arctic research community is why she joined the ARCUS Board. ARCUS provides the support not only for professional development and research communication for Arctic scholars and knowledge holders, but also a strong network for early career and established researchers to connect and collaborate.

Though she thoroughly enjoys her Arctic family, Victoria also works with coastal communities in the Lower 48 and U.S. territories on climate change adaptation as a National Geographic Explorer. In 2016 and 2017, as lead researcher for America's Eroding Edges project, she traveled across the country interviewing more than 350 local leaders to identify what is needed most to safeguard coastal communities against the unavoidable impacts of climate change. Her current project, Rise Up to Rising Tides, is creating an online matchmaking platform that connects pro bono experts with climate-affected communities. Supported by the J.M.K Innovation Prize (<https://www.jmkfund.org/innovation-prize-2019/>) and partnered with the National Trust for Historic Preservation, her ongoing project seeks to safeguard heritage by connecting national expertise to some of the 13 million Americans at risk of being displaced due to rising waters in the coming years.



In her free time, Victoria teaches sustainability at American University and science communication at the University Centre of the Westfjords, Iceland, and takes long walks with her dog Atlas. She was previously a Junior Fellow at the Carnegie Endowment, a Fulbright Canada Awardee, a Mirzayan Science and Technology Policy Fellow at the National Academies of Sciences, and a Gates Scholar at the Cambridge University, where she received her PhD in Geography.

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