

# OUR ARCTIC NATION



Connecting the [United States](#) to the Arctic  
A U.S. Arctic Council Chairmanship Initiative



Cover Photo: Cover Photo:  
Hosting Arctic Council  
meetings during the  
U.S. Chairmanship gave  
the United States an  
opportunity to share the  
beauty of America's Arctic  
state, Alaska—including  
this glacier ice cave near  
Juneau—with thousands of  
international visitors. *Photo:*  
*David Lienemann, [www.davidlienemann.com](http://www.davidlienemann.com)*

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# The Arctic Region



Names and boundary representation are not necessarily authoritative.  
August 21, 2015 - U1282 STATE (HJU)



## WHAT DOES IT MEAN TO BE AN ARCTIC NATION?

Today, the Arctic region commands the world's attention as never before. The U.S. Chairmanship of the Arctic Council (2015-2017) provided the United States with an unprecedented opportunity to explore and strengthen our own Arctic identity. During this period, our local, state, and national leaders worked closely together to advance U.S. interests in the region; we welcomed countless international visitors to the U.S. Arctic—from heads of state and foreign ministers to business and community leaders—and sent many of our Arctic experts and leaders abroad as well; and notably, for the first time in history, a sitting U.S. President traveled north of the Arctic Circle.

We appreciate those who have worked with us at home and abroad during our chairmanship to forge stronger regional connections, to better understand our mutual priorities, and to identify ways to collaborate on the challenges and opportunities facing us in today's rapidly changing circumpolar region.

The United States became an Arctic nation 150 years ago this year, following our acquisition of Alaska from Russia. Alaska has since grown extraordinarily in value to the United States as a whole. The Arctic region has also emerged as an increasingly critical and complex area of the planet, one defined by peaceful cooperation, political stability, cultural and environmental richness, and natural resources.

While Alaska is the only U.S. state with land above the Arctic Circle, each of the other 49 states, as well as the District of Columbia, enjoys special links with the Arctic. Each of these—whether scientific, historical, cultural, economic, military, academic, or otherwise—contributes to America's identity as an Arctic nation. It is these connections we sought to highlight through the “Our Arctic Nation” blog in 2016 and now through this book, which features excerpts from the blog's 51 entries (all of which can be read in full online). This initiative provided an opportunity for Arctic experts and enthusiasts from across the United States to reveal fascinating—and often surprising—links between our states and the top of our world. We are grateful to the many authors who were willing to share their stories and to the countless others who contributed their time and talent to this effort.

This book represents a valuable look into the many, inextricable links that exist between the Arctic and the states of *our Arctic nation*. I hope you enjoy reading about them as much as I did.



*David A. Balton*

Ambassador David A. Balton

Washington, D.C.

May 2017

# 01 ALABAMA

Research Associate Professor Katey Walter Anthony (right) and a research assistant set fire to escaping methane gas trapped beneath the ice on a pond near the UAF campus. The naturally occurring phenomenon is made worse by thawing permafrost and increased plant decay caused by global warming. *Photo: Todd Paris, University of Alaska Fairbanks*





## Alabama, Alaska, and the Mystery of Arctic Methane



Bubbles of methane frozen in an Arctic lake. Photo: iStock.com

### About the Author

Hannah Lyons is a public affairs Specialist at the Department of State in the Bureau of Public Affairs. A graduate of Auburn University in Auburn, Alabama, Hannah works on environmental issues including climate change, ocean issues, wildlife trafficking, and Arctic issues. Hannah traveled to Alaska in 2015 for the Department of State's Conference on Global Leadership in the Arctic: Cooperation, Innovation, Engagement and Resilience (GLACIER). Photo: Department of State



Most people growing up in south Alabama never see real snow. In my hometown of Dothan, not far from the Gulf of Mexico, winter temperatures usually hover around 50 degrees Fahrenheit, rarely dropping below freezing. On those rare occasions that we have snow, even the smallest snowflakes that melt as soon as they hit the ground are reason enough to run outside in the middle of the night, which is exactly what my father and I would do when I was a child. I knew other Americans lived in cold places like Alaska, but to me the north was a perpetually frozen land ruled by polar bears and a few rugged individuals who lived in igloos and rode around on dog sleds.

Today, thanks to my career as a public affairs specialist focusing on environmental issues, I have learned much more about Alaska, which is warming at a much higher rate than the rest of the country. This is having disastrous consequences for those who live there: melting ice makes traveling across the ice by dog sled or snow machine to hunt or visit family unpredictable and dangerous; permafrost (soil frozen year after year) is thawing beneath buildings and affecting their very infrastructure; and without sea ice to protect coastal villages, sea waves are eating away their beaches, pulling them into the sea.

In August 2015, I traveled to Alaska for the Secretary of State's Conference on Global Leadership in the Arctic (GLACIER), which brought together world leaders, including President Obama, to seek ways to address challenges in the rapidly changing Arctic region.

While there, I visited Portage Glacier. I'd never seen a glacier in person, and it was a sight I'll never forget. Unfortunately today, ice in most of Alaska's glaciers is melting faster than it accumulates, which not only contributes to rising sea levels globally but may also rob our children of the opportunity to know the magnificence of these natural gems.

One of the drivers of Arctic warming is methane gas. According to the U.S. Environmental Protection Agency, "pound for pound, the comparative impact of methane on climate change is more than 25 times greater than carbon dioxide over a 100-year period." Methane is released into our atmosphere from man-made sources such as landfills and fossil fuel production, but also from natural sources like volcanoes, wetlands, and melting permafrost in the Arctic.

Scientists in both Alaska and Alabama are trying to learn more about methane in the Arctic. Assistant Professor Katey Walter Anthony at the University of Alaska Fairbanks (UAF) studies sources of methane in Arctic lakes. About 4,000 miles away, University of Alabama researchers, including Dr. Natasha Dimova, are studying how methane from Arctic lakes can be traced to groundwater that comes from thawing permafrost. Dr. Dimova says, "Accurate climate change predictions for the Arctic partially depend...on gaining a better understanding of methane sources in this region."

As methane is a clear, odorless gas, tracking it can be difficult. However, it is a bit easier to track in cold areas like Alaska because methane freezes into bubbles underwater. In warm areas like Alabama, methane simply escapes into the atmosphere unmeasured. In the Arctic, methane seeping from frozen ice can even be set on fire, as you see in the accompanying photograph.

Despite their vast differences, there is much more linking Alabama and Alaska than just their place at the beginning of the alphabet. And thanks to the work of scientists like those from the University of Alabama and the UAF, we are beginning to understand more about climate change, methane, and how the gases in our atmosphere can impact the the health of our planet for future generations.

# 02 ALASKA

The author's daughter,  
Aqattaq, picking blueberries  
near Qikiqtaġruk (Kotzebue).  
*Photo: Morgan Joule*





## Paglagipsi Means Welcome in Iñupiaq: An Alaskan Shares What It Means to Call the U.S. Arctic Home

### About the Author

Elizabeth Saagulik Hensley was born in Anchorage, Alaska and calls both Qikiqtaġruk (Kotzebue) and Anchorage “home.” She is an attorney at the law firm Landye Bennett Blumstein and has been active in Alaska and Native American affairs for many years, working to meet the unique legal needs of Alaska Native tribes, tribal nonprofit health and social service organizations, and corporations. She holds a B.A. from Dartmouth College and J.D. from University of Arizona James E. Rogers College of Law. You can reach her at [Elizabethh@lbbllawyers.com](mailto:Elizabethh@lbbllawyers.com). *Photo: Landye Bennett Blumstein LLP*



The author's daughter and son, Piitaq, mush on the frozen Chukchi Sea. *Photo: Elizabeth Saagulik Hensley*

### Paglagipsi. Welcome.

Alaska: the state that makes the United States an Arctic nation, and my home. In the Alaskan Arctic, communities hunt, fish, gather and work hard day in and day out, honoring ancestors and future generations. It is a complex web of knowledge developed over generations, cutting-edge technology, sweat, and endurance. It is where traditional drumbeats mix with hip hop, where thousands-year-old indigenous words intersperse with English brought over from another continent. The Arctic is a place where much has changed, yet much is the same as it was, and as it always will be.

American political and pop culture interest in the Arctic has ebbed and flowed over time. Most recently, we have experienced a major ebb with the U.S. Chairmanship of the Arctic Council and the visit to Alaska by President Barack Obama himself.

His trip to Anchorage, Dillingham, and the place I have roots, Qikiqtaġruk (also called Kotzebue), inspired stories that will doubtless be told for generations to come. Our own five-year-old daughter, Aqattaq, will tell her children someday about the day she sang for President Obama with her classmates of Nikaitchuat Iisaġviat, the Iñupiaq language and cultural immersion school in Qikiqtaġruk.

I will certainly tell my grandchildren someday about the time the people of Qikiqtaġruk came together to provide the most impeccable hospitality I have ever seen for the President, his many staff, and the myriad other visitors (media and political leaders, for example) who flocked to Qikiqtaġruk over the course of not just a day or two, but weeks. I will tell my grandchildren that our community members worked their tails off to ensure these guests received only the best caribou

soup, sheefish and salmon prepared dozens of different ways, tundra blueberries and salmonberries served with milk and sugar and as aqquaq (traditional “ice cream”), sourdough hotcakes, fresh bread made like our aanas (grandmas) taught us, and other delicacies that are implicit in who we are as Iñupiat, or the “Real People” in English.

I will tell my grandbabies that these hundreds of guests were provided comfortable shelter in a community with a dire housing crunch even without visitors present. I will solemnly whisper to them that our children, Elders, and those in between honored our guests by sharing traditional motion dances with them, telling some of the most intimate stories of our People, despite their previously being outlawed by federal agents.

I will share that we welcomed our guests to join the dancing, and that they shoved any insecurities aside and did and we shared smiles and laughter together. I will tell them that when he visited in 2015, the President opened his time and space to connect with community leaders, Elders and youth, that he sat on a rock by the beach in Qikiqtaġruk, which is reinforced by steel to prevent our town from washing into the ocean, and pondered his visit and the scenery, and that he took the time to fly over the village of Kivalina to see how its beach is currently eroding. This is a life and safety issue for the whole community because each time there is a heavy storm off the coast, there is no road by which people can travel to escape the ocean waves.

As I reflect in the dusk of 2016 with an eye toward a new year, a new period in which the United States will transition out of the Chairmanship of the Arctic Council, and an imminent new commander-in-chief at the helm of our nation, the urgency for keeping the focus on the Arctic and continuing





Elizabeth Saagulik Hensley's daughter, Aqattaq, paddles a traditional Inuit qayaq made by her father, Maligiaq Padilla. Photo: Elizabeth Saagulik Hensley

This Elder grew up with his family traveling with the seasons between their traditional camp locations. Their main home was a sod house at a place named Ikkatuq located 10 miles from Qikiqtagruk (Kotzebue). He is 75 years old and like many Elders has seen tremendous change in his lifetime. Photo: Elizabeth Saagulik Hensley



the dialogue between the people of the Arctic and people and institutions in positions of power presses upon us.

The strategic position of the Alaska Arctic enables the United States to play a key role in economic development, national security, global shipping, and international cooperation. It also presents tremendous opportunity for the United States to demonstrate model behavior for how to uphold fundamental human rights embodied in a score of international treaties the United States has signed and which have therefore generally become “the law of the land” on par with the other laws and treaties the United States has promised to uphold.

A core fundamental human right that is of utmost importance is the right to safety. The United Nations Declaration on the Rights of Indigenous Peoples, Article 7(1) states, “Indigenous individuals have the rights to life, physical and mental integrity, liberty, and security of person.” As we move into this era of multiple new fronts, let our nation keep at the forefront this commitment, and invest in solutions where as a nation we are not hitting the mark. The fulfillment of additional rights and responsibilities will only become more important at this critical junction in time: the right to maintain, control, protect and develop cultural heritage, traditional knowledge and traditional cultural expressions;<sup>1</sup> the right to establish and maintain culturally appropriate educational systems and to provide education in indigenous languages;<sup>2</sup> the right to self-governance;<sup>3</sup> the right to free, prior and informed consent before the adoption or implementation of legislative

or administrative measures that may affect the indigenous peoples concerned;<sup>4</sup> and, finally, the right to be secure in the enjoyment of the indigenous communities’ own means of subsistence and development, and to engage freely in all their traditional and other economic activities.<sup>5</sup>

Let’s take a moment to focus on subsistence and economic development. Hunting, fishing and gathering is of utmost cultural, spiritual, and nutritional importance to the indigenous peoples of Alaska’s Arctic. It is intertwined with all of the other rights listed above; it *is* culture, it *is* traditionally the school, it *is* self-governance.

Participating in contemporary economic development is also of great import, as the indigenous communities of the Alaskan Arctic are a part of the global economy. Alaska Native communities in so many ways “live in two worlds with one spirit”—that is, they are traditional and modern... all at the same time. And it is articulated in international legal instruments that living in two worlds, or to hone in a bit, engaging in *both* traditional subsistence and participating in the cash economy, is a fundamental human right that our nation pledged to stand behind. To boil it down further, indigenous peoples get to be the contemporary version of themselves as a matter of international law.

Time is short, and the world is changing rapidly. The natural environment of my childhood is no longer after the passing of just a few decades, and social dynamics are changing quickly with the change of the natural world. The people of the Arctic are not bystanders watching the change, they are adapting—some perhaps because they have to in order

1 United Nations Declaration on the Rights of Indigenous Peoples, Article 31.

2 *Id.* at 14.

3 *Id.* at 4.

4 *Id.* at 19.

5 *Id.* at 20.



**Left:** Students working on a song they will sing for the President's 2015 visit to Kotzebue, Alaska. Photo: John Thain/KTVA; **Right:** President Obama greeting audience members after speaking at Kotzebue High School in 2015. Photo: White House, Pete Souza



to survive and some because they want to in order to thrive and enjoy a high quality of life.

Through all of this, the voices of the Arctic are and will remain of critical importance. The voices of the Arctic are valid. They are important. They are varied. They are not an anecdote; they are where the story begins and where the story will end. Some represent indigenous worldviews rooted in the land, waters, sky, and spirit world that have provided for communities for thousands of years.

Some voices represent families who colonized Alaska and who now know this place as their home. Their voices matter, too. The voices of the Alaska Arctic are intriguing, valuable and critical to a path forward in a global world that is seeing rapid change. If anything, as we move forward in time, let's listen to each other.

#### What do you want the world to know about the Arctic?

For her entry on Alaska, Elizabeth Saagulik Hensley asked her friends, family, and colleagues the following question, "What do you want the world to know about the Arctic?"

#### This is how they responded:

The Arctic is home. It's where my soul feels most at ease. And somehow it's still so hard. It's hard to live in the cold, in the dark. Where food from the store could be why you feel like you're living without even though you know you're working and very fortunate. You can feel so isolated. But it's home. And I've never been so calm. I often wonder how this lifestyle can be so rewarding because when people ask me how I like it, it sounds like I hate it. But I love it. Every season has its bounty. Every activity has its purpose. I don't do things because I'm bored; I'm doing them because it's

time. It's work, hard, enjoyable, memorable work. — *Young Iñupiaq mother from Qikiqtaġruk, Alaska*

Our Iñupiaq culture and traditions (culture/language/heritage). And how we as a people thrive in our sustainable cold environment that ties us all to the land (example: sigaloaqs ice cellars melting)? What endangers us as the ice caps melts (drilling, global warming/environmental changes, etc.)? What we can do to help or get involved. — *Iñupiaq father and hunter from Utqiagvik, Alaska*

I would like the world to know that we are the 'real people' [this is the English translation of Iñupiat] attempting to save what we have left... identity and culture. We are also a people trying to fit into society. Sadly society dictates who you are in today's fast-changing world. — *Iñupiaq grandfather, hunter and dog musher from Iviq, Alaska*

The Arctic is our home, our life, our sustenance. We are not saving a people, we are preserving a culture and saving our land—our Iñupiaq culture and the land we subsist on. Our way of life sustains us—enriches our lives, feeds our souls and sustains a culture over 15,000 years strong. All we ask is that you respect and honor this, as we do. — *Iñupiaq grandmother from Qikiqtaġruk, Alaska*

Hunting. Our subsistence way of life. We're not savages; we do have an education. — *Iñupiaq man with roots in Utqiagvik, Alaska*

People have so many different points of views... There are so many stories to be told... So much is going on in the Arctic life. — *Iñupiaq father and hunter from Qikiqtaġruk, Alaska*

President Obama checking out Iditarod champion John Baker's dog sled in Qikiqtaġruk (Kotzebue). Photo: White House, Pete Souza



*“The Arctic  
is our home.  
We share  
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supposed to  
live here with  
the unwritten  
laws on how  
to be....”*



**Left:** Salmon drying in Alaska. **Right:** The view from Air Force One of Kivalina Island, an Arctic town that's receding into the ocean as a result of rising sea levels (2015). *Photos: White House, Pete Souza*

People live there, global warming is real and it is affecting those who call the Arctic home the most, for now. Soon that effect will affect the world. By then it would be too late. Do something now.—*Athabaskan hunter from Allakaket, Alaska*

I believe that the people of Alaska's Arctic are going to be okay through big threats to our lifestyle such as climate change, but what threatens our lives and future the most are the beating hearts of other human beings who would exploit this land and people. I would want people of other culture and histories, other governments and organizations of the world to deeply feel, understand and innovate utilizing our cultural values, taking example of how our strongest live, and taking only this from us.—*Iñupiaq woman who grew up in the Washington, D.C. metropolitan area, whose family is originally from Sivuaqqaq Boxer Bay, via the village of Gambell on St. Lawrence Island, Alaska*

The Arctic is our home. We share with fellow beings who know the way that we are supposed to live here with the unwritten laws on how to be. If you come from the outside, it is your responsibility to take the time to fully understand this, until then you are a visitor, and even a visitor should come with respect. We have a sacred space where we hold that energy, and that is the core of who we are. We might get Western educations, but that system should not become our way of being, but simply serve as a shield of protection, a tool to deal with the Western world. Unfortunately, this is not how it is right now, but speaking openly about it will hopefully help us back to keeping the Arctic how it is supposed to be.—*Inuk mother and artist from Greenland who lives between Alaska, Greenland and Denmark*

The myth of Iñupiat still living in ice igloos. It's the 21st century and people still think we live in ice igloos. I live in Idaho now and people still ask the question however reluctantly.—*Iñupiaq grandmother from Qikiqtagruk, Alaska*

About our changing environment and that we love our subsistence food.—*Iñupiaq grandmother from Selawik, Alaska*

I want the world to know that we are a highly adaptable people and that the Arctic nations need to combine their considerable expertise to figure what we can do to help mitigate the effects of climate change.—*Athabaskan man and culture-bearer from Eklutna, Alaska*

The Arctic environment is changing very rapidly due to climatic change...and it seems to be getting warmer faster. Food security is becoming an urgent matter for hunting communities who have little money to support them in the modern economic conditions Arctic residents face. As a whaler, I have seen the ice mass shrink from 22–30 feet to about 18 inches in my lifetime. There is no more old ice around my hometown of Barrow, Alaska.—*Iñupiaq grandfather from Utqiagvik, Alaska, now residing in Fairbanks*

Every policy decision must put its first people first and go forward from that point. Arctic policy decisions will affect the entire world as time goes on. It will impact its residents first of course.—*An individual who hails from a rural cold state, North Dakota, and has spent the last 37 years in Alaska working all over the state*

As a transplant who came from New England originally, then California and Oregon, I think people should understand that the first peoples of the north have never left, and that those of





Subsistence foods of northern Alaska: salmon berries; Quagaq (Sour Dock—a perennial herb), and tundra blueberries. Photo: Elizabeth Saagulik Hensley

us who are settlers do have an obligation to respect land claims and desires of the original inhabitants. People in the south really need to understand that there are vibrant cultures and economies and communities alongside the incredible beauty. Perhaps there also needs to be an exploration of different definitions of wealth and well-being because I think folk in the south don't understand those concepts from northern perspectives. —*Educator residing in Anchorage, Alaska*

I'd like the world to know and come to respect the tenacity and wisdom of the Inuit to manage their lands, their resources sustainably for over 10,000 years. I'd like the world to finally embrace and respect the right of Inuit to continue to make decisions about the place on the planet that they are the premier experts, then and now in modern day times. The original weather predictors, the original sustainable hunters, the original environmentalists, the original technologists, the original and last stewards of all that is the Arctic. —*Utqiaġvik (formerly Barrow) community member of Native Hawaiian descent from Niimalu, Hawaii, and who now resides in Anahola, Hawaii*

What is considered 'the Arctic,' what is its history from a non-Western civ perspective, what is it like today, the push and pull of modern versus traditional lifestyle, the affect of policies on a personal level. —*Lifelong Alaska resident from Anchorage, Alaska*

The Indigenous Peoples of the Arctic are the key decision makers for anything/everything regarding the Arctic. If the diversity of their internal issues means they have divergent views on what to do or not do, then it is up to them to work that out and the rest of us can support them doing that without

inserting our own values/beliefs/monetary interests into the picture. I'm not from the Arctic, but I live in a state that has Arctic peoples and lands in it. I stand with the indigenous peoples of the Arctic to be the drivers of their destiny, just as I know they would do for my indigenous peoples of the rainforest and islands of Southeast Alaska. Our destinies are intertwined, and our self-determination of what is best as lived by our values and embedded in our cultural practices and languages will guide us in the right direction. When we sever that and look instead to other's values, we will lose our footing in our own homelands. Accept no substitute. —*Tlingit and Haida auntie from Southeast Alaska*

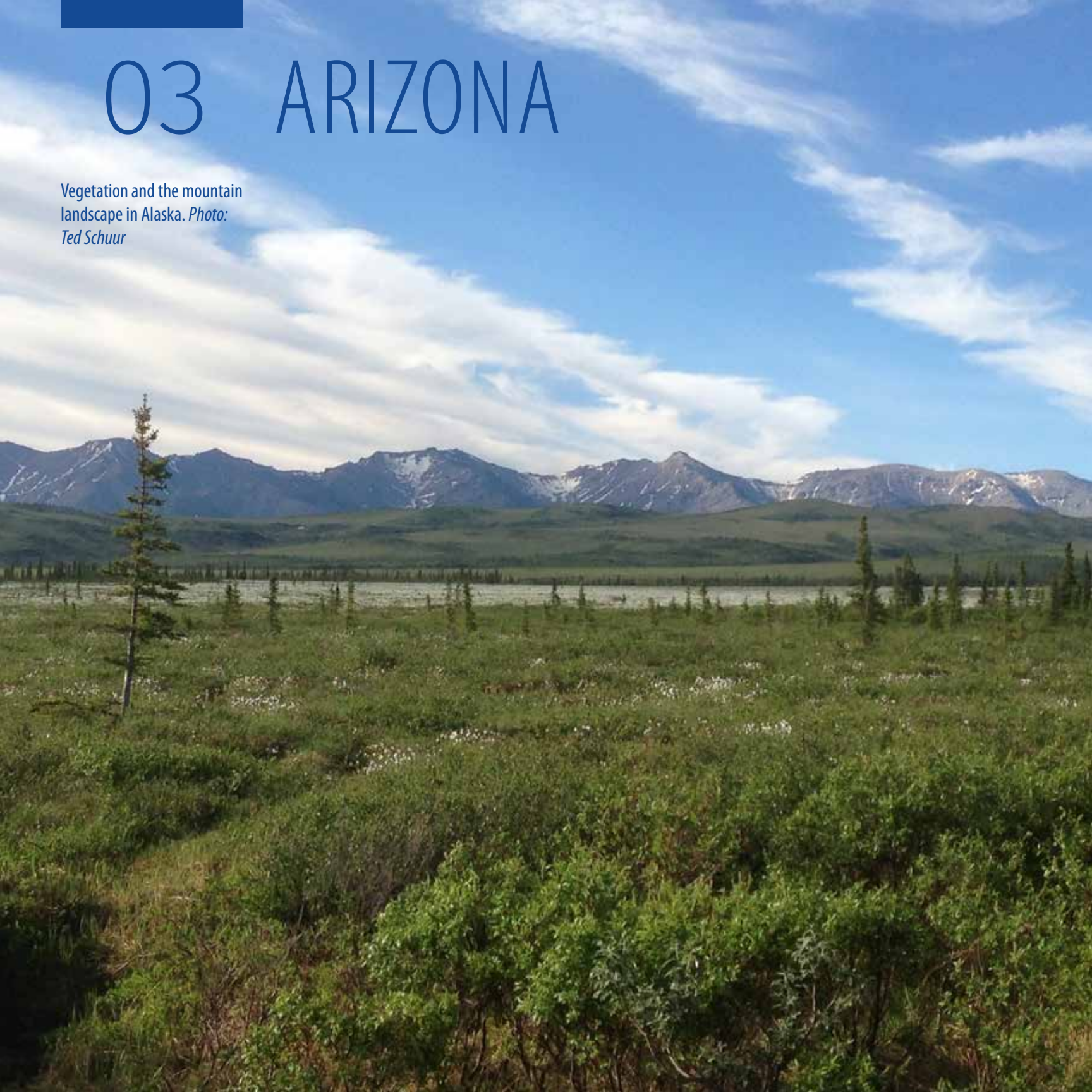
Self-determination is the key to our overall well-being. Amazing example is Teck-John Baker Youth Leaders (TJBYL) program, which truly teaches our youth self-determination—youth learn skills to use in their schools and communities to prevent bullying, substance abuse, suicide. Then they are expected to be responsible for how things are going in their schools and expected to use the tools and skills they were taught. It is so effective that for the first time since the 80s, when our tracking system first started, the youth rates of attempts and fatalities have fallen below the rate of adults in our region. The drop correlates almost exactly with the start of TJBYL program. —*Iñupiaq grandmother and social services provider from Qikiqtagruk, Alaska*

Fish drying at fish camp. Photo: Elizabeth Saagulik Hensley



# 03 ARIZONA

Vegetation and the mountain  
landscape in Alaska. *Photo:*  
*Ted Schuur*





## From an Arizona Classroom to an Alaska Cabin: A Professor Takes a Closer Look at Arctic Carbon



**Left:** A group of scientists conducting a snow survey in the Alaskan mountains. **Right:** The Schuurs, including the family Corgi, Pippen, at their cabin in Alaska. *Photos: Ted Schuur*



### About the Author

Dr. Ted Schuur is a Professor of Ecosystem Ecology at the Center for Ecosystem Sciences and Society in the Department of Biological Science at Northern Arizona University. His work focuses on the response of Arctic ecosystems in a warmer world, which is key for understanding how natural ecosystems interact with human emissions to control the overall pace of climate change. Dr. Schuur and his family spend each summer in Alaska.

You can reach him at [Ted.Schuur@nau.edu](mailto:Ted.Schuur@nau.edu). *Photo: Northern Arizona University*



I live with my wife Michelle, two children—Clara, age 13, and Julian, age 11, —and a short, fat Corgi named Pippen in Flagstaff, Arizona. We moved here amidst the ponderosa pines almost three years ago when Michelle and I were each offered research professorships at Northern Arizona University (NAU) in the Center for Ecosystem Science and Society, and the Department of Biological Sciences.

We were recruited to NAU because of our work on environmental change, a global issue that knows no state or country boundaries. This research focus has taken me to locations as remote as the tropical rain forest all the way to the Arctic tundra, with a common focus on a search for carbon in all of these expeditions. Increasing amounts of carbon dioxide and methane are the primary contributors to the warming that has been observed on our planet over the past 150 years.

I travel with my family each summer to Alaska, where we live in a rustic cabin in the woods just outside of Fairbanks. Like a number of Fairbanks residents, our cabin has no running water, just the water that we haul in for cooking and cleaning. This serves as our home base to conduct field research around the state of Alaska during the long days of the short summer season. The population of Alaska swells in the summertime with people from Arizona and elsewhere, who, just like me, come north beckoned by the remoteness, the possibility for adventure, as well as for work in the seasonal industries like fishing and tourism.

Presently, my research tries to understand how Arctic ecosystems in remote places far from where most people live are responding to the warming temperatures on our planet, particularly, how the carbon that has been stored frozen in permafrost over hundreds to thousands of years is vulnerable to changes in climate.

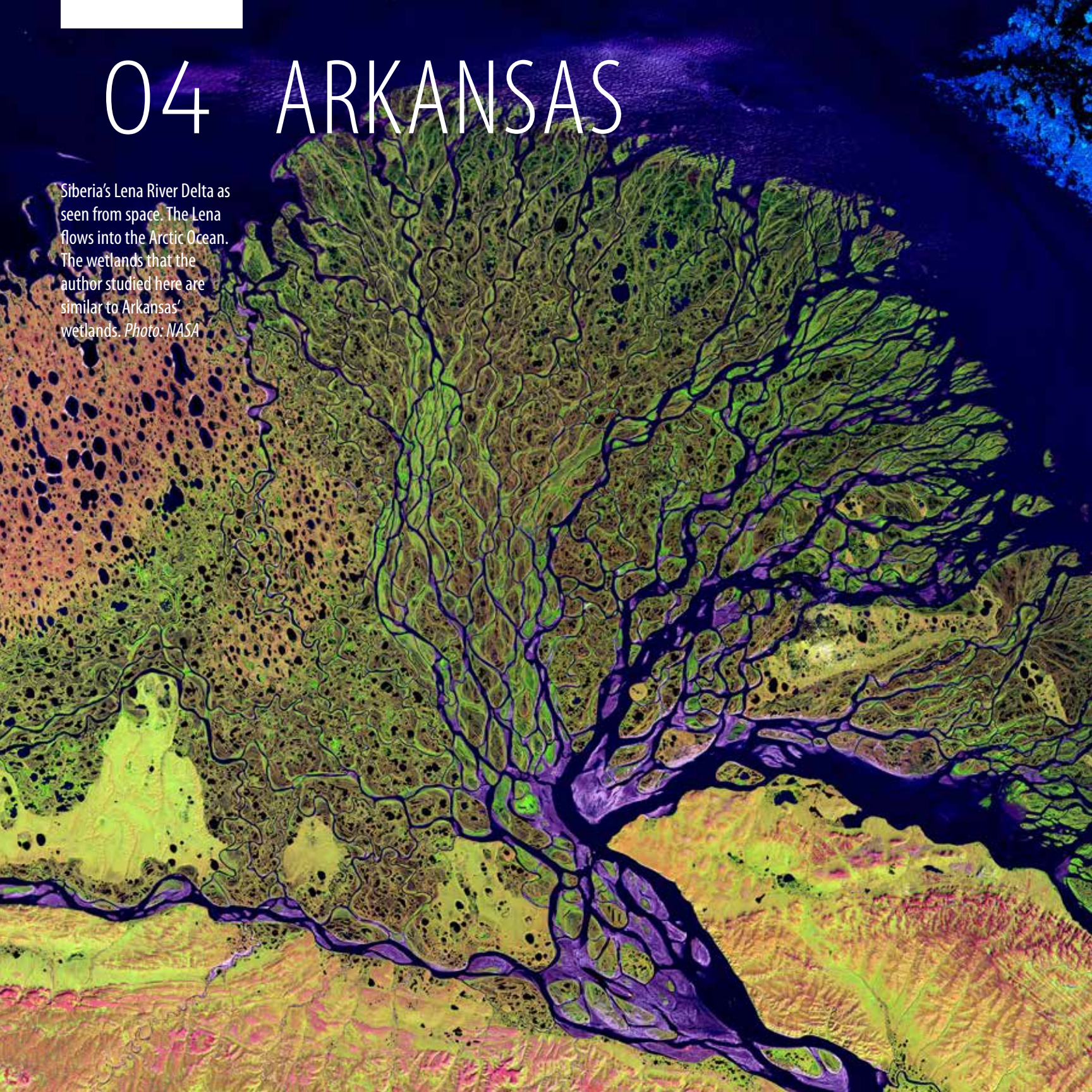
Carbon stored in tundra ecosystems represents a balance of carbon taken from the air by plants as they grow, and then deposited into the permafrost soils where it is slowly returned by the activity of soil micro-organisms as they decompose the dead organic matter, returning that carbon back to the atmosphere. Plants are growing faster, getting bigger, and taking carbon out of the air. From the perspective of climate change, that's a good thing; it means tundra vegetation is making up for any carbon that is being lost from the soil.

But, the Arctic's short summers do not make up for the long winters. My research group continues to document carbon emissions in the winter. We found that while the plants are dormant, the microbes continue to eat the soil organic matter. It turns out that they release enough carbon during the winter to offset everything the plants gained in the summer, and then some, so the total balance shifts the ecosystem to a net source of carbon. This means that carbon is being moved from where it has been historically stored in permafrost soils into the atmosphere. With desert temperatures hitting maximum values in the summer, how much hotter conditions might get in the cities in Arizona is a question of great importance to the residents here.



# 04 ARKANSAS

Siberia's Lena River Delta as seen from space. The Lena flows into the Arctic Ocean. The wetlands that the author studied here are similar to Arkansas' wetlands. Photo: NASA





## Rice and Ice: the Wetlands of Arkansas and the Arctic

### About the Author

Assistant Professor Dr. Benjamin R. K. Runkle researches carbon and water cycles in wetland environments at the University of Arkansas Department of Biological & Agricultural Engineering. He has executed scientific research worldwide and was a Fulbright scholar in Mauritius. He received his Ph.D. and M.S. from the University of California, Berkeley in Civil & Environmental Engineering and received his B.S. from Princeton University, also in Civil & Environmental Engineering.

Follow him on Twitter:  
@DrBenRunkle.

Photo: Norman Rößger,  
University of Hamburg



**Left:** Meteorological measurement station in a rice field in central Arkansas after a summer storm (2015). **Right:** The icebergs left by the flood of the Lena River in 2014. Photos: Benjamin Runkle



The Arctic cools the earth, controlling weather patterns far beyond its borders through its chilly winds and reflective snow and ice cover. The Arctic is also a safe haven for many fascinating and charismatic animals. Polar bears, musk ox, walrus, and reindeer all hark from the great north. Additionally, many birds fly north in the summer to find refuge in the cool, wet climates of the vast Arctic landscape. We all have a stake in protecting the Arctic—even those of us in Arkansas.

I write as a scientific researcher and educator from our state's premier institute of higher education, the University of Arkansas. My research focuses on how Arctic wetlands preserve organic matter—or the remains and waste products of animals, plants, and other organisms left in the environment after initial decomposition.

Prior to arriving in Arkansas, I worked as a scientist at the University of Hamburg in Germany and performed month-long visits to Siberia's Lena River Delta. This extraordinary landscape is filled with wetlands on the islands between channels of the Delta. One of these islands is home to a long-standing research station supported by both the Russian and German governments; similar stations exist around the Arctic as prime examples of international cooperation and collaboration.

The river rearranges the Delta, the winds rearrange the island banks, and the landscape keeps carbon in its soils rather than let it circulate in the atmosphere. These behaviors act on different scales of time and space—some are local processes that occur over a long time, some are wide-reaching but quite quick.

One example of the latter—in both 2013 and 2014, I stayed on the research station during the annual spring flood of the

Lena River. Because this river flows from a warmer south to a colder north, the flood advances northward as more snow and ice melts, so the river can rise over twenty feet in twenty-four hours. The icebergs left behind on the banks are extraordinary, despite the damage they made to our measurements sites.

The astonishing conditions of the major flood of 2014 were somewhat scary on the ground, but provided a great research opportunity. This big event delivers lots of fresh water and ice into the Laptev Sea and Arctic Ocean. Seeing this happen in person generates new research ideas and a new, tangible understanding of the geographic setting.

The flood carries dissolved organic matter—small pieces of carbon derived from decomposed plant and organic material. Even in the first week of measurements during the flood period, we saw the concentrations of carbon in the river water more than double before the peak flood even arrived.

Arkansas has its own delta where the St. Francis, the White, and the Arkansas rivers empty into the Mississippi from the west. Our state is home to more than 50% of the rice paddies in the USA. Like so much of the Arctic, the rice fields are wetlands—and wetlands have certain similar swampy conditions which slow down the decomposition of organic matter—offering both regions potential storage areas for pulling carbon out of the atmosphere. These conditions are friendly to plants like rice (in Arkansas) and special sedges (in the Arctic) that have developed a soft spongy tissue, allowing them to bring oxygen from the air down to their roots. As a researcher, I strive to better understand these landscapes, so we can we control and predict the outcomes of the changing climate to create a safer future—both for Arkansas and for the Arctic.

# 05 CALIFORNIA

Economics and international relations student Caroline Chen in Finland during USC's 2016 Arctic summer study program. *Photo: Dr. Steven Lamy*





# Arctic Academics, Actors, and Agriculture from the “Near- Arctic” State of California



Left: Dr. Lamy chats with his 2016 Arctic program students in Oslo, Norway. Right: Mixing with the locals in Iceland, where trolls are an important part of local folklore. Photos: Caroline Chen



## About the Author

Dr. Steven Lamy, a professor of international relations, was appointed USC Dornsife's Vice Dean for Academic Programs in July 2008. He is charged with overseeing undergraduate and graduate programs and recruitment, as well as counseling for current students and counseling for life beyond college. He holds a Ph.D. from the Josef Korbel School of International Studies, University of Denver, and has published more than 40 articles and book chapters in these areas.

Photo: USC



I write this blog from the city of Tromsø, the “Arctic capital” of the Kingdom of Norway, a fellow Arctic nation. I am here with 20 undergraduate students from the University of Southern California (USC) as part of a three-week visit to Iceland, Norway, and Finland to study the impacts of climate change on the politics and the economics and cultures of the region.

I serve as the Vice Dean for Academic Programs at USC Dornsife, the university's College for Letters, Arts and Sciences. I also transform into an intrepid polar professor, taking students out of our southern California classrooms and into the world. During this Arctic visit, our students have met political leaders, academic researchers, and members of critically important nongovernmental organizations with first-hand knowledge on critical Arctic issues. Experiences like these promote active learning and help these students see things from a different perspective—the world is the best classroom.

Having visited the region five times, I find the Arctic to be a remarkable place to study issues of governance, regional cooperation, the natural environment, and sustainable economic development. With each visit I gain a greater appreciation for the resiliency and interdependence of communities above the Arctic Circle. Many people in Norway ask us why students from California would be interested in the Arctic. Well, China recently became an Observer to the Arctic Council by declaring it was a “near-Arctic nation-state,” given its relative geographical proximity to the region, so perhaps we can consider California a “near-Arctic U.S. state.”

The health of the Arctic environment is critical to California's economic and political stability. The most immediate impacts to our state might be rising sea levels, possible changes in

our climate, and unusual weather events. These conditions could have major economic consequences on California's agricultural products such as almonds, grapes, and cotton. Changes in Arctic weather influence ocean currents from the tropics to the Arctic—providing the swimming and surfing conditions that people in California so enjoy. Animals from California that migrate towards the Arctic also rely on our marine environment, including northern elephant seals, gray whales, humpback whales, and countless species of birds.

The Arctic region has been and will continue to be a source of inspiration, drama, and tension for Hollywood's entertainment industry. The very popular television show *Game of Thrones* is actually filmed in Iceland, and actors like Drew Barrymore (*Big Miracle*), Sean Connery (*The Hunt for Red October*), and John Cusack (*The Frozen Ground*), among many others, have all looked to Alaska and the Arctic for impressive physical backdrops and intriguing story lines for their films.

As the state with the largest population and the nation's second-largest city, Los Angeles, California, is simultaneously a major source and victim of CO2 emissions. Government and industry across California are also exploring solutions to global and local challenges presented by the Arctic. Stanford University, UC Berkeley, UCLA, the Scripps Institution of Oceanography at UC San Diego, and others are studying the region from a variety of security, environmental, and cultural standpoints. Beyond academia, a program called, “Fresh Tracks,” is running an exchange program between youth in Compton here in southern California and youth in Alaska.

The one message that my students keep hearing here is that the future of the Arctic depends on the choices made by citizens in the rest of the world. The Arctic and its people may be the first to suffer if we do not recognize our interdependence.

# 06 COLORADO

Dr. Tad Pfeffer in Alaska:  
when you're a glaciologist,  
a pair of skis can help get  
you where you need to go,  
whether it's out to the field  
for research or just to the  
office. *Photo: Ethan Welty*





## Where Colorado Meets the Arctic: Science and Global Climate Change



**Left:** The author installs a time-lapse camera during a storm at the Columbia Glacier, near Valdez, Alaska. *Photo: Ethan Welty*; **Center:** Walter Orr Roberts taking photos of the solar corona with the 5-inch coronagraph he built in the 1940s. Roberts' work led to the creation of the High Altitude Observatory (HAO) at the National Center for Atmospheric Research (NCAR) in Colorado. *Photo: UCAR*; **Right:** A scientist surveys at Alaska's Columbia Glacier. *Photo: W.T. Pfeffer*

### About the Author

A resident of Colorado for more than 25 years, Dr. W. Tad Pfeffer is a glaciologist, geophysicist, and photographer at the University of Colorado at Boulder. He is a Fellow of the University's Institute of Arctic and Alpine Research and a Professor in the Department of Civil, Environmental, and Architectural Engineering. He is presently living and working in Washington, D.C., as a Jefferson Science Fellow, a program of the U.S. Department of State and the National Academies of Science that engages the scientific community in the formulation and implementation of U.S. foreign policy. *Photo: Ethan Welty*



Nearly always, when I tell someone that I work in the Arctic studying glaciers, climate, and sea level rise, I get a laugh and the same response: "living in Colorado, you can't be too worried about sea level rise!" Many people think that Colorado has its share of wide-open, cold, snowy spaces without borrowing any more from the Arctic. However, there are some very important threads linking these two places. As a glaciologist, with more than 30 years studying the mechanics of how glaciers in Alaska, Greenland, and elsewhere move and change in response to climate, my own connections to the Arctic are perhaps slightly stronger than those of most Coloradans, but nevertheless, the Arctic is really closer to Colorado than many people might think.

Arguably the strongest connection between the Arctic and Colorado—and this is equally true for all of our states—are the links of the increasingly global economy that tie all our fortunes together. Healthy economies require a healthy climate, as any rancher in eastern Colorado will tell you, and our climate—in Colorado and globally—is already experiencing some dramatic and hard-to-predict changes.

As the Arctic warms and as the thin veneer of sea ice covering the Arctic Ocean shrinks ever further and faster, the various channels that move atmospheric and oceanic heat around the northern hemisphere light up, with heat streaming into the Arctic. As atmospheric carbon dioxide continues to accumulate, the heat available to move into the Arctic and the energy to move it is pushing the entire climate system into new states that we don't understand very well yet. The effects hit the USA—from the desert southwest, to Colorado, to New England—and go right back up to the Arctic.

These changes are affecting our economy in Colorado, especially our weather-dependent industries like ranching and tourism, which brings skiers from around the country and world to Colorado's slopes every winter. According to the 2015 Colorado Climate Change Vulnerability Study, "Rising temperatures, heat waves, and droughts can reduce crop yield and slow cattle weight gain. Colorado farmers and ranchers are already accustomed to large natural swings in weather and climate, but may find it especially challenging to deal with expected changes in water resources."

In Colorado, some of the country's best scientists and academics are working on Arctic and climate change issues. The University of Colorado at Boulder is one of the world's top institutions in geosciences research thanks to its long involvement in Arctic and Alpine research in collaboration with the U.S. Geological Survey (USGS); its engineering expertise in satellite remote sensing, including collaboration with the National Institute of Standards and Technology (NIST); and climate research, through its links with the National Center for Atmospheric Research (NCAR) and the National Oceanic and Atmospheric Administration (NOAA) laboratories. These institutions and their collaborations—and the valuable science that has come from these—make a great story for us to tell, both as Coloradans and as Americans. For those who might want to learn a bit more about this particular part of the Colorado-Arctic story, I'll leave you with two clues: Walter Orr Roberts and Colorado's High Altitude Observatory.

# 07 CONNECTICUT

The U.S. Coast Guard  
Cutter Healy. Photo: Debbie  
Hutchinson, USGS





## Taking *Semper Paratus* to a Whole New Latitude in Connecticut and the Arctic



**Left:** Coast Guard Academy Cadets Victoria Sutherland and Taylor Peace with U.S. Special Representative for the Arctic Admiral Robert J. Papp, Jr. at the University of Alaska Fairbanks' 2016 Model Arctic Council. *Photo: Dr. Martha McConnell, USCGA*; **Right:** Coast Guard Commandant Admiral Paul Zukunft signs the Arctic Coast Guard Forum Joint Statement in July 2016. *Photo: Petty Officer 2nd Class Patrick Kelley, USCG*



### About the Author

Lucy Daghir is a first-class cadet at the United States Coast Guard Academy, the administrative assistant to the Center for Arctic Studies and Policy, an assistant coach for the Bears women's lacrosse team, and a yoga enthusiast. She is currently studying Marine and Environmental Science. Lucy sees her options as endless both in and out of the Coast Guard and is excited to work in the Arctic regardless. You can reach her at [Lucy.M.Daghir@uscga.edu](mailto:Lucy.M.Daghir@uscga.edu).

*Photo: Ryan Carpenter*



Although the most recognizable link, the United States Coast Guard (USCG) Academy in New London, Connecticut is not the only connection Connecticut has to the Arctic. Captain George Comer, the noted polar explorer, cartographer, whaler, author, photographer, and anthropologist grew up in East Haddam, Connecticut. As a teenager, Comer walked to New London and joined a whaling ship headed to the Arctic, journaling throughout his first sailing experience. He continued to document his experiences during his entire career in the whaling industry, which took him all over the Arctic. In total, he took 14 voyages to the Arctic and three to Antarctica, and counted notable Arctic explorers like Robert Peary and Frederick Cook among his friends.

Today, Arctic exploration continues to be an interest in Connecticut. The USS Nautilus, located in the town of Groton, is the world's first atomic submarine and the first submarine to complete a submerged transit of the North Pole. It receives around 250,000 visitors a year.

Visitors are also starting to travel further north as Arctic temperatures increase creating easier access to the region, resulting in additional responsibilities for the USCG. Melting ice and warmer Arctic waters mean more visitors, and more visitors means a greater number of people who need rescuing, escorting, or protection in the frigid and perilous waters off coastal Alaska. To help prepare the USCG for America's increasing role in the Arctic, the USCG Academy in New London, Connecticut is taking steps to ensure that their cadets can be, as the Coast Guard motto says, *Semper Paratus*, or "always ready"—even in the remote and unpredictable Arctic.

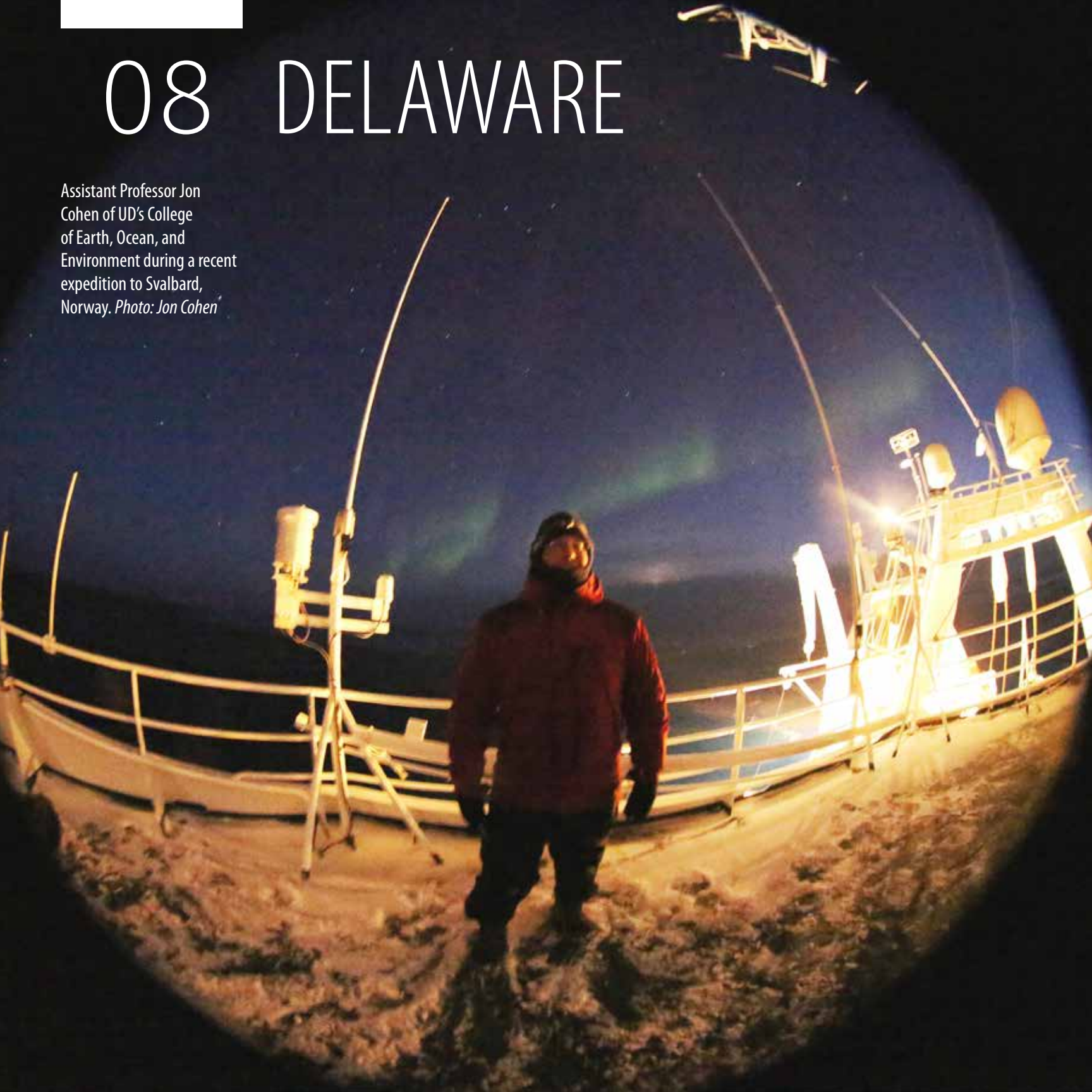
The newly created Center for Arctic Study & Policy (CASP) at the Academy is an operationally focused academic think tank to promote research, broaden partnerships, and educate future leaders about the complexities—and relevance—of this unique region.

Connecticut also hosted the first meeting of the Arctic Coast Guard Forum at the Academy in 2015. During the meeting, representatives of all eight coast guard agencies of the Arctic nations signed a Joint Statement forming this "operationally-focused, consensus-based organization with the purpose of leveraging collective resources to foster safe, secure and environmentally responsible maritime activity in the Arctic."

Although the Coast Guard is expected to execute search & rescue missions in Alaska with the same ability that they do in the "lower 48" states, the service is strained and spread thin when it comes to Arctic waters, lagging behind other nations in terms of resources such as icebreakers. The Arctic is a place of potentially higher traffic density in the near future, requiring an even greater commitment of limited Coast Guard resources and assets. The inaugural Crystal Serenity cruise, a luxury cruise-liner carrying an estimated 1,700 passengers and crew, in fall 2016 is a clear example of the types of vessels that will transit through the Arctic in the future. Due to such remote locations, emergency medical evacuation by plane from the Arctic can reach costs of \$50,000 or more. Without a doubt the Coast Guard will be watching this and other voyages carefully, ready to assist with our Arctic skills and expertise if necessary.

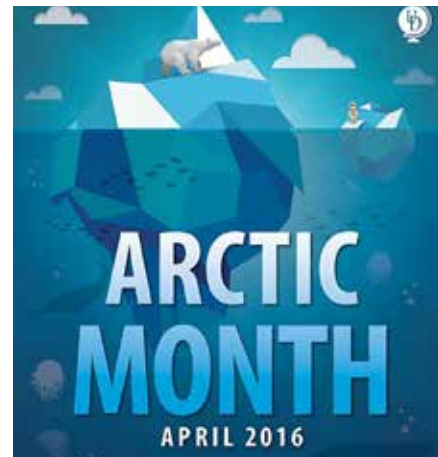
# 08 DELAWARE

Assistant Professor Jon Cohen of UD's College of Earth, Ocean, and Environment during a recent expedition to Svalbard, Norway. *Photo: Jon Cohen*





## The Arctic in Delaware: Today's Leaders, Tomorrow's Experts, and a Climate of Campus-wide Engagement on Global Issues



**Left:** Lindsey Craig, a former UD student who now works in the sustainability field, cites her Danish study abroad program as the highlight of her undergraduate career. First-hand experiences like climbing a wind turbine, visiting zero-emission housing developments, and touring biomass power plants abroad gave her perspective she applies today as part of her work with an American company. *Photo: Lindsey Craig*; **Right:** In April 2016, UD celebrated the Arctic and its commitment to research, conservation, and education by organizing film showings, interactive research stations, and special guest lectures. UD also played the sounds of breaking ice and singing whales on the campus carillon. *Photo: Christian Derr*

As cherry blossoms begin to bloom on campus, the University of Delaware (UD) will jump back into winter for a special celebration of the Arctic throughout the month of April. From the sounds of breaking ice and singing whales on the University's carillon to *Ice Breaker* talks, film showings, interactive research stations, and special guest lectures, the University will honor its interdisciplinary commitment to research, conservation, and education in this vast region of the world.

UD has a long history of not just bringing the most pertinent global issues of the day to our students here on campus, but also of sending them around the globe to learn about such issues first-hand. This has long been a UD tradition—our University is considered by many to have founded the first study abroad program in the U.S. in 1923.

More than thirty years ago, UD began its longest-standing study abroad partnership with the Danish Institute for Study Abroad (DIS) in our fellow Arctic nation of Denmark. Since its inception in 1985, over 100 UD students have explored the city of Copenhagen and traversed its surrounding Arctic and European neighbors.

Annette Brocks, a recent alumna of the program, relived her favorite moments—seemingly out of an adventure book, “I have climbed to the top of a windmill, learned to compost, and walked around a city in Sweden to see architecture in action... I hiked over ancient burial grounds in Aarhus and snowshoed in Norway.”

The Danish study abroad experience has opened doors for graduates, like Hannah Laub, who returned to Denmark to

lead other DIS students through surrounding Arctic and European nations. Former UD student Bill Cook was inspired to pursue his master's in urban and regional planning at the edge of his forties. William Lescas, one of the most recent participants, returned to the country with the Fulbright U.S. Student Program in 2016.

UD faculty make an impact on scholarship and innovation across the region. Jonathan Cohen, an Assistant Professor of Marine Science, ventured on a research cruise to Svalbard just this January with a team of international scientists from the Norwegian University of Science & Technology (NTNU) and the Arctic University of Norway to launch a new autonomous kayak. The 2011 Fulbright Arctic Chair and Director of UD's School of Marine Science & Policy, Mark Moline, has mentored students like Heather Cronin, a recent master's graduate. Others, like UD oceanographer Andreas Muenchow and his doctoral student, Peter Washam, are part of an international research team from the University of Delaware, Oregon State University, and the University of Gothenburg responsible for setting up an automated weather station (AWS), built by researchers at UD's Delaware Environmental Observing System.

Finally, Alyce Graham, a Ph.D. student in the history of American civilization, began her doctoral research on early 19th century courage-filled narratives of often catastrophic British explorations in the Arctic. UD Professor of English McKay Jenkins sits on her dissertation committee and is the author of the 2005 book *Bloody Falls of the Coppermine*.

### About the Author

Nikki Laws is a communications coordinator in the Institute for Global Studies (IGS) and Office for International Students & Scholars (OISS) at the University of Delaware. She is a Delaware native, a graduate of UD's Anthropology and American History programs, and an avid traveler. You can reach her at [nlaws@udel.edu](mailto:nlaws@udel.edu). *Photo: Kathy Atkinson, University of Delaware*



# 09 DISTRICT OF COLUMBIA

The author near the North Pole in the Svalbard Region of Norway. *Photo: Paul Miller*





# A Mathematical Musician's Journey from Our Nation's Capital to the Arctic Circle



Left: DJ Spooky turns ice into music by producing electronic sounds that mirror the geometry in ice crystals and climate change data. Photo: Paul Miller; Right: Cherry blossoms and the Washington Monument in Washington, D.C. Photo: Nate Lee

## About the Author

Paul Miller, known by his stage name DJ Spooky, That Subliminal Kid, is an electronic and experimental musician, philosopher, composer, and author. He was born in Washington, D.C. He studied philosophy and French literature at Bowdoin College in Maine, and is a Professor of Music Mediated Art at the European Graduate School. He was the first artist-in-residence at New York's Metropolitan Museum of Art. Learn more here: [www.djspooky.com](http://www.djspooky.com). Photo: Paul Miller



I grew up in Washington D.C. at Connecticut Avenue and R Street, and in Shepherd Park, at 13th Street and Geranium Street. They were two different visions of what Washington could be, and the connection was Rock Creek Park. I went to the park to ride my bicycle down from our house to my mother's clothing boutique, Toast and Strawberries, one of the few African American-owned stores at Dupont Circle.

Biking through the park each day after my mother's store closed gave me a sense of beauty to contrast with the Federal City. In a world where geographical frontiers are becoming more and more scarce, sometimes it's our sense of contradiction about something that leads to new visions. Even as a child, something as simple as the quiet, natural beauty of Rock Creek Park and the challenges that it posed to the bustling, man-made fabric of the city was an intellectually fascinating juxtaposition for me.

Today, I still collect my inspiration from the contrast between the natural and man-made. In 2014, I traveled to the Arctic with Sierra Club Director Michael Brune and Rue Mapp, Founder and CEO of Outdoor Afro. This journey inspired me to create my album *Arctic Rhythms*. The music on the album is electronic, but inspired by the nature, specifically the geometry, of ice.

In visiting the Arctic, I saw a place undergoing rapid change, but also a place that gave me a new vocabulary, and new data for composing my music. When I compose, I take data from nature, such as the geometric formulas of snowflakes, and turn them into music.

Even President Obama has caught Arctic fever. Last year, he issued an Executive Order on the Arctic and outlined steps to "prepare the Nation for a changing Arctic and enhance coordination of national efforts in the Arctic." He then traveled to Alaska to visit the Arctic, pointing to the region as a bellwether of global climate change impacts to come.

I wonder if the President issued his Arctic Executive from the Oval Office's Resolute Desk, which is made from the timbers of HMS Resolute, a British Naval ship used for Arctic exploration. After being frozen in the ice in the Canadian Arctic and abandoned, it was eventually recovered by an American whaler, restored by the U.S. government, and returned to Britain as a gesture of goodwill. Once it had served out its useful life in the UK, it was dismantled and some of its timber was used to create a desk, which was then presented by Queen Victoria to President Hayes in 1880. The Resolute Desk has been used by most U.S. presidents since.

When Admiral Peary and Matthew Henson fatefully met in the late 1800s in Washington, D.C., Peary was already dreaming of being the first human to reach the North Pole. This desire pushed the duo forward to Greenland by ship then by dog sled toward the top of the earth many times, with their final and successful effort in 1909.

While Peary and Henson had to rely on the most basic scientific tools, today technology can provide us with a picture of the entire Earth in real time. From Global Positioning Satellites (GPS) to Google Maps, humanity has now seen far beyond both the big and little bears, and is able to look back down at itself from the sky. This technology-driven world creates an information-drenched sense of the impacts of climate change. Thanks to NASA, which is based here in D.C., we can see that Arctic ice is melting at an astonishingly rapid pace.

The question is how will we move forward now that the ever-evolving language of science is presenting us with this new vision of the Arctic—not the one of our imaginations, but one that we are irrevocably changing.

# 10 FLORIDA

When Sarah (right) reaches the age of her life expectancy in 2068, sea levels in Portland, Oregon may be 26 inches higher than they are today. When George (left) reaches his life expectancy in 2076, sea levels in New Orleans may be 39 inches higher than today. *Photo: Mary Brandenburg*





## Where Goes the Arctic, There Goes Miami: Florida, the Arctic, and Our Rising Seas



**Left:** Sunny-day flooding at Stranahan House in Fort Lauderdale, built in 1901. *Photo: Serena Hoermann; Right:* Dr. Bill Landing of Florida State University plays his saxophone at the North Pole in August 2015. *Photo: Bill Schmoker, PolarTREC*



### About the Authors



Dr. Colin Polsky is a Professor of Geosciences and Director of the Florida Center for Environmental Studies at Florida Atlantic University (FAU). *Photo: FAU*



Dr. Leonard Berry, recently retired founder and Director of the Florida Center for Environmental Studies at FAU, continues his work in sea level rise on the local, national, and global scale with Coastal Risk Consulting. *Photo: Coastal Risk Consulting*



Serena Hoermann serves as Coordinator for the Florida Climate Institute at FAU, a multi-disciplinary network concerned with achieving a better understanding of climate variability and change. *Photo: Serena Hoermann*

**T**hey have snowshoes, we wear flip-flops. They have snow machines and sled dogs to carry them over pristine ice, we have year-round fishing and diving in sparkling, warm waters. They have the city of Barrow, the northernmost incorporated place in all the U.S. territory, and we have Key West, the southernmost incorporated place in the contiguous 48 states. Obviously, Alaskans and Floridians live at opposite extremes in worlds so distant and different; they seem completely unconnected. But today, with our increasing understanding of changing ice and weather patterns, we see that these places are linked. Unfolding changes in Alaska and elsewhere in the Arctic reverberate throughout the United States. These effects may be most evident along the eastern coastline that many Floridians call home.

Warmer air means warmer water, and as the water heats, it expands. This added volume is felt as a rise in sea levels. Also, warmer air melts land ice, which flows to the coasts, increasing ocean volume locally. These local outcomes are eventually felt globally, as the world's oceans are not stationary but instead circulate across the globe over time. Some of these predictions are already being observed in Florida. In the last 50 years we've seen 9 inches of sea level rise, already compromising drainage canals and causing local flooding. A local working group of the Southeast Florida Regional Climate Compact projects additional rises of 6 to 10 inches by 2030 and up to 2 feet by 2060. We must also explore the current and future risks of Arctic-influenced sea level rise, raise awareness among all spheres of society, search for policy solutions, and find ways to combine mitigation efforts with those of adaptation.

Many efforts are already underway across Florida to meet this challenge, engaging not only academia but also the public and private sectors, and civil society. In 2015, three Florida State University researchers joined David Kadko and a team from Florida International University on board the U.S. Coast Guard Cutter Healy, the United States' largest and most technologically advanced icebreaker. South Florida businesses like Grey Door Luxury Homes are taking sea-level rise into account when developing coastal property. In 2016, with the support of the University of Florida, a UNESCO World Field Laboratory: *Sea Level Rise and the Future of Coastal Settlements* examined the effects of sea level rise on Miami-Dade County. Also in 2016, the Florida Center for Environmental Studies at Florida Atlantic University (FAU) hosted its third Sea Level Rise Summit to compare impacts and responses in Alaska and Florida for building coastal resilience locally and globally.

FAU also commissioned Florida-based photographer Mary Brandenburg to take a series of photographs that would draw further attention to sea-level rise. Together with Climate Central's Ben Strauss, calculations were made for how much sea levels are expected to rise in different coastal cities around the United States. The result was a photographic series titled "Sea Level Rise in My Lifetime"—a powerful visual testament to the future that awaits America's children living in coastal areas due to climate change and its impacts, especially those changes happening today in the Arctic.

# 11 GEORGIA

The authors designed a social media campaign for the Norwegian Embassy's *Meet the Arctic* film contest. The contest logo was a puffin, not only because puffins are found throughout the Arctic, but they happen to be one of the Norwegian Ambassador's favorite animals. *Photo: Richard Bartz*





## Peaches, Puffins, and The Pips: Georgia's Unexpected Arctic Connections



Atlanta youth leader Charles Orgbon III (center) with colleagues in the Canadian Arctic in 2016 during a visit to study tree lines. *Photo: Charles Orgbon III*

### About the Authors



Madeleine Dargis is in her second year at American University in Washington, D.C., where she is pursuing a degree in criminal justice. She was raised in northern Virginia. *Photo: Bailey Culver*



Keira Waites is a sophomore at American University majoring in business. She grew up in Atlanta, Georgia, where she attended international school. She is passionate about film and plans to work in the entertainment industry. *Photo: Sofia Kim*

**I**n Georgia, the weather is overwhelmingly hot—it's just about as opposite from the Arctic as you could get, or so it might seem. Once you dive below the surface of the Peach State, however, you find some unexpected connections.

**Keira:** I grew up in Atlanta and while I didn't think much about the Arctic, I did get a glimpse of it when we took school trips to the Georgia Aquarium, which is actually the largest aquarium in the Western Hemisphere. The Arctic Room is one of the most popular rooms there because it features beluga whales, which are only found in the Arctic.

**Maddie:** Even though I'm from Virginia, I had my first introduction to the culture of one of our fellow Arctic countries, Russia, in Georgia. In high school, I traveled to the University of North Georgia (UNG) in the town of Dahlonega (pop. 5,250) to study Russian for three weeks as part of an intensive language-immersion program.

Keira and I are both students at American University (AU) in Washington, D.C. We met as freshmen and were offered spots in AU's Visual Literacy Seminar. Since then, we've learned a lot about the Arctic. For our final project, we were responsible for designing a social media campaign for a real-life client: the Norwegian Embassy in Washington, D.C.

**Keira:** Norway is an Arctic country and also on the Arctic Council like the United States. They wanted to do something to interest Americans in the Arctic, so they decided to hold a short film contest called *Meet the Arctic*. It was our job to help them help get the word out. We researched everything we could about the Arctic—environmental challenges, social issues, music, art, business—and it opened up an entirely new world for us. We also made short films using our friends as actors and created an Instagram feed and hashtag (#MeetTheArctic) as well.

Through this project I learned how other Arctic nations see themselves. In America, we don't really think of ourselves as

an Arctic nation, but we are. In Norway, people seem to know a lot about the Arctic—and lots of Norwegians live there. One of the biggest cities in the Arctic is Tromsø Norway, which has 71,000 people. In our Arctic, the biggest city is Barrow, Alaska, with about 5,000 people. It's much harder for Americans to visit our Arctic because Alaska is so far away.

Another Arctic-Georgia connection is Charles Orgbon III, a University of Georgia (UGA) senior. He's the founder and CEO of Greening Forward, a non-profit organization that helps young people build the partnerships and skills they need to create community-based approaches to solving environmental issues. In 2015, he visited the Canadian Arctic. He told us, "I think that the best way to start saving the Arctic is to start by saving our own communities—driving less, consuming less, conserving what we can. That's what's going to save the polar bear from extinction and the ice sheets from melting more. The answer isn't in the Arctic, it's everywhere. People who are doing these things—conservation, sustainability—are inherently doing Arctic work."

**Maddie:** The Arctic is a really cool place (no pun intended!) and luckily Keira and I were able to continue working on Arctic issues through the U.S. Department of State's Virtual Student Foreign Service, which is like a "virtual intern" program, during the U.S. Chairmanship of the Arctic Council.

**Both:** There are also a lot of other Georgia-Arctic connections that we don't really have time to go into—but feel free to explore on your own! We'll leave with you with a final connection related to Arctic energy, a song called "Alaskan Pipeline" by Gladys Knight and The Pips. Gladys Knight, the "Empress of Soul," is a Georgia native and Atlanta restaurateur, and the song is from the 1976 movie she starred in called *Pipe Dreams*, which was filmed in Alaska. Thanks for reading!

# 12

# HAWAI'I

The humpback whales that spend winter and spring breeding and calving in Hawai'i migrate to Alaska in the summer to feed. *Photo: iStock.com*





## Hawai'i's Arctic Connections



**Left:** The Pacific golden plover, or kolea in Hawaiian. *Photo: Kalani Chong*; **Right:** One of many examples of coastal erosion damage next to structures on O'ahu's Sunset Beach, 2013. *Photo: Dolan Eversole, University of Hawaii*

### About the Author

Dr. Nancy D. Lewis is Director of Research at the East-West Center (EWC). Based in Honolulu, Hawai'i, the EWC is a non-profit education & research organization established by Congress in 1960 to promote better relations and understanding between the governments and peoples of the Asia Pacific region, including the United States. A resident of Hawai'i for more than 30 years, Dr. Lewis previously served as a professor and associate dean at the University of Hawai'i. She holds A.B., M.A., M.S. and Ph.D. degrees from UC Berkeley. *Photo: East-West Center*



**B**almy Hawai'i might seem to be as far away from the frigid Arctic as you could imagine any place to be, but even America's southernmost state has important Arctic ties. In fact, it was while en route to (unsuccessfully) seek the elusive Northwest Passage through the Arctic that British explorer James Cook became the first recorded Westerner to encounter the Hawaiian Islands in 1778.

Long before then, however, Hawai'i had been receiving annual visitors from the Arctic in the form of migratory species like the Pacific golden plover, or kolea in Hawaiian. The kolea's twice-yearly 2,500-mile non-stop flight between Hawai'i and the Arctic is considered one of the animal kingdom's greatest migratory feats.

Unable to touch down on water, the Pacific golden plover flies approximately 50 hours without stopping on its seasonal migration between Alaska and Hawai'i. Each fall, the adult plovers make the southward journey first, leaving their young to make the flight on their own weeks later. How the fledgling birds are able to navigate to the Islands alone on their first trip remains a scientific mystery. Despite their impressively long migratory route, individual birds often return to the exact same lawn year after year.

In terms of biodiversity, we are connected to the Arctic through humpback whales. Humpbacks from Arctic waters frequent the Islands each winter, generating a thriving whale-watching industry.

As with other islands worldwide, Hawai'i is especially vulnerable to rising sea levels resulting from the melting of polar ice due to climate change. Already in recent years, the Islands have had to deal with increased beach erosion. For example, in certain parts of O'ahu's famous North Shore, beachfront homes have been threatened with collapse due to increasingly severe seasonal sand displacement.

Experts forecast that a sea level rise of less than a meter could inundate Waikiki and other resort areas that serve as the state's economic engine, driving our \$14 billion a year tourist industry. Those who work and live along Hawai'i's shores are working to solve this particularly difficult challenge.

Hawai'i also has an important policy connection to the Arctic through the annual North Pacific Arctic Conference. Each August since 2011, this conference has brought together world experts on Arctic governance, navigation, natural resources, and other fields—as well as indigenous leaders, policy makers, and stakeholders from other countries—for consultations at the East-West Center here in Honolulu.

At our most recent conference, we noted that while the Arctic continues to experience rapid changes, these changes are producing a more complex situation than the one envisioned just a few years ago.

Both states and non-state actors, including the East-West Center and other public diplomacy institutions, can play constructive roles in the effort to maintain the Arctic as a zone of peace and prosperity. They are also crucial to ensuring that the region's resources are developed in a sustainable manner as links between the region and the global system continue to grow.

Here in Hawai'i, we are thousands of miles from the Arctic, but thanks to our biodiversity, innovative energy initiatives, and efforts to promote international collaboration on Arctic issues, we are much closer to the region than one might think.

Thank you for reading and I welcome you to learn more by visiting our website at [www.eastwestcenter.org](http://www.eastwestcenter.org). Mahalo.

# 13 IDAHO

The Alaskan tundra.  
*Photo: Holly McQuinn*





## Idaho and the Arctic... What's the Connection?



**Left:** Arctic villages in Alaska like the Native Village of Elim, pictured here, are being forced into a different future than imagined in light of rapid regional changes. *Photo: Anaru Kliskey; Right:* Strips of smoked red salmon wait to be canned by participants of a youth camp hosted by the Kenaitze Indian Tribe in Kenai, Alaska in 2015. *Photo: M. Scott Moon/Kenaitze Indian Tribe*

### About the Author

Dr. Anaru Kliskey is a Professor in the Department of Forest, Rangeland, and Fire Sciences, and the Landscape Architecture program at the University of Idaho. His research interests include human response and adaptation to environmental change; spatial methodologies for understanding coupled natural human systems and representing indigenous & traditional knowledge; and social-ecological systems and place-based science. He feels at home in New Zealand, Alaska, and Idaho. You can reach him at [akliskey@uidaho.edu](mailto:akliskey@uidaho.edu). *Photo: Sarah Dengler, University of Idaho*



**W**hat is a New Zealander doing in Idaho and working on the Arctic? Like the Arctic tern that migrates from its wintering grounds in Antarctica and New Zealand to its breeding grounds in the Arctic, sometimes pausing in Idaho on this massive 20,000-mile journey, Arctic scientists can also make that journey.

Take me: a New Zealander who is also the Director of the Center for Resilient Communities (CRC) at the University of Idaho. With Dr. Lil Alessa, I founded the center to serve as a national program to develop tools that Arctic communities can use to assess how they might respond to the multitude of biodiversity, climatic, and economic changes that they face due to today's Arctic.

While many people have been living and thriving in the Arctic's harsh climate for thousands of years, changes happening in the region today are occurring so rapidly that many of the region's approximately four million inhabitants are facing serious challenges. In fact, some communities that have relied on a particular animal as a food source for millennia are suddenly finding that this particular species is not appearing at the expected time of year (or, in some cases, not at all). As a result, entire villages face the risk of food shortages.

Because Arctic communities are being forced to adapt quickly to new and harsher realities—including food shortages plus eroding coastlines and melting permafrost—the CRC seeks to help communities make informed decisions about the future, adapt effectively, and continue to thrive in the place they call home.

Last year, for example, we designed and developed an innovative and fun new way for students to learn about salmon ecology. We created *SalmonSim*, a virtual reality world that puts the player into the shoes—or fins, perhaps—of a sockeye salmon returning from the ocean to spawn in a freshwater river in Alaska.

The virtual world of salmon offered by *SalmonSim* has produced remarkable educational outcomes for youth from the Kenaitze Indian Tribe of southcentral Alaska—which has more than 1,600 tribal members across Alaska's Kenai Peninsula and beyond—and the Coeur d'Alene Indian Tribe of northern Idaho, which has approximately 2,000 enrolled citizens, many of whom reside on the tribe's sovereign reservation in northern Idaho.

This is just one example of how we can work together to address our common challenges. Idaho and Alaska share stunning landscapes, economies that rely on natural resources, and vibrant Indigenous cultures, and our work looks for ways to bridge diverse ways of understanding the world. By seeking broad connections that weave the social, ecological, and physical sciences with partnerships among communities and scientists, we build a science of integration. The valuable tools that arise from this type of thinking have applicability not only in the Arctic and its communities, but also in Idaho and elsewhere.

Indeed, Idaho's relevance to the Arctic is driven by cultural and ecological parallels, partnerships between communities and scientists, and the journeys of birds, fish and, of course, people.

# 14 ILLINOIS

Students from Illinois and  
KTH Royal Institute of  
Technology in Stockholm  
hike across the archipelago  
of Svalbard, Norway in 2012.  
*Photo: Mark Safstrom*





## The Changing View of the Arctic: The University of Illinois and Arctic Studies



Swedish researcher Dr. Dag Avango explains the history of Longyear City, Svalbard to students from Illinois and KTH in 2012. Photo: Mark Safstrom

### About the Author

Dr. Mark Safstrom is Lecturer in Swedish and Scandinavian Studies at the University of Illinois at Urbana-Champaign, where he coordinates the Scandinavian Program. He researches 19th and 20th century Nordic history, religious history, immigration to North America, Arctic studies and polar exploration. During the summers, he has frequently taught at KTH Royal Institute of Technology in Stockholm, Sweden KTH as part of the *Stockholm Summer Arctic Program: Environment and Society in a Changing Arctic*. Photo: Evan London



Though firmly planted in the American Midwest, faculty and students at the University of Illinois (UIUC) have long looked north to the Arctic for research and educational opportunities...and maybe even adventure. Some early expeditions involving Illinoisans include the *Crocker Land* expedition to Greenland (1913–17), as well as an expedition led by Frederick Schwatka (1878–80) in search of written records left behind by the Franklin expedition. Artifacts, records, and books accumulated by these expeditions can today be found in the University Library's rare book collections and the Spurlock Museum.

Those early adventures have since evolved into more academic study. Groundbreaking research in glacial geology has been conducted in Illinois itself, including that of the Illinois State Geological Survey. For example, Illinois hosts evidence for the southernmost extent of glaciation during the last ice age (one of these periods is even named the "Illinois Episode," occurring between ~130,000 and ~190,000 years ago).

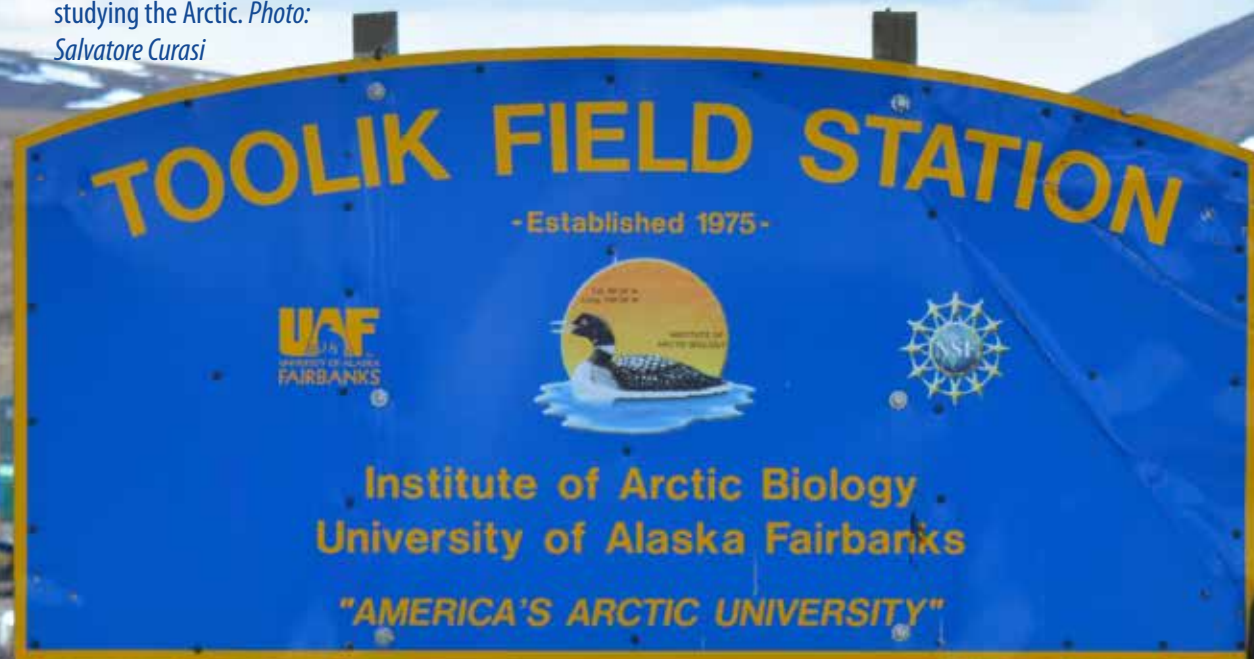
Current Arctic-related research includes work in plant biology by UIUC researchers like Prof. Feng Sheng Hu, who have analyzed how the past and present distribution of plant species in the Arctic region reflects changes in the global climate. Others researchers like Prof. John Walsh have gathered data from polar weather stations and satellites in order to create climate models that help forecast sea ice coverage for the next century, as well as the frequency of extreme weather events (heat waves, strong winds, floods, and droughts). In geology, researchers like Prof. Alison Anders have sought a clearer

understanding of past climates through studying erosion by glaciers in places like Alaska.

My own research in Scandinavian history has found an Arctic application in a summer course I have team-taught with colleagues at the Royal Institute of Technology in Sweden. Organized by Dr. Dag Avango, *Environment and Society in a Changing Arctic* is a five-week intensive with a research visit in the Arctic. UIUC students have traveled twice to Svalbard, Norway and three times to Lapland, Sweden. During our field visits, we tour sites related to the coal and iron mining industries, as well as museums and historic preserved buildings. This type of instruction falls within the framework of public history, as it analyzes the "delivery areas" of history – how history is narrated through national parks, monuments, historic sites, and built environments. Our students have seen how society in the Arctic has changed over the centuries, as well as how humans have changed the environment, visible in the histories told in places like Jokkmokk and the UNESCO World Heritage Site of Laponia in Sweden. Complementing these historical questions, the students are also challenged by faculty from the natural sciences to consider environmental factors, such as ice and glacier dynamics, the health of reindeer populations, and the impacts of mining on the ecosystem. Questions raised in one field intersect with others. We hope that when students make connections across disciplines, this will prepare them to be the kind of well-informed citizens that we need to address the complex questions facing our environment and society today.

# 15 INDIANA

The author at Toolik Field Station, an important base camp in Alaska for scientists studying the Arctic. *Photo: Salvatore Curasi*



VISITORS BY PRIOR  
ARRANGEMENT ONLY.





# Indiana—"The Crossroads of America"—Paves the Way toward a Better Understanding of Arctic Ecosystems and Communities



Left: Dr. David Lodge (far right) and Notre Dame Diplomacy Lab students at the U.S. Department of State in 2016. Photo: Rachel Oidtman; Right: Notre Dame researchers dissecting vegetation and soil samples in the North Slope region of Alaska. Photo: Rocha Lab, UND



One could say that Indiana is far better known for its sports teams, farmland, manufacturing industry, and cold winters than its role in the Arctic. However, our state is often called the “Crossroads of America,” and a closer look at “The Hoosier State” reveals a number of roads that link us directly with the Alaskan Arctic, the Russian Arctic, and the region more broadly.

Despite being roughly 1,700 miles away from the Arctic Circle, Indiana is heavily engaged with the Arctic. Not only is the state ecologically linked to processes occurring in the Arctic, but researchers in Indiana are playing active roles in Arctic communities, cultures, and the study of Arctic ecosystems.

Two Indiana University-Bloomington (IUB) faculty members recently traveled to the American Arctic for an important mission: to return human remains and sacred objects. These items were first brought to IUB in the 1920s by Mollie Greist, a missionary nurse from Monticello, Indiana, who, with her husband, worked and lived in Barrow for more than a decade in the early 1900s. The IUB envoys traveled to the small town of Barrow (pop. 4,400) on Alaska’s North Slope under the auspices of the Native American Protection and Repatriation Act, a federal law requiring museums to inventory and return remains and sacred objects to their appropriate tribes. The effort was part of the university’s objective “to return Native American cultural items to lineal descendants and culturally affiliated Indian tribes, and to provide information about culturally unidentifiable Native American collections.” It was an invaluable experience that allowed the Indiana scholars to build connections with an Arctic community in a very real and sacred way. They hope to continue the relationship by bringing visitors from Barrow to Indiana in the future.

Here at the University of Notre Dame (UND), we are also very connected to the Arctic. Dr. Adrian Rocha, a UND assistant

professor of biology whose research focuses on vegetation and permafrost in Arctic tundra, and graduate students such as myself carry out fieldwork primarily on Alaska’s North Slope at Toolik Field Station. Toolik is a scientific station run by University of Alaska Fairbanks (UAF) with support from the National Science Foundation (NSF)—it’s a bit like a Grand Central Station for scientists and educators conducting Arctic field research and other work in northern Alaska. (Coincidentally, it’s also where I sit as I type this, preparing to begin four weeks of research investigating tundra carbon cycling.)

Recently, UND students carried out research on shipping and Arctic invasive species through the State Department’s Diplomacy Lab, a program allowing university students from across the country to work directly with the government on projects and research of importance to U.S. foreign policy.

UND Diplomacy Lab participants investigated current-day ballast water movement by ships in the Arctic, the part cruise lines could play in passenger education and the prevention of species introduction, and the role native communities could play in invasive species monitoring efforts. Such research is timely given that climate change and declining sea ice are opening up the Arctic, leading to increased shipping, economic development, and more tourism.

At the end of the semester, the students, with support from Notre Dame’s Reilly Center for Science, Technology and Values as well as the GLOBES Graduate Certificate Program in Environment and Society, presented their work to officials in the State Department.

Indeed, Indiana truly plays an important role in protecting and studying our Arctic nation.

## About the Author

Salvatore Curasi is a biology Ph.D. student in the Rocha Lab at the University of Notre Dame. His research combines fieldwork and ecological modeling to investigate how climate change will affect vegetation and carbon cycling in Arctic tundra. You can contact him at [scurasi@nd.edu](mailto:scurasi@nd.edu).

Photo: Luis Weber Grullón



# 16 IOWA

Dr. Andrey Petrov, director of University of Northern Iowa's ARCTICenter, holds a piece of ice from a Siberian lake.

*Photo: Gertrude Saxinger*





## From the Polar Vortex to Polar Research: Iowa's Growing Engagement with the Arctic



**Left:** The “polar vortex” can bring Arctic-like weather to Iowa. *Photo: iStock.com;* **Right:** The Consul General of Canada Jamshed Merchant and graduate student Emily Francis pause for a photo after the 2015 Arctic Symposium co-hosted at UNI by the Consulate General of Canada in Minneapolis, ARCTICenter, and UNI Museum. *Photo: Jessica Cruz*



### About the Authors

Dr. Andrey N. Petrov is Associate Professor of Geography and Director of the Arctic, Remote and Cold Territories Interdisciplinary Center (ARCTICenter) at the University of Northern Iowa (UNI). His work is in the area of economic geography, human well-being, and sustainable development in northern communities. You can contact him at andrey.petrov@uni.edu.

Emily Francis is a biologist with the U.S. Fish and Wildlife Service and a research affiliate with the ARCTICenter. She is a biogeographer who studies migration of caribou and wild reindeer using various remote sensing and telemetry methods. You can contact her at efranc@uni.edu. *Photo: Andrey N. Petrov and Emily Francis*



Iowa is not a place where most residents feel close to the Arctic, except when cold Arctic air shows up in the form of the well-publicized “polar vortex.” Arctic researchers in Iowa are often faced with the question: How does studying the Arctic benefit Iowans and serve our state? First of all, climate change and Arctic amplification are always an easy-to-make connection. For Iowa, an important (and vital) question is the impact of Arctic warming on mid-latitude weather patterns, natural hazards (such as tornado activity, ice storms, deep “polar vortex” freeze), droughts, and overall weather volatility. Farming is for many in this state more than a method of economic survival but a deeply ingrained cultural necessity. Iowa recently experienced its share of droughts and floods, causing residents to pay close attention to climatic variability.

Many Iowa rural communities share surprisingly similar characteristics to those in the Arctic, including a shrinking and ageing population, small labor force, over-reliance on one or two industries or employers, limited access to financial capital, small local market, etc. Understanding how Arctic communities are coping with these factors is instrumental in designing regional and local development strategies in the Midwest. And, conversely, rural development experiences in Iowa may be useful in the Arctic.

Iowa is a significant player in the energy market, as it is a renewable fuel producer and a wind energy powerhouse. Our state has a major stake in the energy sector, and oil prices and dynamics of fossil fuel production impact the state economy. To a certain extent, Iowa, a new development frontier of renewable energy, indirectly competes with the Arctic, the last frontier of traditional fuels. On the other hand, the Midwest may become a new crossroads of North America if resources from the Arctic and sub-Arctic flow through the region, while grain exports could be transported to overseas markets through increasingly ice-free Arctic ports.

Iowans have made significant contributions to Arctic studies. Iowa native Dorothy Jean Ray (1919–2007), a University of Northern Iowa graduate, was a leading Alaska anthropologist. Vilhjalmur Stefansson (1879–1962) and Frank Russell (1868–1903), who both studied at the University of Iowa, became important Arctic explorers.

Recently, Iowa researchers became more engaged in studies of various social, cultural, and economic processes in the Arctic. Many of these efforts have been spearheaded by the new Arctic, Remote and Cold Territories Interdisciplinary Center (ARCTICenter) at the University of Northern Iowa. The scope of this work is considerable: from impacts of resource development and issues of sustainability in Arctic social-ecological systems to Inuit church music and Arctic Olympic Games, from tracking reindeer using satellite telemetry to examining technological innovation in rural Alaska communities. It seems with the creation of the ARCTICenter that Iowa is gaining particular strength in Arctic social sciences and sustainability science.

Iowa is home to more than just humans, with a landscape teeming with biodiversity. However, some are just visitors. Arctic birds use the prairie landscape in annual flights from the Arctic to the Gulf Coast region and beyond. These feathered, northern neighbors take part in long-distance migration patterns, just like other Arctic species, such as caribou and reindeer.

Iowa researchers bring concerns and aspirations of Arctic communities to greater national and global audiences. Coupled with outreach activities that engage Iowa schools and the general public, we strive to place the Arctic into the homes and hearts of fellow Iowans, and of all Americans, in order to give everyone an opportunity to know and to love the American Arctic and its circumpolar neighbors.



# 17 KANSAS

The author and her daughter, Eleanor, observe a receding glacier on Mt. Rainier in Washington. *Photo: Andrew Myers*





## A Kansan Inspired by the Arctic



**Left:** The author in Paris during COP 21, which took place not long after major terrorist attacks in the city. The shoes were a symbol in place of a planned climate march that was canceled for security reasons. *Photo: Jill Kubit*; **Center:** DearTomorrow logo. **Right:** The golden magic of the midnight sun in Swedish Lapland. *Photo: Eva Troell*

### About the Author

Trisha Shrum is co-founder of DearTomorrow and a post-doctoral fellow at the University of Colorado Earth Lab. She earned her Ph.D. in Public Policy at the Harvard Kennedy School, specializing in behavioral science and environmental economics. She holds a B.A. in Environmental Science and a B.S. in Biology from the University of Kansas and a Master's in Environmental Science from the Yale School of Forestry and Environmental Studies. She was born and raised in Olathe, Kansas. *Photo: Matthew Nager*



**T**raveling to the remote corners of the Arctic is not quick or easy. On my first visit to Lapland, I drank frigid glacier meltwater straight from a stream, met a lovely native Sami woman who sold delicious homemade bread to trekkers and learned a bit about their culture, and killed 14 mosquitoes with a single swat of my hand. The Sami woman laughed as we hunkered down with bug nets and swatted away the hordes of mosquitoes and joked, “Those are our pets.” Reaching the summit of a hill, we would overlook valleys dotted with Sami huts and framed with winding streams. It captured the very essence of the Arctic.

Six years later, I was invited to give a talk on climate change and renewable energy in Reykjavík, Iceland. Remembering the beauty I had experienced that first trip, I desperately wanted to return to the Arctic.

Little did I know that these three days would change my life.

At the meeting, I listened to a talk from Christiana Figueres. At that time, she led the United Nations Framework Convention on Climate Change. She told the audience she was haunted by a dream where the faces of children from the future looked at her and asked, “You knew about climate change. What did you do?” In her position, she has done more than just about anyone to address climate change. Hearing she is driven by the understanding that citizens of the future will look back and hold us responsible for our actions sparked a very powerful idea.

On my flight home, I stared out the window and thought of my own daughter. What would I want her to know about my own battle on climate change both within myself and with the world? It is hard to take on a problem that is so big

when we are each so small. It is hard to grapple with the sad realities of the future without losing hope. Right there on the plane, I pulled out my laptop and wrote her a letter that I would give to her in the year 2050, when she might even have her own children. As I wrote I realized that all the work I do to fight climate change was for her. And for that reason, I knew that I could never give up. Writing that letter shifted my perspective. I saw that it was not about me or polar bears or “future” generations. It was about the next generation. It was about my daughter. She relies on me to protect her, and I would do everything in my power to give her the best chance for a beautiful future.

This idea of writing letters to those who will inherit the climate we shape is powerful and inspired me to co-found an organization called DearTomorrow. DearTomorrow invites people to send open letters, photos, and videos about climate change to loved ones living in the future. They are submitted online, where we build an archive of messages—documenting a pivotal moment in history—for future generations. Instead of talking about climate change as a partisan issue, we are talking about it as parents who are doing the best we can for our kids. Republican, Democrat, Arctic, or Kansan—every parent loves their kids. The drive to protect our own children is one of the most universal values in the world.

To date, nearly 15,000 people have visited our website to read these letters and we’ve reached millions more through news stories and social media. And this is just the beginning. We hope the work we are doing will help give our children the chance to look out upon the incredible glaciers and winding rivers of the Arctic under the midnight sun and be inspired to build their own legacy for the generation that will follow.



# 18 KENTUCKY

The author gets ready to set his net near Egegik, Alaska.

*Photo: Mary Beth McKinley*





## Salmon and Sustainability: From the Icy Waters of Alaska to the Tables of Kentucky

### About the Author

Jason McKinley is a commercial sockeye salmon fisherman in Bristol Bay, Alaska. In the off-season, he and his wife reside in their home state of Kentucky, where they are raising their two young boys (ages 2 and 7 months) and sharing with them their love for adventure and the outdoors. They also own and operate Caught Wild Salmon. They market and distribute their Alaskan wild-caught sockeye salmon in and around the state of Kentucky. You can learn more about their work at [www.caughtwildsalmon.com](http://www.caughtwildsalmon.com) and email him at [info@caughtwildsalmon.com](mailto:info@caughtwildsalmon.com).  
*Photo: Mary Beth McKinley*



Salmon steak filleted and ready to grill in Homer, Alaska. Photo: Jason McKinley

I was born and raised in Kentucky, but I've always had a heart for travel and exploration. I love to explore and find common ground with places and people. It has been nearly twenty years since I've spent a summer at home. Why? For the past two decades, I've traded in the hot, sticky summer months of June and July here in Kentucky for commercial fishing in the world's largest sockeye salmon run in Bristol Bay, Alaska.

Even though I only spend a couple of months in Alaska every year, my fellow Kentuckians know me as the "Alaskan fisherman." Kentuckians are enthralled with Alaska's allure and rightfully so. There is an understandable mystery and pull to the "Last Frontier" when I talk about fishing and traveling there—it's what continues to call me back and allows me to bring delicious, wild-caught, healthy sockeye salmon from Alaska to the tables of my friends, family, and customers in Kentucky.

My passion for Alaska began when I was 22 years old as part of an unexpected road trip. With a car full of camping equipment, I decided to drive north and see where the road took me. I ended up in Homer, Alaska and spent two glorious months living in a tent surrounded by the grandeur of beautiful Alaska...open water, ice-capped mountains, and fresh air. That fateful summer, I landed a job hauling and filleting fish for several charter companies, and my life hasn't been the same since.

This summer will be my seventeenth season fishing Bristol Bay. These days, my fishing passion has become a family business. We transport part of our season's catch back to Kentucky, where my wife and I travel to farmer's markets around our current hometown of Stanford, hand-delivering one of Alaska's healthiest exports to Kentuckians. We also distribute to local retailers, specialty shops, and restaurants that are committed to selling and serving wild-caught salmon.

Climate change is affecting ecosystems around Alaska, and we are still learning how salmon are responding to these changes. Some scientists are predicting that Arctic warming will lead to changes in Bristol Bay watersheds, which will then lead to shifts across the entire ecosystem that supports our industry. The annual harvest out of the Bay for the past twenty years has been, on average, just under 30 million fish. Forty percent of our country's wild-caught seafood comes from Bristol Bay, and it also produces about 50 percent of the world's supply of wild-caught sockeye salmon. Continuing to study the impacts of Arctic warming and how we can adapt will help to ensure the sustainability of this precious resource, a resource that's important to many not just as a source of income and nutrition, but as a way of life.

Over the years, I've learned much more about the importance of sustainability and its role in ensuring that future generations—both in Alaska and Kentucky—can enjoy the same bounty we do today. Like Alaskans, Kentuckians value sustainability. My wife and I love meeting community members in both places who share similar values about taking care of nature so that we can continue to enjoy what it provides. Even though our Alaskan salmon is not local to Kentucky, we have been welcomed into the local food circles by Kentuckians who want a wild-caught fish option. They greatly appreciate knowing their local fisherman and having a protein source that they can trust in terms of fishing practices, quality, and traceability.

It has always been important to me to take great care of our Mother Earth and what God has given us. I learned this from my grandfather, who was a farmer in Kentucky. He and I shared many moments in his garden, where he taught me about growing my own food, harvesting it, then giving it to others. Today, I put these values into action.



# 19 LOUISIANA

Louisiana's bayous are threatened by climate change. Water from the melting polar ice caps is making global sea levels rise and submerging the Louisiana coast. *Photo: Tina Freeman*





## Shared Fate, Shared Liberation: Louisiana, the Arctic, and the Rise against Climate Change



**Left:** A photograph of Iceland's Breiðamerkjökull Ice Cave by Tina Freeman, a New Orleans-based photographer who studies land- and sea-based ice around the world. *Photo: Tina Freeman*; **Right:** Gulf South Rising COP 21 Delegation in Paris. *Photo: Gulf Coast Center for Law & Policy*

### About the Author

Colette Pichon Battle has worked for ten years with local communities, national funders, and elected officials around equity issues in Louisiana, her home state. She most recently served as executive director of the Gulf Coast Center for Law & Policy, developing programs focused on global migration, community economic development, climate justice, and equitable disaster recovery. Colette has won many awards for her work with Gulf Coast communities. In 2016, she was recognized as a Champion of Change for Climate Equity by the White House. You can reach her at [cpichonbattle@ushnetwork.org](mailto:cpichonbattle@ushnetwork.org).



Arctic Youth Ambassador Esau Sinnok (left) and Colette Pichon Battle. *Photo: Erin Robertson*

**F**rom a distance, there's not much in common between the hot and humid Gulf South and the northern territory's frozen desert-like conditions. But it is the rapidly warming planet that forms one of the strongest direct connections between my home state and the Arctic.

Waters flowing from melting polar ice caps are the same ones submerging Louisiana's coast—threatening ways of life at both ends of our nation and around the globe. The retreating ice, coastal erosion, and rising sea levels are only worsening as global warming speeds up. Residents in the Arctic and in the Gulf Coast are losing the land they've depended on for generations. Our communities face relocation from the places we call home. My grandchildren will never know the land that raised me and all the generations that came before.

As the founder and executive director of the Gulf Coast Center for Law & Policy, a public interest law firm and justice center, I work with communities of color on the front lines of climate change. Our work is rooted in climate-based disaster recovery. When poor, black, and indigenous communities are hit hard by climate disaster, either through disappearing land or record-breaking extreme weather, there are few resources available to prevent damage or to recover from the unimaginable impacts.

As in Louisiana, the people of the Arctic are suffering from the impacts of climate change, including in Alaska's indigenous communities.

I was inspired after meeting Esau Sinnok, an Iñupiat Eskimo from Shishmaref, Alaska to speak out against the federal plan

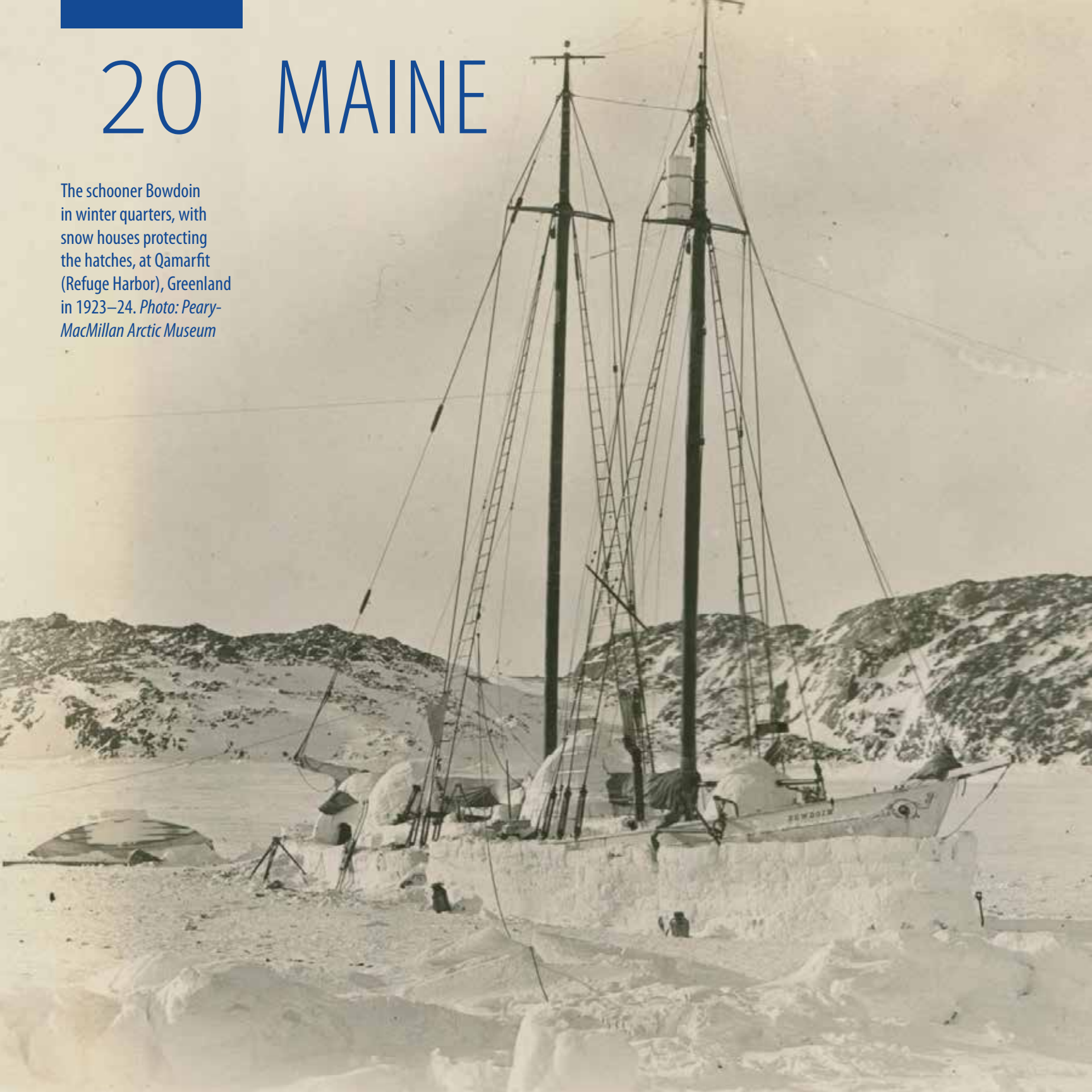
that would allow more offshore drilling in the Gulf and the Arctic for the next five years. We shared and compared the stories of our two communities, which are in fact the oldest coastal communities in the United States.

Esau's island village is located just south of the Arctic Circle on the edge of the Chukchi Sea. As the permafrost beneath the village thaws and the sea ice around it melts, each big storm threatens the lives, history, and indigenous culture of Shishmaref's 600 citizens—the majority of whom are Alaska Native. Recently, Shishmaref voted to relocate its entire village to a spot on the mainland five miles away, which will cost an estimated \$180 million. Our people here in Louisiana have faced similar relocation issues. In January 2016, the federal government allocated nearly \$50 million to relocate Isle de Jean Charles, an island here that has lost nearly 98% of its land since 1955 due to coastal erosion and sea level rise. The residents of the island, who are primarily Native Americans from the Biloxi-Chitimacha-Choctaw Tribe, are America's first climate refugees. Now, it appears as though Alaska Natives like Esau and his family are not far behind.

In Shishmaref, Esau's community, climate change is the catalyst for conversations on relocation and loss of tradition—which is exactly what we are facing in Louisiana. In discussing what was at stake in each of our communities, we understood that our fates are tied. I understood that to fight for climate justice and ecological equity in the Gulf South required me to actively work together with the people of the Arctic. Our fates are tied together—and so is our liberation.

# 20 MAINE

The schooner Bowdoin in winter quarters, with snow houses protecting the hatches, at Qamarfit (Refuge Harbor), Greenland in 1923–24. Photo: Peary-MacMillan Arctic Museum





## Maine and the Arctic: A Shared History



**Left:** The authors at the site of Arctic explorer Robert Peary's 1908–09 shore camp on Floeberg Beach, Ellesmere Island, Canada. *Photo: Susan A. Kaplan and Genevieve LeMoine;*  
**Center:** Navarana K'avigak teaches a Bowdoin College student the basics of Inuit drumming. *Photo: Peary-MacMillan Arctic Museum collection;* **Right:** A Ramah Chert artifact. *Photo: Maine State Museum*

### About the Authors



Dr. Susan A. Kaplan is a professor of anthropology and director of the Peary-MacMillan Arctic Museum and Arctic Studies Center at Bowdoin College. She studies prehistoric and historic Inuit and the history of Arctic exploration and teaches courses on a variety of Arctic topics. You can contact her at [skaplan@bowdoin.edu](mailto:skaplan@bowdoin.edu). *Photo: Doug Cook, Bowdoin*



Dr. Genevieve LeMoine is an archaeologist and curator/registrar of the Peary-MacMillan Arctic Museum and Arctic Studies Center. She has worked at archaeological sites across the Arctic. She researches skeletal technology, experimental archaeology, and women in prehistory. You can contact her at [glemoine@bowdoin.edu](mailto:glemoine@bowdoin.edu). *Photo: Christyann Darwen*

**I**n August 2016, Maine Senator Angus King traveled to Greenland and made a video in which he claimed he was in Maine—10,000 years ago. It was a joke with an essential grain of truth. An ice sheet once blanketed Maine and when it retreated, a tree-less tundra covered the state. To this day Arctic-adapted plants grow on Maine mountaintops.

The Senator's point was that Maine is an Arctic state because of its northern ties. Those include a tradition of Maine cod fishermen sailing “down the Labrador,” and Maine shipyards building Arctic-purpose vessels such as SS Roosevelt and schooner Bowdoin. More recent northern-focused ventures include Iceland's shipping company Eimskip's move to Portland, Maine, whose expanded port facilities are encouraging increased trade and investment in North Atlantic markets. The New England Ocean Cluster serves as a North Atlantic business incubation center, and the University of Southern Maine has an educational exchange program with Iceland's Reykjavik University. Businesses are exploring northern opportunities and law firms are building their Arctic expertise, recognizing Maine's strategic position relative to North Atlantic countries and commercial ship traffic using the Northern Sea Route or Northwest Passage.

Maine's ties to the Arctic go back about 4,000 years when ancestors of the Wabanaki carried on a long distance trade with neighbors in what is now maritime Canada. A sugary-grey quartzite known as Ramah Chert, quarried from Labrador's Torngat coast, was a major component of that trade. Mainers fashioned it into implements now found in archaeology sites throughout the state.

Beginning in 1860, Bowdoin College faculty and students went north to study the natural history of Labrador and Greenland.

The most famous was Robert E. Peary (Bowdoin 1877), who explored northern Greenland and Canada. In 1908–09 he led the first expedition to reach the North Pole. Donald B. MacMillan (Bowdoin 1898) joined Peary's 1908–09 venture and embarked on 26 more expeditions to the Arctic, most aboard schooner Bowdoin. He pioneered the use of motion picture films, radios, and airplanes in the eastern Arctic and established lasting ties with people in the region.

Today, people from Maine go north in ever-growing numbers. They include researchers from The Climate Change Institute, at the University of Maine who study the earth's complex relationship to the environment, and Bigelow Laboratory for Ocean Sciences who are developing solutions to vexing problems in northern seas.

Maine's ties to northern communities reach back over 130 years and still resonate today. For instance, children in Qaanaaq in northern Greenland can pronounce “Bowdoin” (it's bow-dun), and many of their grandparents have fond memories of MacMillan and his schooner Bowdoin, too.

People from Alaska, Greenland, Canada, and Iceland also visit Maine. Northerners come to study collections at the Peary-MacMillan Arctic Museum, participate in workshops, perform, lecture, exhibit their art, or explore business partnerships. Often they express an appreciation for Maine's natural beauty. More importantly, they mention the warmth and hospitality of the people here, so much like the hospitality we experience in their communities.

# 21 MARYLAND

An Arctic polar bear.  
*Artist: David Scheirer*





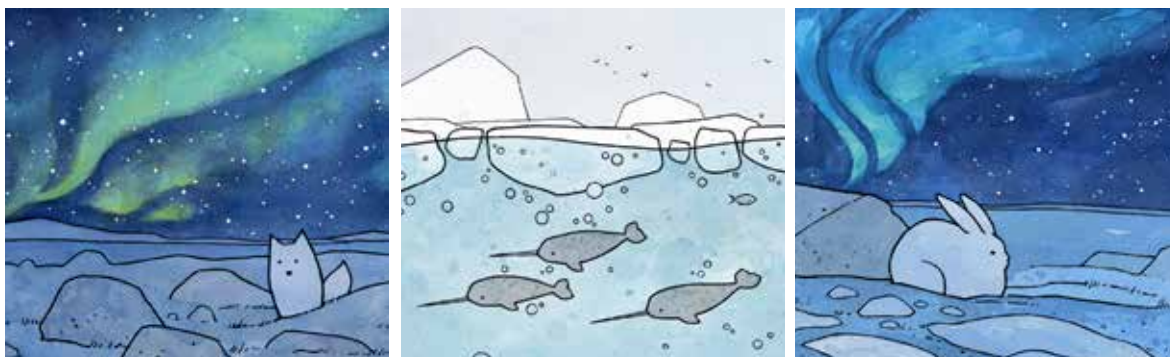
## Whimsical Arctic Art from a Maryland Illustrator

### About the Author

David Scheirer is a dad (to one boy and two cats), an Eagle Scout, a full time painter and illustrator, and a part time bird-watcher, fossil collector, and beachcomber.

He grew up in Kensington, Maryland and graduated with a degree in painting from the Maryland Institute College of Art in Baltimore. He lives on a small farm 40 miles north of Washington, D.C., and is inspired by the serenity of horse pastures and farm fields outside his studio windows. See more of his artwork at [www.studiotuesday.com](http://www.studiotuesday.com).

Photo: Torrey Seely



Left: An Arctic fox. Center: Narwhals. Right: A snowshoe hare. Artist: David Scheirer

As a lifelong Marylander, I am intrigued by the connections between my home state and the Arctic. Maryland's most obvious connection to the Arctic is migratory birds. I enjoy birdwatching and especially appreciate the Arctic residents that visit our state at certain times of the year. Various sandpipers, plovers, and turnstones that nest in the Arctic can be seen along Maryland's coasts and waterways as they migrate in the spring and autumn.

When I was young, my dad occasionally traveled for the government. On one such trip, he visited Thule Air Base. Located 750 miles north of the Arctic Circle in Greenland, it is the United States' northernmost Air Force base. Dad returned with stories of flying in ski planes and seeing Arctic wildlife, including his favorite, the Arctic fox. His stories and pictures spurred my own interest in the Arctic, which is now a favorite subject for me when drawing. The iconic animals, harsh weather, open grassy tundra, and icy barren landscapes are all interesting subjects that suit my minimal style.

My illustrations are drawn in a graphic, simplified manner and are created with ink and watercolors. I especially enjoy drawing animals and the habitats they live in. I try to find a balance between simplicity and reality in these drawings, and I enjoy finding ways to capture the essence of an animal with a few simple lines.

In addition to the playful illustrations shown here, I also create realistic watercolor paintings, often of subjects close to home: birds, animals, fossils, and plants from Maryland and the East Coast. My whimsical illustrations offer an interesting contrast to that work, although they are rooted in reality and science as well. They allow me to create from my imagination. I have fun drawing environments from across the globe that maybe I have yet to visit.

Many of my snowy owl illustrations depict them wintering in more southern habitats, such as along our coastline. Snowy

owls like beaches, farm fields, airports, and other open areas that mimic the tundra. The past few years, lucky Maryland and Washington, D.C., residents were able to see snowy owls that wintered farther south than usual.

Tundra swans also come to spend winter on the Chesapeake Bay and its tributaries. I discovered this for myself while hiking along the Potomac River in southern Maryland, at a point where the river is wide and slow moving. As I came within earshot of the river, I heard a strange droning. I was very confused until I came out of the trees and realized that the noise came from the honking of many hundreds of brilliant white tundra swans. The Algonquian Native Americans had names for different parts of the Potomac River, and there is good reason that this southern section was called *Patawomke*, which means *river of swans*.

The Northern Lights are another of my favorite subjects. I love seeing how other artists interpret them! For me, they are a challenge and I enjoy experimenting and painting them in new ways.

My illustrations are well suited for children, but I've found they are enjoyed by people of all ages who love animals, and in particular (somewhat surprisingly to me) people who study animals. Over the years, I've had the pleasure of fulfilling commissions for biologists, interns, and others who devote their time to learning, teaching, and conserving wildlife and wild spaces.

We are an Arctic nation at heart, being a people who are inspired by the freedom inherent in the expansive polar environment as well as the challenge of life in such rigorous, often dangerous, conditions. We feel connected to the Arctic in many ways, especially through story, history, and art. My Arctic artwork expresses my own connection to this fascinating and beautiful part of our planet.

# 22 MASSACHUSETTS

*Scene in the Arctic* by William Bradford (1823–1892).

Bradford was an American artist and explorer from Fairhaven, Massachusetts and one of the country's most preeminent painters of Arctic seascapes and ships.

*Artist: William Bradford, circa 1880, De Young Museum, The Fine Arts Museum of San Francisco, PD-1923*





## From Exploitation to Understanding: Massachusetts and the Arctic

### About the Author

Jed Willard is Director of Global Engagement at the Franklin Delano Roosevelt Foundation at Adams House, Harvard University. Besides his interest in the Arctic, Jed's work covers the Transatlantic Alliance, public diplomacy, the Enlightenment tradition, and information operations. Jed was Founding Director of the Public Diplomacy Collaborative at Harvard's Kennedy School and a Founding Partner and board member at LanguageCorps. His other experience includes media relations and market analysis, and he's also an amateur forester and Cajun cook. Jed is a native of New Orleans, with a Bachelors Degree in History and a Masters Degree in Public Administration from Harvard. You can reach him at [jed.willard@fdrfoundation.org](mailto:jed.willard@fdrfoundation.org).

Photo: NATO



**Left:** Whalebone was a key structural underpinning for women's fashion in the mid-1800s. It was integrated into corsets like this one made of whalebone and cotton with steel busk and back supports in the Victoria and Albert Museum (Gift of Miss S.P. Emery). *Photo: Valerie McGlinchey*; **Right:** After their presentations, the Arctic Innovation Lab students engaged in a dozen lively roundtable discussions with the nearly 200 audience members. *Photo: Arnthor Biriksson/Iceland*



The people of Massachusetts have a long and sometimes bloody tradition of Arctic engagement. Sailors out of Massachusetts ports from Nantucket to Provincetown braved the frozen waters of the far north from colonial times onward in search of whales. Whale oil—used for fuel, lubricant, and candle manufacturing—and other whale-derived products such as the many items manufactured from baleen (the bristly, tooth-like filtering system found inside the mouths of baleen whales) were essential export products for the state. To this day, the mansions of successful whaling magnates can be explored along the Massachusetts coast, especially in the town of New Bedford.

While Massachusetts whaling was greatly scaled back in the late 19th century, Arctic exploration was on the rise. Massachusetts-born Donald MacMillan, along with colleague Robert Peary, was one of the preeminent Arctic explorers of the early- to mid-20th century. MacMillan brought the tools of modern exploration to the Arctic, introducing new technology on his many voyages and new open-mindedness in his extensive dealings with indigenous Arctic communities. MacMillan accompanied Peary at the outset of the latter's successful voyage to the North Pole in 1908, and later assembled both the famed Arctic schooner *Bowdoin* and a dictionary of the Inuktitut language. Thankfully, it is MacMillan's legacy of exploration and understanding that defines the Massachusetts-Arctic relationship today.

Many of the state's large number of research institutions maintain Arctic studies programs. Here at Harvard, student and professors explore the region from a variety of disciplines—from climate to security to public health. Chair of the Arctic Council's Senior Arctic Officials, Ambassador David Balton (A.B. 1981), treated us to a visit in fall 2016, inspiring a group

of students to embrace science diplomacy as one path to further international cooperation in the Arctic. Harvard professor James McCarthy, co-chair of the Nobel Peace Prize-winning Intergovernmental Panel on Climate Change, serves on the U.S. Arctic Research Commission and is one of our leading climate scientists. Upcoming projects include engagements with the Finnish government as they chair the Arctic Council from 2017 to 2019.

For a number of Massachusetts students, the Arctic was uncharted territory before they started preparing for the Arctic Innovation Lab, a new platform where “students and young professionals can pitch and develop ideas and work with experienced practitioners” in order to “facilitate an ongoing dialogue between generations to speed up knowledge transition and build capacity for the future of the Arctic.”

The Lab was launched in October 2016 at the Arctic Circle Assembly in Iceland, an annual event in Reykjavik. During the Assembly, a special Arctic Innovation Lab side event was organized by Harvard students in collaboration with the Iceland School of Energy at Reykjavik University, the University of Greenland, the Fletcher School at Tufts University, and the University of Iceland.

Over centuries of engagement with the Arctic, the people of Massachusetts have come a long way. While the exploitation of Arctic whales was highly profitable for a time, it was terribly cruel, dangerous, and eventually untenable both financially and environmentally. The shift in the late 19th and early 20th centuries away from whaling and toward scientific exploration and deeper understanding marks a hopeful chapter in the long story of American engagement in the Arctic. May we keep this lesson in this new century.

# 23 MICHIGAN

Decked out in Finnish national costumes, community children pose in a traditional Finnish hämäläinen-style boat made by Copper Country elders during a Michigan Traditional Arts Apprenticeship Program.  
*Photo: James Kurtti*





## Finland, Copper, and Reindeer: Tracing Michigan's Historical Roots to the Arctic on Two Continents

### About the Author

James N. Kurtti is the Honorary Consul of Finland for Upper Michigan's 15 counties and the director of Finlandia University's Finnish American Heritage Center and Historical Archive. He is also the editor of *The Finnish American Reporter*, the largest circulated newspaper for Finns in North America. Kurtti's immigrant grandparents, who were among the thousands who cast their lot in the copper mines of the New World, were from the reindeer herding families of Kuusamo, Finland. Photo: Karen Johnson, Finlandia University



**Left:** Inupiat men in Alaska with domesticated reindeer. Photo: New Bedford Whaling Museum, David H. Jarvis, 1897; **Center:** Finnish flags and bilingual street signs line the main street of Hancock, Michigan—a place the early Finns called *Amerikan Lappi* (American Lapland). Photo: James Kurtti; **Right:** Saunas are an important part of Finnish culture. The “Sauna Belt” of the Upper Midwest extends from northern Minnesota through the Upper Peninsula of Michigan, where the Saturday night sauna is still a mainstay of cultural life. Photo: iStock.com

In his history of Finns in the United States, *Amerikan Suomalaisen Historia*, Pastor Salomon Ilmonen recounted the stories of the first permanent Finnish settlers who came to Hancock, located in northern Michigan's Copper Country, in 1865. Thanks to these early settlers from the Scandinavian Arctic, the Finnish spirit remains strong in Hancock, as well as other cities in northern Michigan, where communities maintain deep and strong ties to the culture of their Arctic forebears.

In the late 1800s, a U.S. government program brought reindeer—a species integral to cultures and diets of many Arctic peoples—from Siberia to Alaska to alleviate starvation and promote economic development among the Inupiat, the indigenous people of northern Alaska. Reindeer herding families, including Sami, who had been recruited directly from Scandinavia, arrived in Alaska, followed by reindeer.

A decade after the program started, a prominent Michigan businessman offered to recruit reindeer herders from among the newly arrived immigrants to Michigan's Copper Country, rather than make a long trip to Scandinavia to find new recruits. Eleven Finnish men from the region left for Alaska to partake in the project. Although relations with the government waxed and waned, the Inupiat, Samis, and Finns lived in relative harmony during the reindeer herding period.

Copper was king in Michigan and thousands of Finns, as well as many other nationalities, came to the region to work the mines. The influx of Finns to northern Michigan of course led to a need for services tailored to the Finnish community. In 1877, Hancock resident Antti Muikku established the first Finnish newspaper in the United States, *Amerikan Suomalainen Lehti*. Numerous other Finnish newspapers,

many short-lived, were also produced in the Copper Country. Of the two remaining newspapers serving Finns in the United States, *The Finnish American Reporter* is the most widely circulated with readers in all 50 states, most Canadian provinces, and seven other countries.

In 1867 the local Finns, Kvens, Sami, Swedes, and Norwegians formed the Scandinavian Evangelical Lutheran Congregation of Quincy, commonly called Holy Trinity, making a tongue-in-cheek reference of Finns, Swedes, and Norwegians worshiping under one roof. By 1871 the congregation received its second pastor, H. G. Roernaes, of Lyngen, Norway, who unlike the first pastor also spoke Finnish and Sami.

After 150 years of Finns coming to the *Amerikan Lappi* (American Lapland), as Hancock is known, Finnish Americans have greatly assimilated, and yet Finnish culture is alive and well.

Today, more Finns live in northern Michigan than anywhere else in the United States. The five northwesternmost counties of Michigan's Upper Peninsula are the only counties in the United States in which Finns are the largest ethnic group, with approximately 35% of the residents claiming Finnish heritage in the most recent national census.

Recently, a visiting Finnish cellist remarked, “I arrived in Hancock on the 4th of July. The town was empty. There were Finnish flags everywhere and the street signs were in Finnish. I thought, what kind of alternative universe am I in?” Ironically, though Hancock doesn't host an American Independence Day celebration, there has been a Finnish Independence Day celebration every year since 1917 when the Republic of Finland was founded.



# 24 MINNESOTA

Like Norwegians, the cold of winter doesn't keep Minnesotans from engaging in all kinds of outdoor activities, including ice skating on frozen rivers.

*Photo: iStock.com*





## Cold Climates and Cultural Connections: Minnesota, Norway, and the Arctic

### *About the Author*

Eivind Heiberg serves as the Chief Executive Officer of Sons of Norway and Sons of Norway Foundation. On September 1, 2015 he was appointed Honorary Consul General of Norway for the state of Minnesota. Mr. Heiberg currently serves on the Boards for the Minnesota Insurance and Financial Services Council, American Fraternal Alliance, and Ski for Light, and is a member of the Young Presidents' Organization. He earned a Bachelor's degree in Business Administration and Mass Communications from Concordia College and completed his coursework for a Masters in Speech Communications from the University of Minnesota. He is married to Michele and is the proud father of triplets. *Photo: Honorary Consulate General of Norway in Minneapolis*



A woman serving traditional Norwegian waffles during a "17 Mai" celebration in Minnesota. May 17th is Norwegian Constitution Day, the National Day of Norway and an official holiday. *Photos: Honorary Consulate General of Norway in Minneapolis*



Minnesota is not an Arctic state.

This is probably a surprising opening statement for those of you who came here expecting to learn how Minnesota contributes to America's identity as an Arctic nation. Yes, it may certainly feel like the Arctic when temperatures creep below the range of normal thermometers. And with our snow, you might think you are much farther north when you see roads covered for months by a layer of white flakes so thick that it would have caused schools and public offices elsewhere in America to close down immediately.

But still, we are not an Arctic state.

Similar to Alaska, Minnesota is a place where outdoorsy people thrive, even in the winter. A Minnesotan's threshold for what constitutes "cold" weather is usually pretty high. Winter temperatures here can drop as low as -60 degrees Fahrenheit. In the town of International Falls in northern Minnesota, which calls itself the "Icebox of the Nation," schools close only when the temperature dips below 50 degrees below zero.

Minnesota is not located in the Arctic, either. However, the geographical oddity of Angle Inlet, Minnesota—located at a latitude of 49.22° north—is the only part of the contiguous "lower 48" that falls above the 49th parallel. This makes Minnesota the closest state besides Alaska to the Arctic Circle.

But Arctic-like weather and near-Arctic geography still don't make Minnesota an Arctic state.

So what are the state's connections to the Arctic, and how does it contribute to America's identity as an Arctic Nation?

Minnesota has, as many will know, strong cultural ties with Scandinavian countries like Norway, where the Arctic is very much a part of the national identity. Nearly 10% of Norway's population lives north of the Arctic Circle, as part of thriving communities that offer everything you would expect to find in a developed society. Northern Norway is also rich in natural

resources, both at sea and on land, as well as its well-known natural beauty.

It's no wonder that immigrants from Scandinavian countries like Norway quickly felt at home when they first arrived in Minnesota in the middle of the 19th century. (And no wonder that the state's professional football team ended up being called the Vikings).

Norway has had a diplomatic presence in Minnesota since 1906. The state is today home to nearly 900,000 people who claim Norwegian roots—the largest group of Norwegian descendants outside of Norway, nearly 16% of the state's population. Even today, Norwegian traditions like the holiday Syttende Mai ("May 17th"), which marks the signing of Norway's constitution and Norway's beginning as an independent nation, are celebrated in Minnesota.

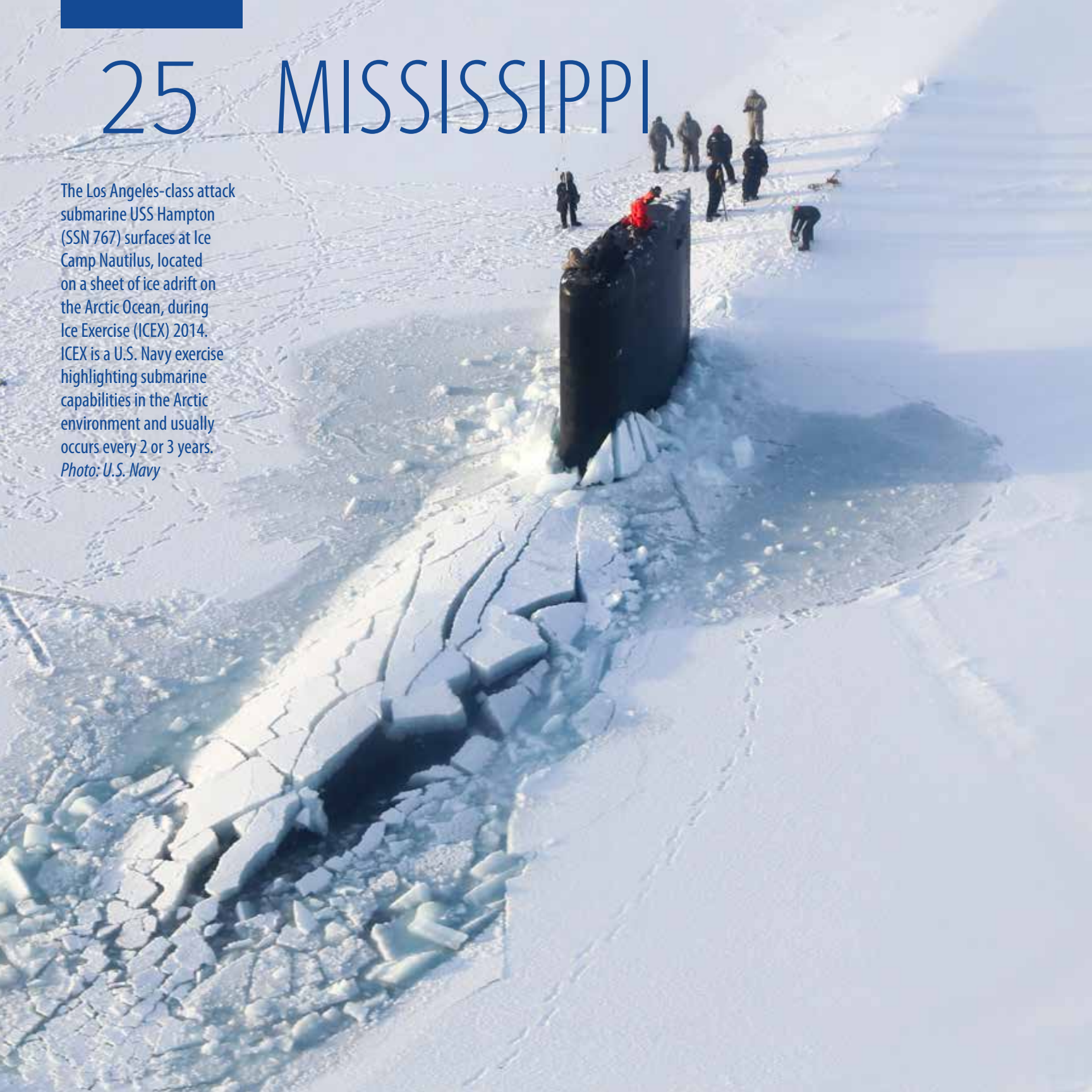
Just like the Arctic, Minnesota is guarding a massive storage of fresh water. The mighty Lake Superior, one of the largest bodies of water on the planet, is right at our doorstep. With many of the most densely populated regions of the world facing increasing water scarcity and food insecurity, there is a very real shift in the value of fresh water, wherever it can be found. This could lead to competition for local water resources, even in the water-rich Land of 10,000 Lakes.

Believe it or not, in Minnesota there is even a "Save the Winter" movement, which educates people about the declining reliability of deep cold that allows for such a robust and prolonged winter sports season, now threatened by a rapidly warming and destabilized Arctic climate system.

So while Minnesota might not be an Arctic state like Alaska per se, its cultural and environmental ties to the Arctic region are strong, for better or worse. And for visitors and Minnesota residents alike, the Arctic—and the Arctic nation of Norway—will continue to influence the state for years to come.

# 25 MISSISSIPPI

The Los Angeles-class attack submarine USS Hampton (SSN 767) surfaces at Ice Camp Nautilus, located on a sheet of ice adrift on the Arctic Ocean, during Ice Exercise (ICEX) 2014. ICEX is a U.S. Navy exercise highlighting submarine capabilities in the Arctic environment and usually occurs every 2 or 3 years.  
*Photo: U.S. Navy*





## Mississippi and the Arctic: Making Ice Predictions from the Magnolia State



**Left:** The Defense Meteorological Satellite Program (DMSP) monitors meteorological, oceanographic, and solar-terrestrial physics for the U.S. Department of Defense. *Photo: U.S. Air Force*; **Right:** Near real-time DMSP Special Sensor Microwave Imager/Sounder (SSMIS) sea ice concentration (March 27, 2017) for the northern hemisphere. *Image: National Snow and Ice Data Center*

### About the Authors



Pamela Posey has more than 30 years of experience working at the Naval Research Laboratory (NRL) in Arctic sea ice prediction. She was awarded the Dr. Delores Etter Top Navy Scientist and Engineer of the Year (2013) for her contributions to Navy sea ice modeling. *Photo: Pamela Posey*



Dr. Ruth Preller is the Superintendent of the Oceanography Division at the NRL's site, located at Stennis Space Center, Mississippi. Dr. Preller received her B.S. degree from Dickinson College, in Carlisle, Pennsylvania and her M.S. and Ph.D. degrees in meteorology from Florida State University in Tallahassee, Florida. *Photo: Dr. Ruth Preller*

At first glance, Mississippi, with its hot, humid summers and mild winters, has little in common with the cold, snowy Arctic. However, on the banks of the Pearl River, next to the Mississippi-Louisiana border, one can find a small group of scientists that study the Arctic at the United States Naval Research Laboratory (NRL). Housed within the John C. Stennis Space Center (SSC), the Oceanography Division of the NRL is responsible for planning and executing research, development, testing, and evaluation of programs in biological, chemical, dynamical, and physical processes of the deep ocean and coastal areas, including the Arctic Ocean.

The United States Department of Defense conducts various missions, exercises, and training in the Arctic. These operations can require resources including icebreakers, Navy or Coast Guard ships, unmanned aerial or underwater vehicles, or even submarines. Such operations can be challenging and hazardous due to the harsh Arctic environment. Winter air temperatures can plummet to -40 degrees Fahrenheit or colder, high winds and breaking waves occur, and a continuously changing ice cover can make previously open water regions impassable. Conditions in the Arctic can change rapidly as well as unexpectedly, and keeping track of conditions is critical to mission success.

In 2014, a joint military training exercise in the Arctic called Ice Exercise, or ICEX, was brought to an unexpected early end because of a rapid change in sea ice conditions. The ICEX began on March 17 and was scheduled to continue through March 30 with an ice camp, called Nautilus, set up on a large ice floe north of the Alaskan coast near Barrow, Alaska.

Large shifts in wind direction and speed, however, created instabilities in the movement of the ice flows near the camp leading to multiple fractures in the ice. These cracks prevented

the use of several airfields used for transporting personnel and equipment to the ice camp. The rapidly changing ice conditions, along with extremely low temperatures and poor visibility, hampered operations. On March 27, the ice camp completely disbanded in a controlled fashion without loss of equipment or personnel.

Knowing Arctic environmental conditions is important to the success and safety of humans operating in the Arctic. Predicting conditions a few days to weeks in advance could help mitigate environmental risks during military, scientific, humanitarian, and other missions. NRL has developed Arctic ice and ocean forecast systems based on numerical models, similar to the type of models that the National Weather Service uses for their daily weather forecasts. NRL's Arctic models currently provide a seven-day forecast each day of sea ice movement as well as the growth and decay of the ice cover. These forecasts are sent to the National Ice Center in Suitland, Maryland for further distribution to their users, both military and civilian.

One might ask, "How can ice conditions be forecast from southern Mississippi?" The NRL Oceanography Division has been predicting ice conditions in the Arctic for the Navy since the 1990s. NRL scientists develop the Navy's ice forecast systems using satellite observations of ice cover to initialize each day's forecast. These forecast systems are transitioned from NRL into Navy operations at the Naval Oceanographic Office and are run on Department of Defense supercomputers, both located at SSC. Having the researchers co-located with the operational Navy facilitates the seamless transition from research to operations—and this all happens in southern Mississippi!

# 26 MISSOURI

The wind energy system  
powering Shawn Marriott's  
cabin in the Canadian  
Arctic came all the way  
from Missouri. *Photo:*  
*Shawn Marriott*





## Hot Topics and Cold Places: Arctic Wind Energy Generates Interest in Missouri

### About the Author

Crystal Shank is the Online Content Manager at Missouri Wind and Solar, a small business in Seymour, Missouri that her father started seven years ago after noticing a gap in the residential wind power sector in Missouri. She has a degree in horticulture from the Auburn University in Alabama and before joining the renewable energy industry owned her own landscaping business. In her spare time she works for the Humane Society in her current hometown of LaGrange, Georgia. You can reach her at [Crystal@shank.us](mailto:Crystal@shank.us). Photo: Crystal Shank



Left: A wind turbine from Missouri Wind and Solar sits atop the Leaf River Estuary Lodge during summer 2016. Photo: Leaf River Estuary Lodge; Right: A Missouri Wind and Solar wind turbine at Vatnshellir Cave in western Iceland in 2013. Photo: Vatnshellir Cave, Iceland



The Arctic is a hot topic of conversation in energy circles, especially for those of us working in renewable energy, which accounts for just under four percent of our electricity generation here in Missouri. Use here is increasing all the time, just as it is in the Arctic.

From our office in Seymour, Missouri (which we run almost entirely on renewable energy), we here at Missouri Wind and Solar export wind turbine and solar power systems around the world. We have customers in Alaska, Canada, Iceland, and Norway all relying on our systems to generate energy.

Our clients who operate off the grid—like Leaf River Estuary Lodge in Nunavik, Canada—appreciate the access to quiet, clean, and low-cost energy that wind and solar systems provide. The lodge is entirely owned and operated by residents of the Inuit village of Tasiujaq, and it welcomes only a limited number of clients each season to their extremely remote location in order keep life sustainable. As the lodge can't plug into a power grid to run the few appliances and lights it has, it has two choices: bring in gasoline to run a generator or generate energy on-site through renewable energy systems. Running their generator can cost up to \$120 per day in gasoline, plus it's noisy and has to be unplugged at night to let guests enjoy some peace and quiet. Today, the lodge operates one of our 1600 watt Missouri Rebel 9 Blade Wind Turbine system, which they've paired with their existing solar panels and solar hot water heater, which helps to solve both their cost and noise issues.

Another one of our customers is Vatnshellir Cave in Iceland. While Iceland is more well-known for its use of geothermal

energy and hydro power, the island nation also uses wind energy. A few years ago, the cave ordered one of our wind turbines to power their office. However, they ran into some weather challenges, as happens in the Arctic. When installing a wind turbine in the Arctic, it's critical to have a way to take the system down when truly extreme weather conditions arise.

Our Raptor blades are rated for up to 125 mph and made to withstand freezing temperatures, but the generator and the mechanics inside are a different matter. Wind turbines are designed to be under a load at all times—some piece of equipment or an appliance must be drawing power from the battery bank. In a wind storm, the turbine will quickly charge the batteries. When the batteries are full, the turbine will spin wildly, creating excessive heat in the generator, which eventually causes it to seize up. The sudden braking can cause a metal shaft to shear off, hurling the blade into the air. This is what happened at Vatnshellir Cave. They experienced a day of 62 mph winds with gusts over 125 mph, which sheared the shaft of the turbine. Happily, the blades remained intact despite being thrown quite a distance.

Does this mean wind power is dangerous? No. With planning, a wind turbine tower can be designed to be raised and lowered to prevent any damage. Wind power is perfect for rural, remote areas that don't have a reliable grid power.

Wind and solar energy can be a great solution for customers here in Missouri and up north. We enjoy working with our Arctic clients and look forward to welcoming many more in the future!

# 27 MONTANA

*Photo: Daniel J. Cox*





## Polar Bear Conservation: Exploring the Arctic through a Montana Lens



A polar bear mother and cub near Churchill, Canada. Photo: Daniel J. Cox

### About the Author

Daniel J. Cox has been documenting nature for over 35 years. In 2013 he was honored as the Outstanding Nature Photographer of the Year by the North American Nature Photography Association. He's also been awarded in competitions worldwide, including BBC Wildlife Photographer of the Year and Nature's Best. His most personally satisfying accomplishments include two cover stories for *National Geographic* magazine and his volunteer work as director of the Arctic Documentary Project for Polar Bears International. See more of his work at [www.naturalexposures.com](http://www.naturalexposures.com). Learn more about polar bears by visiting [polarbearsinternational.org](http://polarbearsinternational.org).  
Photo: Daniel J. Cox



One might easily wonder how a person who lives in Montana could have any kind of connection to the Arctic. I grew up in Washington and Minnesota, eventually settling in Montana, which is now my home base. Living in these northern states made me appreciate sparsely populated environments and opportunities to be close to rugged nature.

When I was about 16 years old, I caught sight of a black bear walking across our lawn in Minnesota. Suddenly, the entire animal kingdom was open to me. My mind connected the black bear to its polar opposite cousin *Ursus maritimus*, the polar bear, the most elusive of the bear family. If I could see a black bear, then why not a polar bear?

After my father introduced me to photography as a young man, I pursued my dream of becoming a photojournalist, one who specialized in telling the stories of animals that could not do it for themselves. For me, sharing their stories through photographs was a way to help inspire the general public and encourage interest in nature, wildlife, and the wild places needed for all animals to survive.

My career has taken me from my home base here in Montana to all seven continents, shooting everything from Antarctica to the wilds of Africa to the streets of Europe. I also spent decades photographing polar bears on the shores of Hudson Bay. Churchill, located partly within the Arctic Circle, is known as the "Polar Bear Capital of the World." It is estimated that there are about 20,000 polar bears left in the world, many of them in the Canadian Arctic. Each fall, hundreds of polar bears migrate north and gather near Churchill and wait for the sea ice to form, an occurrence that attracts tourists from around the world. Once there's enough ice, they spend the winter there hunting seals.

In Churchill, I met two very important people in my life who would forever tie me to the Arctic: my wife Tanya, who grew up in Churchill with her family (her father, Len Smith, is credited for building the first Tundra Buggy, a vehicle that gives tourists the opportunity to see polar bears up close and personal in a safe and secure environment) and Robert Buchanan, founder and CEO of the conservation organization Polar Bears International (PBI). I've been involved with PBI since then, donating my polar bear and other Arctic multimedia materials to PBI so they can better educate the public to the plight of all things in the far north. In 2010, I even convinced Robert to relocate the NGO's headquarters to Montana (which, coincidentally, has more non-profits per capita than any other city in the United States).

While PBI began as an organization to educate people about polar bears, it has morphed into a powerful voice for climate change. Polar bears are our hook for getting people's attention to discuss the warming Arctic.

In 2008, I created the Arctic Documentary Project (ADP) under the auspice of PBI to help document the many polar bear stories and scientific research that can best be told through still photographs and videos. Tanya and I donate our time to ensuring that PBI and scientists have quality materials to support their science and ultimately their message. Zoo exhibits and scientific presentations are two important areas where our materials have been used again and again.

I'm fortunate to spend time close to nature here in Montana, in the Arctic, and elsewhere in the world, and enjoy sharing this perspective with those who have an interest.

# 28 NEBRASKA

Just after sundown,  
migrating sandhill cranes  
stand in silhouette on their  
river roost on a sandbar in  
the middle of the Platte  
River. *Photo: Michael Forsberg*





## Nebraska and the Arctic: Cranes, Climate Change, and Academic Connections at the Center of Our Arctic Nation

### About the Author

Dr. Eric Hunt is a staff scientist at Atmospheric and Environmental Research, Inc. He holds a Ph.D. in Natural Resources Sciences with a specialization in bio-atmospheric interactions from the University of Nebraska-Lincoln and has called Nebraska home for the last decade. His research at the university focused on the seasonal relationship of soil water under rainfed and irrigated agroecosystems, the relationship of soil water and evapotranspiration, and the relationship of soil water with other biophysical parameters. He is also interested in matters related to agricultural producers and climate change. *Photo: University of Nebraska-Lincoln*



**Left:** Sandhill cranes, Platte River, Nebraska. *Photo: Michael Forsberg; Right:* Former Nebraska State Senator Ken Haar observes as Nebraska State Climate Office Director Dr. Martha Shulski (passenger side), and Kim Morrow, University of Nebraska-Lincoln Climate Change Resource Specialist (driver's side), prepare to take retired professor Don Cox's Tesla for a spin on the margins of the university's climate-focused Arctic workshop. *Photo: Eric Hunt*



To the best of my knowledge, no one has conducted a straw poll at coffee houses across Nebraska (we love our coffee here in the Cornhusker State) to ask Nebraskans what they think is the state's biggest connection to the Arctic. While some might jokingly refer to the Arctic-like winds we experience in the winter, or mention our sparsely-populated landscape which can resemble the tundra of northern Alaska, those who know the state well would point to something else: a very special bird that migrates through Nebraska on its way to the Arctic: the sandhill crane (*Antigone canadensis*).

Every spring more than 500,000 sandhill cranes, 8.5 million waterfowl, untold numbers of shorebirds and songbirds, and endangered whooping cranes stop to rest and refuel in the rich farm and ranch lands of the Rainwater Basins, Platte River Valley, and Loess Hills. They spend a few weeks with us here in Nebraska before re-embarking on their journeys to nesting areas in northern Canada, Alaska, and Siberia. The nutritional boost they gain during their stay in Nebraska gives them the energy they need to complete migration and raise their families during the short Arctic summer.

Back to those folks in Nebraska coffee houses. Keeping with a weather and climate theme, some may point to connections between a changing Arctic and future risks to the lifeblood and backbone of our state—agriculture. Thankfully, researchers and extension professionals at the University of Nebraska-Lincoln are already thinking of these issues and have taken steps toward ensuring our state is prepared for the changes the future will bring.

In November 2015, the university hosted a workshop entitled, "Implications of a changing Arctic on water resources and agriculture in the central United States." A key goal of the workshop was to initiate a dialogue within the science community and between scientists and practitioners on the

implications of changes in Arctic climate on agriculture and water resources in the Great Plains and Midwest, as well as for other regions of the country.

The last part of the workshop engaged the Department of Defense on issues of global food security that could arise from changing weather patterns induced, at least indirectly, by changes in the Arctic and the geo-political consequences of ice-free Arctic summers. The event was very timely given the growing body of scientific literature on the influence of changes in the Arctic on mid-latitude weather and climate patterns.

It might seem incongruous for an institution in Nebraska to be hosting an event focusing on the Arctic, but we are very forward thinking and proactive here. The workshop was held at the Nebraska Innovation Campus, a public/private research campus housed on the 249-acre site of the old Nebraska State Fair grounds. The campus provided enough space for retired professor Dr. Don Cox—an advocate of the use of electric vehicles as a way to reduce emissions and address climate change—to bring along one of his Teslas for workshop participants to test drive.

Nebraska's academic connections will be increasing thanks to our pending membership in the University of the Arctic (UARctic)—an international network of academic institutions concerned with Arctic education and research. University of Nebraska-Lincoln's membership in UARctic will afford students from the ranches and farms of our state more opportunities to study abroad in Arctic and other countries. It will also give students from these countries a chance to study in Nebraska and experience a little of "The Good Life" (our state slogan) here in the geographical center of *our Arctic nation*.

# 29 NEVADA

From the "Here"  
series — Esmarkbreen  
Glacier and Ymerbukta Bay  
in Oscar II Land, Spitsbergen,  
Svalbard, Norway, 2015.  
*Photo: Megan Berner*





## The Art of Arctic Elements through the Eyes of a Native Nevadan



Left: Black Rock Desert, 2010. Right: Iceberg, Lilliehöökreen, Norway, 2015. Photos: Megan Berner

### About the Author

Megan Berner is a visual artist living and working in Reno, Nevada. She is greatly influenced by the landscape of her native Nevada home as well as the vast prairies of the Midwest, mapping and exploration, and countless hours of daydreaming. She creates site-specific installations that incorporate video and sound and constructs performative scenes that ultimately exist as photographs. You can reach her at [meganberner@gmail.com](mailto:meganberner@gmail.com).

Photo: Sadie Wechsler



As an artist, I consider myself an explorer, embarking on fantastic voyages through uncharted territories—my analogy to my creative process. Coming from a desert home, I have always been drawn to more desolate, inhospitable, and subtle landscapes—places that seem to only show themselves to those who spend time in them and seek out what they have to offer.

I am a native of Reno, Nevada, a high desert city nestled at the western edge of the Great Basin and just east of the Sierra Nevada. Growing up here gave me an appreciation for the expansive, the arid, and the dramatic. Light and wind are two integral elements of this landscape, indicative of the changing seasons and cycles in the desert.

In the summer of 2015, I spent two weeks with other artists and educators sailing in the Norwegian Arctic on the *Antigua*, a tall sailing ship, as part of The Arctic Circle's Summer Expeditionary residency. Travel has always been an integral part of my art practice, and traveling to the Arctic was an amazing opportunity that fit well with my interest in exploring inhospitable and so-called empty spaces—the desert, the tundra, the ocean—and the psychological experience of place.

As we sailed through the 24-hour-sunlight, we looked out at the geologic layers of mountain ranges that rose up from the shores. These landscapes of extreme environments and hard-to-get-to places are familiar to many of us through photographs and media, but when you are there, feeling the wind, listening to the silence, and sensing your smallness in the vast space around you, it's something else—something I find indescribable in words, but seek to recreate in certain pieces of my art.

Above the Arctic Circle, I was struck by how much the geology of the mountains resembled those in Nevada. In the Arctic and in Nevada, strata is laid bare and you can see the layering of

time, measured much differently from our human perception of time. As foreign as the Arctic landscape was to me, it was strangely familiar—a landscape shaped over millennia by the powerful elemental forces of ice, wind, and tectonics.

In my work, I explore the ways we interact with our environment—how we form relationships with it and how those connections influence our interpretation of the world around us—what marks we leave behind, the experiences—intangible and manifest—and the action of moving through or being in a place. I am particularly fascinated by mirages and other light phenomena as visual representations of the liminal spaces of these relationships.

The light in the Arctic region and the expanses of water and snow create ideal conditions for mirages—skewing perception of depth, distance, and scale. This is not unlike the conditions created in the Nevada desert—driving along The Loneliest Road in America, it is common to see the inferior mirage of the dark lake of water that seems to be pooled over the highway in the distance ahead. The idea of mirages appeals to me because they are observable optical phenomena that can be recorded on camera, yet the images that they appear to represent are interpreted by the mind—not a hallucination but perhaps a representation of our desires. In a very real way, it reflects this idea of a landscape of the mind or imagination—a concept related to mostly uninhabited or unconstructed landscapes that aren't built for human comfort and convenience.

Being in the Arctic was in some ways like being in a suspended moment, inviting introspection on the many and complicated ways that I interact with my environment and how that creates meaning for the places in our lives. It is my hope that I can create a space through my artwork for others to daydream, explore, and discover a new way of looking at the world around them.



# 30 NEW HAMPSHIRE

Postdoctoral fellow Lauren Culler collecting mosquitoes in Greenland. Her work has implications for indigenous communities in the North.

*Photo: Dartmouth*





## New Hampshire Forges America's Next Generation of Arctic Researchers

### About the Authors



Ross Virginia, Ph.D., is the Myers Family Professor of Environmental Science at Dartmouth and Director of the Institute of Arctic Studies at the Dickey Center for International Understanding. He is Co-Lead Scholar for the Fulbright Arctic Initiative. He can be reached at [ross.virginia@dartmouth.edu](mailto:ross.virginia@dartmouth.edu).



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*Photos: Dartmouth*



**Left:** Dartmouth students learn how to talk about polar science with many different audiences, including 4-year-olds. *Photo: Lars Blackmore*; **Right:** Student and faculty venture out of New Hampshire to the Greenland ice sheet for research and educational activities. *Photo: Simone Whitecloud*



New Hampshire may lie midway between the equator and the North Pole, but the Arctic is a recurring theme in our history and the work done here is critical to understanding the rapid changes taking place in the Arctic.

Our Arctic identity began in the 18th century with explorer John Ledyard (1751–1789), a Dartmouth College student. He joined Captain James Cook (1728–1779) on a voyage into the Bering Sea, and then, encouraged by Thomas Jefferson, trekked across Siberia. Canadian explorer and scholar Vilhjalmur Stefansson (1879–1962) founded Dartmouth's Northern and Polar Studies Program with his wife, Arctic researcher and later philanthropist Evelyn Stefansson Nef (1913–2009). The Stefansson legacy includes Dartmouth's Stefansson Special Collection on Polar Exploration and a major donation of indigenous art and artifacts to the Hood Museum of Art.

Stefansson was also instrumental in establishing the U.S. Army Corp of Engineers Cold Regions Research and Engineering Laboratory (CRREL) in New Hampshire. CRREL is located down the street from the Ice Drilling Program Office, which provides scientific leadership and oversight of ice coring and drilling activities funded by the National Science Foundation worldwide.

Founded in 1989, the Institute of Arctic Studies at the Dickey Center for International Understanding at Dartmouth is a hub for polar initiatives nationally and internationally. Dartmouth has developed deep ties with the Government of Greenland and the University of Greenland (Ilisimatusarfik) through exchanges and research collaborations.

New Hampshire's international reach grew when Ross Virginia became Co-Lead Scholar for the U.S. Department of State Fulbright Arctic Initiative. Fulbright scholars from the eight Arctic nations are collaborating on solutions to critical issues

facing the Arctic. Dartmouth is deeply involved in these discussions and is committed to educating a new generation of students who are tackling topics from sea ice dynamics and glacial history to Arctic policy and science communication. Lauren Culler, a postdoctoral fellow at the Institute of Arctic Studies, is studying the potentially devastating effects of Arctic mosquitoes due to warming temperatures.

Even secondary school students from New Hampshire and elsewhere have an opportunity to undertake research and study in the Arctic and Antarctica thanks to National Science Foundation funding of the Joint Science Education Project in Greenland, and the Joint Antarctic School Expedition/Expedición Antártica Escolar, a Dartmouth-Chilean partnership for Spanish-speaking high school students.

At the University of New Hampshire, the Center for Coastal and Ocean Mapping/Joint Hydrographic Center partners with the National Oceanic and Atmospheric Administration (NOAA) on developing oceanographic mapping and sensor development. The university is home to the Institute for the Study of Earth, Oceans and Space, which has a long history of polar research. Keene State University and Plymouth State University faculty and students work on topics ranging from the history of Arctic exploration to the physiological ecology of tundra plants in Alaska.

The collaborations, research, and scholarly work done in New Hampshire are providing a pathway to understanding the environmental and human consequences of rapid environmental change in the Arctic. By building on more than two historic centuries of Arctic research, New Hampshire is helping ensure that our nation continues to excel in Arctic science. All Americans are Arctic citizens, especially those who live in New Hampshire.



# 31 NEW JERSEY

Aerial views during an Army search and rescue mission show damage from Hurricane Sandy to the New Jersey coast, October 30, 2012. Photo: U.S. Air Force





## Putting New Jersey on the Arctic Map: Rutgers University and the Garden State's Arctic Connections

### About the Authors

**Michael Brady** is a doctoral candidate in the Rutgers University Department of Geography. **Dr. Jennifer Francis** is a Research Professor with the Rutgers Institute of Marine and Coastal Sciences. **Dr. Marjorie Kaplan** is the Associate Director of the Rutgers Climate Institute. **Dr. Åsa Rennermalm** is an Associate Professor in the Department of Geography at Rutgers University who studies hydrology and climate in the Arctic region. **Dr. David Robinson** is a Professor in the Department of Geography at Rutgers University and also serves as New Jersey's State Climatologist. **Dr. Hal Salzman** is a Professor of Planning and Public Policy at the Edward J. Bloustein School and Senior Faculty Fellow at the John J. Heldrich Center for Workforce Development. *Photo: Nick Romanenko/Rutgers University*



**Left:** Rutgers graduate student Samiah Moustafa on the Greenland ice sheet drilling a hole used to install an ablation stake to measure melt rate. *Photo: Åsa Rennermalm*; **Right:** Rutgers representatives working at the U.S. Naval Arctic Research Laboratory at Point Barrow, Alaska in 1957. Left to right: Professor John Tedrow, William Gillis '55, Professor Russell Alderfer, John Cantlon '50, James Drew '52, Nathan Perselay '23, graduate student Lowell Douglass, Jerry Brown '58—and Ambercrombie, the mascot. *Photo: Jerry Brown*

Starting in the 1950s, Rutgers University professor and world-renowned soil scientist Dr. John C. F. Tedrow joined a group of researchers as part of a U.S. Air Force project to learn more about soils of Alaska's treeless North Slope. With this project, Dr. Tedrow—who continued to venture out from his home base in New Jersey for countless research trips to both the Arctic and Antarctica—started what has become more than a half century of strong polar research at Rutgers University. Dr. Tedrow helped put Rutgers on the Arctic map. When given the opportunity to name a lake in Greenland, he christened it “Queens College Lake,” after the name that Rutgers was first chartered under in 1766.

Like the Arctic, which is feeling the effects of global climate change, New Jersey residents are already feeling the result of sea-level rise, which has elevated the baseline for coastal flooding during high tides and coastal storms. The Arctic has a direct effect on these—and New Jersey scientists are working to better understand the connections.

The pace of Arctic warming is double of that of other places on earth, a change that Rutgers University atmospheric scientist Jennifer Francis says is affecting the jet stream in ways that make our weather patterns more persistent. Francis' research suggests that amplified Arctic warming is causing these types of patterns to occur more often. Rutgers has the Global Snow Lab, where the changes in snow extent are documented by cryospheric climatologist Dave Robinson. In the Arctic, the early loss of spring snow cover is also impacting the stability of permafrost, resulting in associated impacts on ground transportation and infrastructure throughout this region.

Åsa Rennermalm and her team at the Rutgers Arctic Hydroclimatology Research Lab study climate, glaciers, and water in the Arctic region. The production, transport, and export of water from the Greenland ice sheet is critical to our understanding of global sea level rise, yet remains one of the least studied water-related processes.

For New Jersey, revival plans following recent extreme storms focus on building resilient infrastructure, protecting shorelines, and creating an economy that enables communities to stay together and prosper. Rutgers sociologist and professor of planning and public policy Hal Salzman's work in the Arctic examines the challenges facing local communities in balancing socioeconomic development needs—income, employment, education, technology, and health—with community survival based on subsistence hunting and harvesting, cultural traditions, and maintaining opportunities for future generations. Salzman's Arctic Planning Studio students developed future scenarios that could leverage industrial investments to support village infrastructure, energy needs, and employment.

With National Science Foundation support, Rutgers Geography graduate student Michael Brady's dissertation examines collaboratively mapping stakeholder perspectives of risk associated with rapid shoreline change in Alaska's North Slope.

While the Arctic may seem far from New Jersey, Rutgers researchers have long-recognized the significance and connections between them.



# 32 NEW MEXICO

Los Alamos National Laboratory (LANL) postdoctoral research assistant Heather Throckmorton and LANL staff scientist Jeff Heikoop brave mosquitoes on the Arctic Coastal Plain in Barrow, Alaska to collect soil water samples to understand methane production processes. *Photo: Roy Kaltschmidt*





# How New Mexico's Most Famous Lab Is Working to Understand What May Be the Planet's Next Ticking Time-Bomb: Arctic Permafrost



**Right:** Conducting science in the Arctic can be risky. In this photo, taken in Alaska in April 2016, scientists prepare to evacuate their field site in the face of freezing fog. The fog threatens helicopter landings and scientists must evacuate to avoid being stranded. *Photo: Bob Busey; Left:* Famous New Mexico chilies. *Photo: Eric in SF*

New Mexico is best known for its spectacular scenery, diverse culture, and the oft-asked question, “red or green?” For Americans who don’t hail from the Land of Enchantment, “red or green” may make you think of Christmas, snow, and the North Pole, but here in New Mexico, it’s the ultimate restaurant question used to inquire about which sort of chilies we’d like with our mouthwatering Southwestern regional cuisine (usually the answer is: both!).

But New Mexico’s Arctic connection runs much deeper than a shared love of North Pole-focused holiday colors. We actually have strong links through our sports and Native American and scientific communities.

Some New Mexicans are migrants from our only Arctic State, Alaska, like veteran freestyle skier/geographer Garrett Altmann, who moved to Los Alamos while finishing his Master’s degree at University of Alaska Fairbanks, but who continues to maintain strong ties to Alaska through sporting events, his work as a scientist at the Los Alamos National Laboratory, family, and friends. We also have some New Mexicans who’ve migrated in the opposite direction. Dr. Matthew Sturm grew up exploring the mountains of New Mexico, but moved to Alaska to pursue his Ph.D. at University of Alaska Fairbanks where he is now a renowned snow scientist with the school’s Geophysical Institute.

Many Alaska Natives engage with New Mexicans daily through the Albuquerque-based broadcasts of “Native America Calling,” a “national electronic talking circle” that reaches Native Americans throughout the country, including Alaska, for conversations important to indigenous communities.

So what does my work at the Los Alamos National Laboratory, a lab that is best known for its role in the development of the atom bomb, have to do with the Arctic?

Many of the advances in science, technology, engineering, and high performance computing that are developed at the Department of Energy (DOE)-supported Los Alamos and Sandia National Laboratories for national security can also be used to measure and predict climate change and its impacts on society and the natural environment. The Arctic is warming twice as fast as the rest of the globe, and scientists and engineers at Los Alamos and Sandia contribute to understanding Arctic climate through measurement and modeling activities that track and project changes in the Arctic atmosphere, ocean, sea ice, ice sheets, and land surface.

The Next Generation Ecosystem Experiment, NGEA-Arctic, is one of many DOE-funded projects with a focus on the Arctic. Los Alamos scientists contribute to this multi-institution project by developing novel permafrost hydrology models and carrying out snow depth, snow melt runoff, and other field measurements to understand how warmer temperatures are impacting the Arctic landscape as permafrost thaws.

Our work aims to understand how warming of permafrost and changes in permafrost hydrology might alter the Arctic carbon cycle. Thawing permafrost changes soil moisture and wetland area by changing the structure of the land surface through the formation of collapse pond features called “thermokarsts” or by changing surface and groundwater runoff pathways.

Our New Mexican connection to the Arctic is strong, not only through the research efforts of the state’s National labs, but also through the collaborations with our research partners at University of Alaska Fairbanks and our local Alaska Native and non-native logistics providers who help us get the job done. We love the Arctic, and we love coming home to New Mexico safe and sound.

## About the Author

Dr. Cathy Wilson is the leader of the Atmosphere, Climate, and Ecosystem Science Team in the Earth and Environmental Sciences Division at Los Alamos National Laboratory. She is a hydrologist and geomorphologist who performs research to improve our understanding of climate change impacts on human and natural systems. You can reach her at [cjw@lanl.gov](mailto:cjw@lanl.gov).



Cathy Wilson (left) and colleagues Joel Rowland (center) and Bryan Travis debate last-ditch options to slowing down Arctic thaw. *Photo: Dr. Cathy Wilson*

# 33 NEW YORK

Caribou skin masks of a  
mother and baby from  
Anaktuvuk Pass in northern  
Alaska by Ethel Mekiana.  
*Photo: Dr. Margaret Blackman*





## Unmasking the Connections between New York and the Arctic



Left: A bull caribou in Alaska. Photo: National Park Service; Right: The author with Anaktuvuk mask maker Lela Ahgook. Photo: Molly Lee



### About the Author

Dr. Margaret Blackman is Professor Emerita of Anthropology at The College of Brockport, SUNY. She is the author of *Upside Down: Seasons Among the Nunamiut* (2004), and is currently completing a collection of essays, "Faces of the Nunamiut," on Anaktuvuk Pass mask making. Since 2013 she has been the mayor of Brockport, NY.  
Photo: Richard Black



Shorebirds in New York Harbor, Arctic plant life in NYC, and the venerable NYC-based Explorers Club, founded by Arctic explorers in 1904, are just three of the many eclectic and historic connections the great state of New York has to the Arctic. Of particular note among today's polar connections is the Arctic research generated at the expansive State University of New York (SUNY) system. Thirty years ago SUNY Binghamton's Utqiagvik (Oot'-kee-ahg'-vick) archaeology project at Barrow, Alaska captured worldwide attention as its researchers, working with the local native elders and benefiting from their indigenous knowledge, sought to interpret material from the excavation of a pre-contact and early contact period village that was eroding from the sea bluffs.

Pilot Sig Wien and the airline his Fairbanks family established in 1927, Wien Airlines, the conduit that brought most of the early scientists to northern Alaska. At that time—and not unlike today—much of Alaska was only accessible by air, making airplanes an essential part of any plan for scientists conducting research in remote areas of the state. Change in Anaktuvuk was constant. By 1950 the Nunamiut Eskimo were more or less settled in Anaktuvuk Pass, along a major migratory route of the caribou; there they managed to secure a post office in 1951, assuring the periodic delivery by bush airplane of goods and supplies. The first handsewn masks were created in 1951 by two Nunamiut trappers who were inspired by the Halloween masks one of them had seen in a Fairbanks drugstore. In 1956 villager Justus Mekiana took the idea a step further to create a marketable craft—much more quickly than the handsewn versions.

By the time I arrived in Anaktuvuk Pass in the fall of 1984—one of the first of many seasons I would spend conducting fieldwork and studying caribou masks in Alaska as a cultural anthropologist—Anaktuvuk Pass had been an incorporated second-class city for 14 years; its 200+ residents enjoyed electricity and a state-of-the-art K-12 school; villagers had television and some phone service, along with daily bush plane service, weather permitting. But at 80 miles from the nearest road cradled in the gray shale of the Brooks Range Mountains, Anaktuvuk was, and is still, remote. Waterlines and flush toilets were a welcome capital project at the turn of the millennium, but villagers made fewer masks when they had high paying wage jobs on the water project. Cell phone coverage reached Anaktuvuk Pass in 2010, and when the newly expanded museum opened the following year, villagers snapped photos of the exhibits with their cell phones and eagerly tried out the museum's iPads that guided them through the exhibits.

Most Arctic research in New York today passes through the State University of New York's four university centers—Albany, Buffalo, Binghamton, and Stony Brook. SUNY researchers come from diverse disciplines—atmospheric sciences, health, geography, anthropology, geology, biological sciences, and marine and atmospheric sciences. The State of New York continues to leave its mark on Arctic research, much as the Arctic has left its impact on those of us who conduct research there.



# 34 NORTH CAROLINA

Shismaref, Alaska.  
*Photo: Marek Ranis*





## North Carolina and the Sublime North: An Artistic Interpretation of the Arctic



Romantic, 2010. Artist: Marek Ranis

### About the Author

Marek Ranis is an Associate Professor of Art at the College of Art and Architecture at the University of North Carolina, Charlotte as well as a multimedia environmental artist. Through sculpture, installation, painting, photography, and video, over the last 20 years Ranis has explored social, political, and anthropological aspects of phenomena such as the climate change. Since 2004 Ranis has been working on an artistic and research project titled *Albedo*, which is focused on global climate change. He is also continuing to work in Alaska, Iceland, Greenland, Australia, and South Africa. You can reach him at [mpranis@uncc.edu](mailto:mpranis@uncc.edu). Photo: Tim Remick Photography



I grew up in Poland, a central European country, which is much closer to the Arctic than my current home of Charlotte, North Carolina. We had cold dark winters, with the Big Dipper and the North Star looming high above the dark horizon. In the winter, cold Siberian weather fronts would bring the Arctic weather to our medieval city. Before I graduated from Wrocław's Academy of Fine Arts and Design with my Master of Fine Arts and left the country, this weather was the only Arctic-related experience available to me. Although the distance from Poland to the Arctic Circle is less than 1000 miles, I was living behind the Iron Curtain, and the Arctic felt as unreachable to me as any destination.

Evolving from my early interests in ecology and the place of humans in nature, environmental, cultural, and political developments in the North have become the focus of my artistic practice. Our Western, or Southern, gaze at the Sublime North is still mostly driven by the need for a mythical extreme playground, a stage for the ultimate test of our physical and mental resilience. This is where many of us love to believe we can discover and measure our limits and be rewarded by simply staying alive. This strikes the people who call this place home—like those I've met in Alaska and Greenland—as a rather silly test. The views of the Arctic from the outside and the inside are strikingly different. For us, at once admired, feared, and desired, the North is ever present in our peripheral vision; a possible last resort, still somehow uncharted, a colonial promise, an eternal romantic destination. The Arctic was and is perpetually feeding our imagination from an endless pool of resources and opportunities. For those who live there, it is simply home.

But things are changing today. Looking up from the South to the far North, we see more of a human connection; we all share the common destiny of climate change.

Recently in North Carolina, dramatic weather events, rising sea levels, and growing average temperatures are more relatable communicators of climate change than calving glaciers or thawing permafrost of the tundra. Now more than ever my state has become a climate laboratory. Even without directly observing the Arctic's melting ice, we see animal and plant zone migration and the challenges of near future human resettlement.

My short film *Like Shishmaref* is about a remote barrier island in the Chukchi Sea north of the Bering Strait in Alaska called Shishmaref and The Outer Banks, which are a string of barrier islands off the Coast of North Carolina. The film is the result of a long-standing professional relationship with the Anchorage Museum and their generous support of my research in the Arctic, as well as the support of the College of Arts and Architecture of the University of North Carolina at Charlotte, where I teach today.

Thousands of miles apart, geographically and culturally, Shishmaref and the Outer Banks share the same destiny—rising sea water levels jeopardizing the lives of both communities, already struggling on very low-lying sea coast—yet the responses to the unavoidable for both Alaskans and North Carolinians are very different.

# 35 NORTH DAKOTA

The U.S. flag flies over the Eielson Visitor Center at Denali National Park and Preserve in Alaska. The center was named after Alaska aviation pioneer Carl Ben Eielson, who was born in North Dakota. *Photo: Ken Conger, National Park Service*





## From Nature to Aviation and Everything in Between: North Dakota and the Arctic



**Left:** The Richardson's ground squirrel is named after the 17th Century Scottish Arctic explorer Sir John Richardson. It is also called a flickertail, giving North Dakota its nickname of *The Flickertail State*. *Photo: Chuck Szmurlo; Right:* Dr. Timothy Pasch of the University of North Dakota (far right) with students in Nunavut in the Canadian Arctic. *Photo: Timothy Pasch*



### About the Author

Mike Jacobs began as editor of the *Grand Forks Herald* in 1984, and in 2004 became editor and publisher. He is currently retired, but continues to write a regular column for the paper focusing on North Dakota politics. He grew up milking cows near Stanley and graduated from the University of North Dakota. His career in newspapers includes stops in Dickinson, Mandan, and Fargo, ND. The *Herald* won the Pulitzer Prize for Public Service after the Red River flood of 1997. Jacobs was named editor of the year and won the American Society of News Editors distinguished writing award for his flood-related editorials. *Photo: Mike Jacobs*



In popular imagination, North Dakota may be the most Arctic of states, even though its northern border is more than 27 degrees latitude south of the Arctic Circle. Much of North Dakota's landscape was formed by glaciers, and its landscape resembles the Arctic. Vilhjalmur Stefansson, a great Arctic explorer, knew both the Arctic and the prairie. Although he was born in Canada, he grew up in North Dakota herding cattle on the glacial plain west of the Red River Valley. In his book, *The Friendly Arctic: The Story of Five Years in Polar Regions*, he said that Banks Island, located in the Inuvik Region of Canada's Northwest Territories, reminded him of home.

Another famous North Dakotan was Carl Eielson. Born in Hatton, North Dakota to Norwegian immigrant parents, Eielson joined the aviation division of the U.S. Army Signal Corps in World War I. Later he helped in his father's store, graduated from the University of North Dakota (UND) and founded the state's first aero club.

In 1921, he enrolled at Georgetown University Law School, took a job as a policeman at the Capitol, and met Daniel Sutherland, Alaska's delegate to Congress. Sutherland persuaded him to go north to teach in Alaska. It didn't take Eielson long to take to the air, where he accomplished a number of firsts. With Hubert Wilkins, Eielson flew from Point Barrow, Alaska to Spitsbergen, Norway in April 1928. The distance was 2,200 miles and the trip took 20 hours. It was the first aerial crossing of the Arctic Ocean. Later the pair joined an Antarctic expedition and became the first to fly in both of the Earth's Polar Regions.

Eielson died in the Arctic when he and his mechanic, Earl Borland, attempted to rescue passengers from the trading ship

Nanuk trapped in the ice at North Cape (now Mys Shmidt) in Siberia. An Air Force Base in Alaska and the visitor center at Denali National Park are named for him, as is a school at Grand Forks Air Force Base in North Dakota.

Namesakes of other Arctic explorers abound in North Dakota. Franklin's gulls nest in large colonies in the state, and the birds are familiar to every farmer. The gull is named for Sir John A. Franklin, who was lost in the Arctic in 1847. Franklin's ground squirrel, denizen of rock piles and brush patches, is also named for Franklin. Another ground squirrel is named for Sir John Richardson, the naturalist on Franklin's expedition to the Coppermine River and on an overland expedition. Richardson's ground squirrel is also called a flickertail; it is so ubiquitous that North Dakota is often referred to as "The Flickertail State."

North Dakota and today's Arctic share another fossil heritage, oil. North Dakota recently passed Alaska to rank second among the states in petroleum production. During the Alaska oil boom, young North Dakotans went north. Some stayed. Others still regularly commute between home in North Dakota and jobs on the North Slope. In the Bakken Boom, Alaska license plates began showing up in North Dakota's oil country. Now both states feel the impact of lower oil prices on local economics and state budgets.

The popular imagination is wrong to place North Dakota in the Arctic, but the state has close connections to the Arctic in heritage, landscape, and resources, and the bonds are growing stronger.

# 36 OHIO

Admiral Byrd's notes to pilot Floyd Bennett kept during the North Pole flight stating "Radio that we have reached the pole...". Byrd's Sun Compass and flight certificate, signed by Orville Wright, an Ohioan and fellow aviation pioneer. Note: Byrd's notebook was used casually and not date specific. Photo: Pamela I. Theodotou

WEDNESDAY, JANUARY 14, 1925

used to at the pole  
with a circle  
at a picture  
I want the sun  
that we have reached  
and are now  
with one motor  
ing oil leak. But expect  
able to make Spitzbergen





## Ohio: Home to Arctic Explorer Legacies and World Class Climate Science Researchers



**Left:** Admiral Richard E. Byrd and pilot Floyd Bennett before their historic attempt to reach the North Pole by air on May 9, 1926. *Artwork: Pamela I. Theodotou;* **Right:** Three Ohio State "Buckeyes" at the Arctic Circle. *Photo: Pavithra Joshi*



### About the Author

Pamela I. Theodotou is a Media Specialist at the Byrd Polar and Climate Research Center (BPCRC) where she produces films and media. Ms. Theodotou holds a Bachelors of Science Degree in Biology, a Law Degree, and a Masters in Fine Art. Her work with the BPCRC has focused on communicating cutting-edge research, educating the public about climate change, and exploring the nexus between art and science. Additionally, she produces her own documentary, fictional, and historical works via her film company, NYXFILM ([www.NYXFILM.com](http://www.NYXFILM.com)). Ms. Theodotou most recently worked with the BPCRC Archival Program and curator, Laura Kissel, to direct and produce the documentary feature *Byrd 1933*. *Photo: Pamela I. Theodotou*



**I**n May 1926, Richard E. Byrd, an American naval officer from Virginia who had developed a passion for aviation and navigation during the World War I, was racing to be the first to fly over the North Pole. Byrd and his team arrived in Svalbard, Norway, the launch point of their expedition. They were able to get their plane airborne, fly to the North Pole, and come back to the same airfield before their competitors. Their record-breaking flight of 1,535 miles lasted nearly 16 hours. This not only allowed them to claim the pole first, but established Byrd's legacy as a daring polar adventurer.

In 1929, Byrd went on to be the first person to fly over the South Pole. He would spend the rest of his career deeply engaged in bringing the American people an understanding of distant places through prolonged scientific expeditions to Antarctica and working tirelessly to instill an enduring interest in exploration of the Polar Regions.

Today, Byrd's legacy is intertwined with the research institution that is his namesake. The Byrd Polar and Climate Research Center (BPCRC) at The Ohio State University is a polar, alpine, and climate research center. Established in 1960 as the Institute of Polar Studies, the Center is the oldest research center on campus. In the mid-1980s, The Ohio State University's ongoing commitment to polar research allowed them to successfully submit a proposal to acquire the expeditionary records, personal papers, and other memorabilia of Rear Admiral Byrd.

The BPCRC is multi-faceted in its connection to Arctic history, culture, and science. The cornerstone of the Polar

Archival Program is the Richard E. Byrd Papers, a collection that contains not only the written documentation of Byrd's expeditions, but also includes artifacts, an image collection, and original films. The Polar Archives is a repository for polar history, including collections of other famous explorers such as Sir George Hubert Wilkins and the records of the Frederick A. Cook Society, as well as a rich polar oral history collection.

Today the BPCRC and its scientists are on the cutting edge of science, helping to answer some of the most critical scientific questions about our planet's dynamic systems. With nine research groups covering a wide range of topics, they, like their namesake Byrd, are pioneers in Earth sciences and engineering.

As anchors to our dynamic oceans and atmosphere, the poles dramatically affect our weather. They also are harbingers of larger changes the planet is undergoing and provide critical information in preparing for and responding to our new climate reality. As a dynamic institution for education and research, the BPCRC, while continually engaging in cutting edge research, also offers outreach programs, tours of its facilities, teaching tools for schools, science speakers, and an online repository of informative videos to share our new understanding of earth. The center is a collaborative community of professionals illuminating the planet's dynamic systems and helping our global community navigate our future decisions through the best scientific information available.

# 37 OKLAHOMA

A powerful supercell rotates over a farm in Waurika, Oklahoma, in May 2014. As the Arctic melts and the climate changes, extreme weather events in the state may be increasing. Photo: Dan Whittaker, [LightExplored.com](http://LightExplored.com)

*Oklahoma, where the wind comes sweepin' down the plain,  
And the wavin' wheat can sure smell sweet  
When the wind comes right behind the rain...*

— Lyrics from the Rodgers & Hammerstein musical *Oklahoma!*



## O-O-Oklahoma, Where the (Arctic) Wind Comes Sweepin' Down the Plain



**Left:** Upward-directed lidar beams collect atmospheric data during an Aurora Borealis event. *Photo: Ed Stockard;* **Center:** Physical Scientist David Turner of the National Severe Storms Laboratory in Oklahoma is one of the many scientists from the state carrying out weather research in the Arctic. *Photo: Dr. David Turner;* **Right:** The National Weather Center is located in Norman Oklahoma on the campus of the University of Oklahoma. *Photo: Steven Cavallo*

### About the Author

Dr. Steven Cavallo is an Assistant Professor at the University of Oklahoma's School of Meteorology. He developed and leads the Arctic and Antarctic Research Group in the National Weather Center, located on campus in Norman, Oklahoma. He holds a Ph.D. from the University of Washington in Atmospheric Sciences that was received in 2009. Before arriving at the University of Oklahoma in 2011, he completed a Postdoctoral Fellowship in Polar Regions Research awarded by the National Science Foundation and carried out with scientists at the National Center for Atmospheric Research in Boulder, Colorado.

*Photo: Alicia Keys*



**M**ay 10, 2010 is a date that even to this day still reverberates in the minds of Oklahoma residents. It's not unusual for tornadoes to occur in Oklahoma in May. However, that particular May brought an outbreak of severe weather that included dozens of tornadoes across the state in just one day—an extremely unusual weather occurrence, even in tornado-prone Oklahoma. At the University of Oklahoma, atmospheric scientists in the School of Meteorology's Arctic and Antarctic Research Group (AAARG) are studying severe weather patterns—like those that led to the May 10th event—in hopes of predicting them much further in advance.

To better understand and predict extreme weather patterns, AAARG has started to look to the Arctic for answers, and they've found that the polar vortex plays a role. When the polar vortex is strong, Arctic air circulates along more predictable routes around the North Pole. When the polar vortex is weak, Arctic air can break free and find its way south, even down to Oklahoma. AAARG scientists are studying the links between weak polar vortices and this cold Arctic air, which we scientists refer to as the tropopause polar vortices (TPVs). TPVs spend most of their lifetime in the Arctic, but the jet stream can sweep them down into lower latitudes due to a weak polar vortex. This not only makes Oklahoma residents chilly, but causes extreme weather events. As the climate changes, and as these extreme weather events occur, we in Oklahoma are working to better understand the connection.

Research shows that weather models are consistently predicting weaker TPVs than those that are observed. This means forecasters are likely underestimating severe weather outbreaks.

Instead of waiting around for that infrequent TPV to pass through Oklahoma, our scientists have teamed up with National Oceanic Atmospheric Administration (NOAA) scientists to take measurements from Greenland's Summit Station—where TPVs pass by more frequently than in Oklahoma. Ultimately, we hope to gather enough data from the TPVs that pass over Greenland to incorporate that information into numerical weather models to improve predictions of severe weather. Letting people know about a risk further in advance can help residents and emergency managers prepare and plan before a storm becomes imminent.

The Greenland station is supported by the National Science Foundation (NSF), NOAA, and the Department of Energy (DOE). However, the scientists involved in this research are based in an Oklahoma building called the National Weather Center (NWC). The NWC is the largest research center of its kind in the nation, and where federal entities, state organizations, and the University of Oklahoma School of Meteorology work together to improve understanding of events occurring in Earth's atmosphere.

Having everyone under one roof allows scientists, professors, students, and forecasters to efficiently combine notes and collaborate with each other to foster growth. As our scientists here in Oklahoma learn more about the Arctic's TPVs, the NWC is the ideal facility to pass this knowledge along to weather forecasters, who can broadcast the information to affected communities. In this crucial way, Oklahoma is doing its part in the Arctic and helping keep communities safer on the ground when extreme weather events occur.

# 38 OREGON

An oyster at Whiskey Creek Shellfish Hatchery in Netarts Bay, Oregon. Oregon's shellfish industry is threatened by warmer ocean temperatures and the increase in ocean acidification. *Photo: Oregon State University*

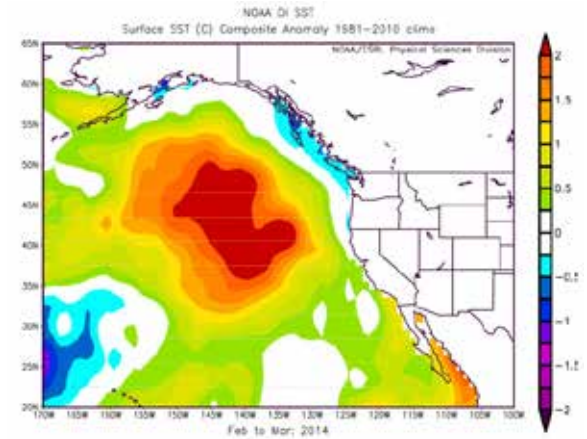




# Arctic Warming and the Quieting of Winds Bring Whispers of Environmental and Economic Change to Oregon



**Left:** Oregon's famous Mount Hood. Snow levels in the Beaver State have been unpredictable in recent years. *Photo: AlexAH; Right:* The sea surface temperature (SST) anomaly, aka "The Blob," in the northeast Pacific Ocean in March 2014. *Image: NOAA/ESRL*



## About the Author

Dr. Rachel D. Mueller is a postdoctoral researcher at Earth & Space Research. She investigates how complex ocean interactions affect the things we care about. Her primary tool for understanding ocean dynamics is numerical modeling of ocean circulation. A broad scientific background in paleoclimate, geophysics, and aeronomy enhances Dr. Mueller's expertise in polar, physical oceanography. She earned her Ph.D. at Oregon State University's College of Oceanographic & Atmospheric Sciences and is currently working to develop a cross-disciplinary research platform that will help integrate scientific advancements with the greatest needs of society. *Photo: Alan Niles*



The Oregon climate is conditioned by the temperatures of the North Pacific Ocean, which are strongly affected by winter winds that help mix and cool the north pacific. Without these winds, as happened in the winter of 2013, the surface ocean warms and helps create a dead zone in the Oregon economy.

Take, for example, the North Pacific Warm Pool anomaly that looked like a bulls-eye "blob" on maps of temperature anomalies. It started in 2013 and persisted through 2015. The consequences of this abnormal heat included several chain reactions Oregonians will continue to feel for years to come. Oregonians and other ocean creatures may have been able to shrug off the first year, but it was nearly impossible to ignore the impact of the heat when it remained for a second. This change mattered to Oregonians because it greatly impacted the things we love, like fish, shellfish, and skiing.

The conditions created by the blob between 2013 and 2015 didn't support basic needs of salmon as warmer waters shifted the species necessary for salmon to feed. As a result, many of the spawning salmon, a crucial part of the Oregon ecosystem, died. In addition, high stream temperatures led to many salmon refusing to enter our streams to spawn; others entered and perished due to the unusual warm waters.

The blob introduced an imbalance in the marine ecosystem off our Oregon coast that supported the production of an algae-bloom known for releasing harmful biotoxins. This bloom flourished in the warm waters and led to the massive, wide-spread, and synchronized closure of shell fisheries along the entire western seaboard of the United States. In addition to impacting our marine life, the blob turned our winter snow into rain and our traditionally popular ski resorts were empty.

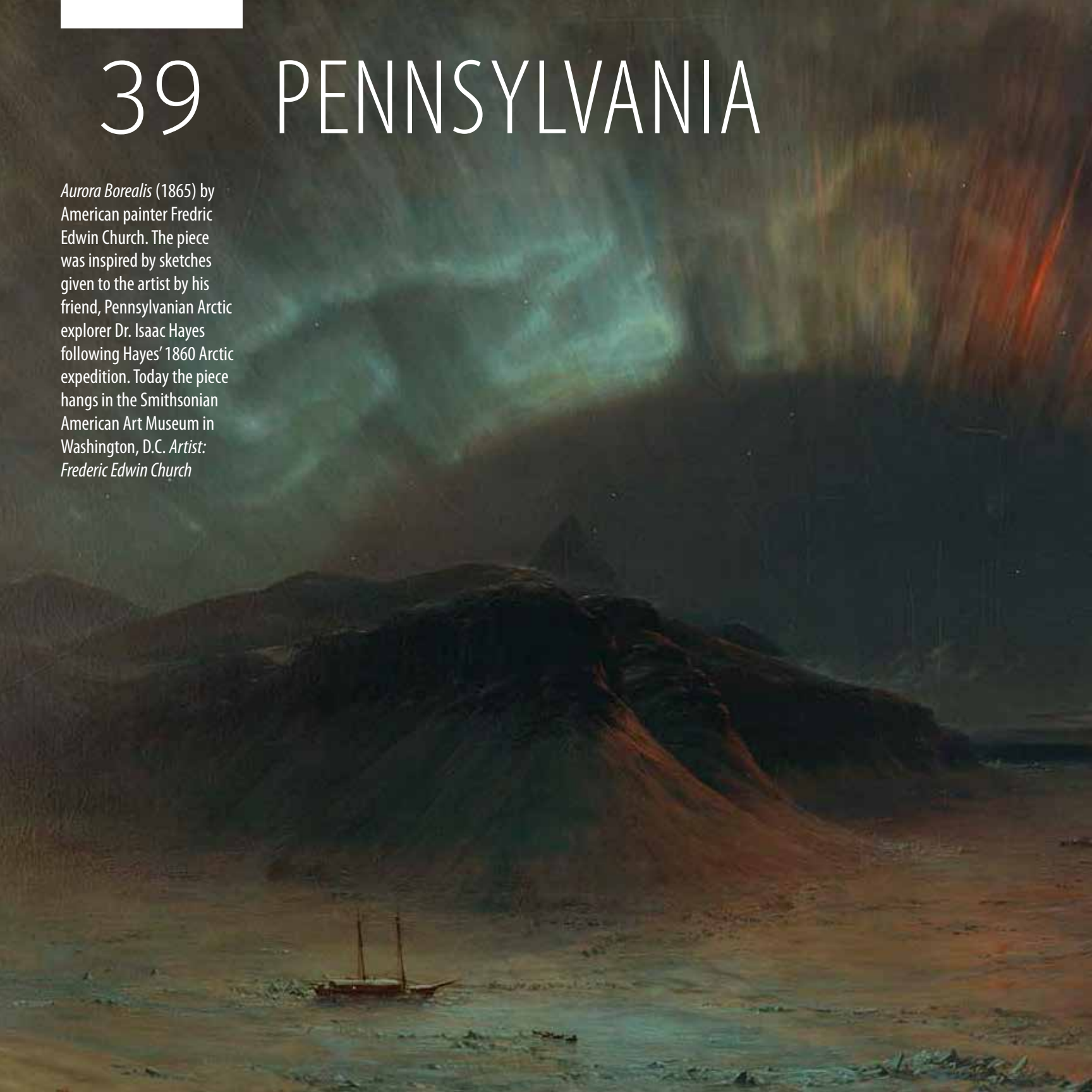
Given that science is a process, it's no surprise we are still working to understand how a warmer Arctic contributed to quieting of winds in the North Pacific Ocean that led to an unusual event during the period of 2013–2015. The obvious culprit for this event is teleconnections with the equatorial Pacific; but teleconnections don't operate in a vacuum. There are also teleconnections between the equatorial Pacific and equatorial Atlantic as well as the equatorial Atlantic and the Arctic and it's through this network of teleconnections that the Arctic can extend its influence toward Oregon in ways we don't yet fully understand.

What we do know is that winds are caused by temperature differentials. On a very simple level, heating the Arctic by increasing greenhouse gases in the atmosphere reduces the temperature differential between the poles and the equator. This reduction in the temperature gradient reduces the overall winds in both the ocean and the atmosphere. Basically, the earth's winds grow still under conditions of high greenhouse gases and a warm Arctic. Our warming Arctic is affecting planetary dynamics in ways that we can't yet fully grasp, but the blob event is an example of the extreme impacts that we can expect to experience as a result of this change.

The economic impact to Oregon from this simple shift in winds between 2013 and 2015 is still being calculated, but the closures of shell fisheries across the western U.S. alone is likely in the millions. This economic impact—together with the future impacts of a warm Arctic on mid-latitude winds—makes it uncertain whether the benefits to commerce from increased shipping routes through an ice-free Arctic will outweigh the loss we experience in other industries.

# 39 PENNSYLVANIA

*Aurora Borealis* (1865) by American painter Fredric Edwin Church. The piece was inspired by sketches given to the artist by his friend, Pennsylvanian Arctic explorer Dr. Isaac Hayes following Hayes' 1860 Arctic expedition. Today the piece hangs in the Smithsonian American Art Museum in Washington, D.C. *Artist: Frederic Edwin Church*





## The State of Arctic History: the Preeminent Polar Explorers of Pennsylvania



**Left:** The Rear Admiral Peary memorial in his birth town of Cresson, Pennsylvania. *Photo: P.J. Capelotti* ; **Right:** Penn State Abington College student Jacqueline Lanning (right) presents Norwegian polar historian Dr. Susan Barr (left) with a copy of her prize-winning artistic print, *North Pole*, during a National Science Foundation workshop in Oslo, Norway, in 2015. *Photo: Leah Devlin*

### About the Author

Dr. P.J. Capelotti is professor of anthropology at Penn State Abington College and a research associate of The Polar Center at Penn State, University Park. He is a retired Master Chief Petty Officer in the U.S. Coast Guard Reserve and the author or editor of more than twenty books, the latest of which is *The Greatest Show in the Arctic: the American Exploration of Franz Josef Land, 1898–1905* (University of Oklahoma Press, 2016). *Photo: Dr. P.J. Capelotti*



Pennsylvania's connection to the Arctic goes back more than a quarter century before the founding of our nation itself, to Benjamin Franklin's interest in a Northwest Passage to the Orient. The Commonwealth is the birthplace of four of the most significant Arctic explorers in American history: Edwin De Haven, Elisha Kent Kane, Isaac Israel Hayes, and Robert Peary. The explorations of these native Pennsylvanians both inaugurated and concluded the American push to discover the geographic North Pole between 1850 and 1909.

Philadelphian Edwin Jesse De Haven is known as the first American explorer of the Arctic. He commanded a U.S. expedition, funded by American merchant Henry Grinnell, to search for the lost British Arctic expedition of Sir John Franklin. Elisha Kent Kane, the surgeon on De Haven's expedition and a member of a prominent Pennsylvania family, wrote the official report of the voyage, and his fascinating account of the North made him the expedition's most famous veteran. Kane was placed in command of the Second Grinnell Expedition, and his subsequent account sparked what would become an obsession during the next half century with reaching the North Pole, the "Moon Shot" of that era.

Kane's own expedition surgeon—and yet a third Pennsylvanian—Isaac Israel Hayes returned to Baffin Bay to search for proof of Kane's imagined "Open Polar Sea." After an 1861 winter in which local Inuit women made new fur clothes for him and his crew, Hayes reached the northern terminus of his efforts but was unable to capitalize on his voyage the way that Kane had. He returned to a nation torn apart by Civil War and suddenly entirely disinterested in Arctic exploration.

It was left to a fourth Pennsylvanian, the titanic and volcanic Robert Peary, to finish what De Haven, Kane, and Hayes had begun. Peary crossed the northwestern corner the Greenland icecap and showed that Greenland was not a massive peninsula hanging southwards from the North Pole, as many of the time believed. Peary's expeditions were filled with claims of new lands discovered and latitudes achieved—including, in 1909, the North Pole itself.

Pennsylvania's interests in the Arctic continue. In Philadelphia, the Museum of Archaeology and Anthropology at the University of Pennsylvania houses an enormous Arctic collection. It includes items dating to expeditions made in the early 1900s by then-Museum Director George B. Gordon to Alaska, the Northwest coast, and the Yukon. The Wharton School at UPenn conducts studies of current business trends in the region, including the extraction of resources from a warming Arctic. In the university's archives, you can also find the papers of Benjamin Sharp, Jr., the zoologist from fellow Pennsylvanian Peary's first Arctic expedition in 1891. Penn State University—itsself established during Kane's second Arctic expedition—recently founded The Polar Center to bring together the interdisciplinary voices at the university, as well as other national and international institutions and the larger Commonwealth of Pennsylvania community. An inaugural art competition among Penn State undergraduates was won by a student of mine, Ms. Jacqueline Lanning, with her representation of the "North Pole."

Thanks to our universities, our historic ties, and the examples set by Peary and his fellow Arctic explorers, the Keystone State continues to play a key role in the Arctic, inspiring a new generation of Arctic explorers.

# 40 RHODE ISLAND

Flooding in West Warwick,  
Rhode Island in 2010  
demonstrates how low-  
lying areas are vulnerable  
to flooding. *Photo: National  
Weather Service*

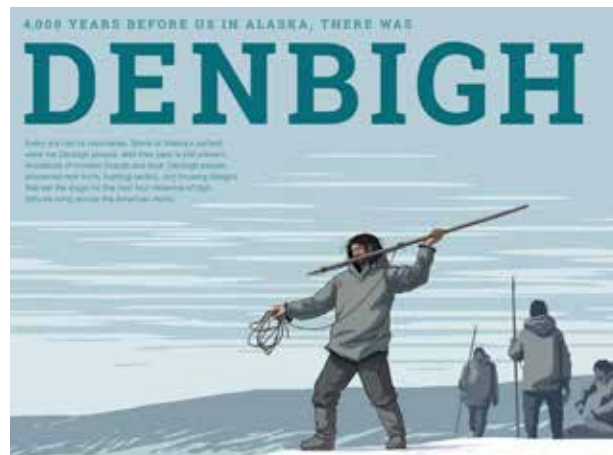




## The Arctic and the Ocean State



**Left:** Admiral Byrd (center right), who once called Rhode Island home, shaking hands with a colleague in front of the Josephine Ford in Spitsbergen, Norway around the time of his North Pole flight. **Artwork:** Pamela Theodotou; **Right:** The National Park Service (NPS) administers, as a National Historic Landmark, the Iyatayet site at Cape Denbigh in Alaska. The Denbigh Flint Complex was named by Brown University's Dr. Giddings. **Image:** NPS



### About the Author

A native of Miami, Florida, Walter Berbrick served ten years in the U.S. Navy as an intelligence officer, rising from seaman to Lieutenant. He spent seven years as an Associate Professor and Founding Director of the Arctic Studies Group at the U.S. Naval War College. He earned a doctorate from Northeastern University and was awarded a fellowship with the Council on Foreign Relations. At present, Walter is a Senior Policy Advisor at the Department of State, a post he assumed in the summer of 2016. He is happily married to Laurie, and they have two young children. *Photo:* U.S. Naval War College



Many stories have been written about Rhode Island and most know the legend of its maritime pastimes, but few know the connection of America's "Ocean State" to the Arctic. Rhode Island is the smallest state of the union. In fact, Rhode Island could fit inside Alaska, our largest and our true Arctic state, 517 times. Famed Arctic explorers have resided here, renowned professors have carried out seminal studies on Arctic archaeology, and today, through the Naval War College, we are informing American strategy and policy in the Arctic region.

We even have a town here in Rhode Island called Arctic Centre. It was the birthplace of America's textile industry and home to generations of French Canadian families since the Industrial Revolution in the late 17th century. Rhode Island is also connected to the Arctic through its biodiversity, especially whales and birds. Beluga whales and humpback whales have been spotted splashing about in Rhode Island's Narragansett Bay—an extremely rare sight considering these colossal creatures normally remain faithful to swimming somewhere between the Gulf of Maine and the high Arctic regions in Norway during the summer months.

Rhode Island's 400 miles of coast remains the lifeblood of the state and no stranger to the consequences of climate change. For example, several lighthouses visited by thousands of tourists each year have been relocated farther inland in the past due to erosion and have been fortified for protection from storms. Experts forecast that the combined impacts of warming temperatures, sea level rise, and coastal hazards will coincide with more severe flooding, falling property

values in coastal areas and losses in tourism revenue for the state—the fourth-largest private sector employer in the state.

Dutch explorer Adriaen Block, who reached the shores of Rhode Island while charting the Northwest Passage through the Arctic, named Rhode Island. Nearly three centuries later, American naval officer and polar explorer Rear Admiral Richard Evelyn Byrd, Jr., earned his place in history as the first to reach both the North Pole and the South Pole by air. Byrd once called Rhode Island home and commanded the Rhode Island Naval Militia in Providence, Rhode Island.

Finally, Rhode Island has important research and education connections to the Arctic. J. Louis Giddings, a professor of anthropology at Brown University from 1959 to 1964, was a pioneer in the field of Arctic archaeology and an authority on ancient inhabitants of the Bering Strait region in Alaska, including the Denbigh Flint Complex.

The University of Rhode Island and the Naval War College also contribute significantly to our state's Arctic connections. Today, Graduate School of Oceanography faculty and researchers are engaged in nine different research projects throughout the Arctic ranging from food web dynamics and microbial and planktonic diversity, to the study of the ocean's chemistry and currents, to the study of copepods and the Arctic Ocean's marine winter environment. Last but not least, the Naval War College has created a new innovative program that educates leaders, strengthens international maritime cooperation, and informs real-world strategy and operations in the Arctic region.

# 41 SOUTH CAROLINA

On the ice in Nunavut, Canada, Inuit community leader Johnny Issaluk holds a print of a South Carolina swamp, which shows what the Arctic looked like 56 million years ago. *Photo: Ira Block*





**About the Author**  
Darla Domke-Damonte, Ph.D., is associate provost for Global Initiatives at Coastal Carolina University. In this role, she develops and implements internationalization strategies for the university. She is also a tenured professor of management and formerly served as assistant dean in the E. Craig Wall Sr. College of Business Administration. She is married to L. Taylor Damonte, Ph.D., and they have two daughters, Alexandra and Laura. In her free time, she enjoys spending time with her family, sailing, cooking, reading, biking, traveling and helping in the community. *Photo: CCU*



**Left:** *The Incredible Fish Value Machine* shows how Icelanders are able to capitalize on 80% of each cod (as opposed to the typical 50%) and derive profit from fish by-products like the head and bones while reducing waste. **Image:** *Iceland Ocean Cluster*; **Center:** Cod is so important to Iceland's economy that the fish is featured on the country's one Króna coin. **Photo:** *iStock.com*; **Right:** Coastal Carolina University Wall Fellows during their study program in Iceland, May 2016. **Photo:** *Darla Domke-Damonte*

**Y**ou might not think that South Carolina has much to do with the Arctic, but here at Coastal Carolina University (CCU), we have real human connections with the Arctic through our important relationship with Iceland.

CCU's Icelandic connections go back to the 1980's, when great soccer players were discovered in Iceland by CCU's Coach Paul Banta. Since then, a number of Icelandic students have studied at CCU. Today more than 80 Icelanders are part of our CCU alumni community and have founded the Icelandic Whales Alumni Association (IWAA), our first international alumni association and an important philanthropic entity.

Thanks to this nearly 30-year relationship, Iceland has had a significant influence on CCU's work in South Carolina through perspectives on innovation and sustainability. In 2015, CCU leadership and alumni discussed deepening our cooperation by increasing efforts to connect current students with Icelandic alumni and organizations through projects that benefited both groups.

Introductions through IWAA led to a visit with Thor Sigfusson, the president of the Iceleand Ocean Cluster in Reykjavik, which became a turning point in the conversation. Iceland Ocean Cluster's mission is "to create value and discover new opportunities by connecting entrepreneurs, businesses, and knowledge in the marine industries." During our visit, he explained the process they had used to encourage the use of cod, by far the most important fish stock in Iceland, in novel and commercially viable ways. According to Thor, Icelanders have produced "an industry fishing machine," and the country takes pride in the fact that no other whitefish nation is utilizing more of each fish caught than Icelanders. The fishing industry in Iceland uses almost all parts of the fish for products such as collagen, food, medicine, oils, and more to produce almost zero waste.

We brought together more constituent groups in South Carolina to determine further cooperation and returned to Iceland. The aim was to determine how to link the innovation and sustainability efforts in Iceland with those programs that support entrepreneurship activity in South Carolina. Further discussions with the Icelandic Federation of Business, the U.S. Commercial Service, and CCU alumni in Iceland yielded a cod-inspired cooperation.

For each of these groups, whether they were in Iceland or South Carolina, it was important to see real cooperation. The Wall Fellows Program, a highly competitive leadership development program for CCU undergraduates, partnered to advance a study and research consulting experience with the businesses of CCU alumni in Iceland. This program promoted research and exchange between student leaders and industry and supported CCU Icelandic alumni.

Two Icelandic companies with CCU alumni participated in the program during its first year, including Star-Oddi, a manufacturer of innovative scientific research tools, and LYSI, a leading producer of fully refined fish oils for human consumption. The CCU Wall Fellows researched issues for six months at home then traveled to Iceland to spend a week fine-tuning their recommendations and presenting them to company leadership.

For the 2016–17 academic year, this program will continue to grow by moving some of the ideas proposed in May 2016 to implementation and beginning new projects with six more Icelandic companies.

We can all learn a lot from the Icelandic approach to natural resources in the Arctic and from the innovative thinking and commitment to sustainability that Iceland offers to the world.

# 42 SOUTH DAKOTA

A spring Aurora Borealis display over Portage Lake, Chugach National Forest, Alaska. *Photo: Carl Johnson*





## From the Black Hills to the Brooks Range: A Visually Inspiring Journey from South Dakota to the Arctic



Left: Dog sledding in the Arctic. Right: Evening light at Sheep Mountain Table, South Unit, Badlands National Park, South Dakota. Photos: Carl Johnson

### About the Author

Carl Johnson lives in Anchorage with his wife, Michelle. His photography strives to understand the whole of a place, from small plants to vast landscapes, and increasingly the people who live with the land and call it home. Carl has served as the Artist-in-Residence for Gates of the Arctic National Park and Preserve, Badlands National Park, and Rocky Mountain National Park. He was the "Environmental Issues" winner for the Windland Smith Rice International Awards in 2010. His first book, *Where Water is Gold*, was published by Braided River in 2016. You can view his photography at [www.arcticlight-ak.com](http://www.arcticlight-ak.com). Photo: Carl Johnson



Inspiration can come from many places, in unexpected forms. It was inspiration through a young life spent exploring the outdoors that lead me from the dry ponderosa forests of the Black Hills with its granite spires and wild turkeys, to the densely covered Chugach Mountains in Alaska, where Arctic ground squirrels scurry about on the tundra.

Born at Ellsworth Air Force Base in South Dakota, I spent most of my younger years in Rapid City, the gateway city to the Black Hills. I had countless adventures hiking and biking around town, in the natural areas of South Dakota's famous mountain range nearby, hopping streams, exploring construction sites for fossils, and exploring caves and abandoned mine sites in the Badlands and the surrounding area.

And all the while, I carried my trusty Kodak Instamatic X-15 camera, snapping shots of everything from garter snakes to ancient geological formations. I went on to serve as a ship's photographer in the Navy, capturing shipboard life, visiting admirals, ports of call, and Soviet ships and aircraft. I became grounded in a photojournalistic style, then continued to shoot while in college in the Twin Cities.

After eight years of living within the steel of a ship or the concrete steel of the Twin Cities, I had long lost touch with nature, so I left the city to work as a canoe guide in Minnesota. Slowly over those two years, the strokes of the paddle on the surface of countless lakes and the sight of splashing moose or Lady Slippers deep in the boreal forest aroused memories of exploration in my youth.

On pretty much a whim, I moved to Alaska. I had never visited the state, but a burgeoning passion for nature photography and exploring the wilderness compelled me there. Through countless day hikes and multi-day backpacking and kayaking

trips, I came to understand the unique nature of the light of the far north, where mountains glow pink at sunrise or sunset, and the light stays a golden warm quality all day long in the winter, or stays up all night in the summer.

My first journey into the true Arctic was when I was selected as the Artist-in-Residence for Gates of the Arctic National Park and Preserve, a massive wilderness expanse in the Brooks Range above the Arctic Circle. I traveled to the headwaters of the Alatna River and, for thirteen days, would explore the high, treeless tundra, watching group after group of migrating caribou pour through the valley as they headed to their wintering grounds. From hiking the open tundra to later floating the river amidst granite cliffs and boreal forest, I had an opportunity to experience the vast diversity of flora and fauna that the Arctic provides. The experience deeply implanted a love for the dramatic, wild landscapes of the Arctic and the amazing quality of light that paints the Arctic world.

Not long after, I decided to return to where it all began, to my home state of South Dakota. I applied for and was accepted into an artist residency in Badlands National Park. That month was an exploration of both the old and new, an opportunity to truly see my old stomping grounds in a way that being a photographer with a deep appreciation for nature could allow me to.

After finishing a project on the Bristol Bay region that culminated in a book, *Where Water is Gold: Life and Livelihood in Alaska's Bristol Bay*, I started another long-term project to explore the unique quality of the Arctic landscape in each of the circumpolar countries—the next step in an unlikely journey that started with a love for exploration growing up in western South Dakota.

# 43 TENNESSEE

Susan Hubbard from Lawrence Berkeley National Laboratory conducts a geophysical survey on the Barrow Environmental Observatory. The instrument, complete with GPS locator, measures characteristics of permafrost landscapes for inclusion into models. *Photo: Stan Wullschleger, Oak Ridge National Laboratory*





## Tennessee: Connected to the Arctic through Service and Science

### About the Authors



Dr. Peter E. Thornton (left) is a senior scientist in ORNL's Energy and Environmental Sciences Directorate and a member of ORNL's Climate Change Science Institute. He leads ORNL's Terrestrial Systems Modeling Group and co-leads the U.S. Department of Energy's Accelerated Climate Modeling for Energy project. He received his bachelor's degree in biomedical engineering and master's degree in geography and environmental engineering from the Johns Hopkins University and his doctorate in terrestrial biogeochemistry from the University of Montana.

*Photo: U.S. Navy*

Dr. Stan Wullschlegler (right) is a distinguished scientist in ORNL's Energy and Environmental Sciences Directorate and Climate Change Science Institute. He serves as the national project director for the U.S. Department of Energy's Next Generation Ecosystem Experiments-Arctic. He received his bachelor's and master's degrees from Colorado State University and his doctorate from the University of Arkansas.

*Photo: Dr. Stan Wullschlegler*



**Left:** The world-class "Titan" supercomputer at Oak Ridge National Laboratory (ORNL) is used to simulate complex challenges in biology, chemistry, material science, physics, and climate. *Photo: ORNL;* **Center:** A dedicated team of scientists on the Next-Generation Ecosystem Experiments project work in all seasons of the year to gather data needed to better inform computer models. *Photo: Stan Wullschlegler and Roy Kaltschmidt;* **Right:** Col. Cory Strobel conducts a physical on a 17-year-old Maniilaq High School student in order to medically clear him to play sports in Kotzebue, Alaska. *Photo: U.S. Air Force*

Tennessee has a long history as the "Volunteer State"—so known because our citizens volunteered their lives in support of the War of 1812 at the Battle of New Orleans and Texan independence in 1836 at the Alamo. Our reputation for volunteering was reinforced during the Mexican War when Secretary of War William Marcy asked for 2,800 Tennessee volunteers and got 30,000.

More than 200 years later that volunteer spirit continues in Tennessee, with efforts by many of our citizens focused squarely on the Arctic. Tennesseans in the U.S. National Guard step forward each year to provide free medical services to communities in Alaska. Through Operation Arctic Care, health professionals in the Guard serve local citizens in remote areas. These service members prepare for future humanitarian missions as part of the largest recurring joint medical and logistics training exercise in operation today.

The Tennessee tradition of service also extends into science. We are studying Arctic ecosystems to help predict the consequences of climate change. Here at Oak Ridge National Laboratory (ORNL), in eastern Tennessee, we use some of the most powerful computers in the world to understand how the Arctic will change as greenhouse gas emissions warm the planet. In the far northern reaches of Alaska, Arctic tundra stretches for hundreds of miles between the Brooks Range and the Arctic Ocean. Unseen beneath the surface, deep wedges of buried ice are interspersed with ancient plant remains and frozen organic ooze. The computer simulations that we are running in Tennessee help us draw connections between the clear patterns that dominate the view on the

surface and the mysteries below ground that we can only glimpse through arduous drilling, manual sampling, and electronic instruments.

Using computers to help guide our expectations for the future is one way to understand the vast and complex Arctic landscape, but hard work out of doors is another proud Tennessee tradition. Arctic soils that have remained frozen for hundreds of years are now thawing, and our work in the field, in laboratories back in Tennessee, and at our partner institutions aim to understand how changing permafrost is connected to changes in climate observed around the world today and predicted for the future.

In Alaska, local populations are already dealing with warmer temperatures. Many are involved in fishing, hunting, and foraging, so they have a good sense of how things have changed year to year, as well as over the last 50 years, and our team members are benefiting from this "traditional knowledge." The residents in Barrow and across the North Slope have been very supportive. As we conduct our research, and expand into western Alaska, citizens are looking forward to hearing about our results because in many cases it's intimately linked with their livelihoods.

Even though the Arctic is far away from Tennessee, we know that our state and our nation need to understand how the Arctic tundra, sea ice, and glaciers have changed over time and will continue to change and influence our planet and its people. Viewed through a global lens, Tennessee and the Arctic are closer than miles on a map suggest.

# 44 TEXAS

The Alaskan Troodon, a small bird-like dinosaur, inhabited the area now surrounding Denali National Park during the Cretaceous period.

*Illustration: Karen Carr*





## From Dinosaurs to Data Networks: Texas and the Arctic in the Anthropocene

### About the Author

Amelia Jaycen is a science journalist and media theorist in Denton, Texas. In 2014 she traveled to Kirkenes, Norway for the Arctic Journalism Internship, reporting on science and energy in the Barents Region. Jaycen writes about a variety of sciences in the lab and in the field, with a focus on interdisciplinary practice at the intersection of arts and sciences. Jaycen is a member of the Society of Environmental Journalists and the National Association of Science Writers. She is interested in ocean expedition science, big data, technology development, astronomy, climate change, and energy. *Photo: Amelia Jaycen*



**Left:** Riding a Widerøe plane north from Hammerfest back to Kirkenes Høybuktmoen in June 2014 with a liquid natural gas shipment in view. *Photo: Amelia Jaycen*; **Center:** In Vadso harbor, King Crab fisherman Edgar Olsen fuels his ship, *Miss Crosby*. Olsen makes his living taking guests, including Norway's Minister of Fisheries, on King Crab excursions. *Photo: Amelia Jaycen*; **Right:** Renowned Texas photographer Dornith Doherty visited the Svalbard Global Seed Vault, the interior of which is pictured in this archival pigment photograph, on the Arctic island of Svalbard, Norway as part of her *Archiving Eden* project which documents global efforts to preserve seed stock in the face of today's environmental changes. *Photo: Dornith Doherty*

### Report from the Top of the World!

**T**he flier caught my attention immediately. The U.S. Embassy in Oslo and the Royal Norwegian Embassy in Washington, D.C., wanted to send student journalists to the Arctic, so I applied and was selected.

I went to Norway to write about science, but I would also learn about issues that affect the region from indigenous rights to food technology. For a sun-loving Texas girl, the freezing Arctic was awakening. Reporting in the Arctic opened my eyes to the rich history of this diverse, complex region where cross-border neighbors are in the habit of cooperation.

As I uncovered all the ways that border lands factor into cooperative development, I began to view my own state of Texas in this context, nestled at the intersection of the United States, Mexico, and the Gulf Coast. In searching for the connection between polar and mid-latitude states like Texas, I found artists and researchers working on projects ranging from photographing specimens in remote seed banks to digging up giant ancient life forms in the Arctic.

The Bering Strait between North America and Russia is today a strategic location for Atlantic-Pacific shipping transportation, but once the Bering Land Bridge played a crucial role in ancient dinosaur migration. Research by paleontologists like Anthony Fiorillo of the Perot Museum of Nature and Science in Dallas reveals that ancient species of dinosaurs moved between continents and adapted to survive in harsh Arctic conditions. The Perot Museum features a large dinosaur exhibit hall with bones from Texas to Alaska. Much of the Museum's research is based on material collected during expeditions in Alaska and has resulted in the discovery of

two new species of dinosaur, one named in recognition of Texas' Perot family.

The Arctic waters of Norway and those of the Texas Gulf Coast are both considered rich with natural resources like oil and gas. While interest in Arctic drilling exploration has increased, concerns remain that it could have serious consequences for climate change, as well as Arctic flora and fauna and the people who depend on them for food.

Dr. Arthur Mason, an anthropologist at Rice University in Houston, studies on-the-ground effects of oil and gas development. He said that exploration activities don't always go as planned. The Russian town of Teriberka experienced the promise of a prosperous future as a hub for Arctic drilling, but it was left at the altar when drilling operations failed.

Today the effects of climate changes are so clear that a discussion has risen over whether to draw the line labeling this period of human history a new era—the Anthropocene, so named for an era in which human impacts on the environment are most evident.

Finding ourselves at the border between epochs where nations and peoples work together to build knowledge and action networks means bringing global citizens together is increasingly valuable. Today's discussion needs a scalable language that retains accuracy and addresses problems on multiple levels. One that crosses borders, supersedes separation by geography or discipline, and brings to light a map of interconnected people working together and sharing tools, knowledge, ideas, and energy. Part of that language is about defining connections, like those between Texas and the Arctic.

# 45 UTAH

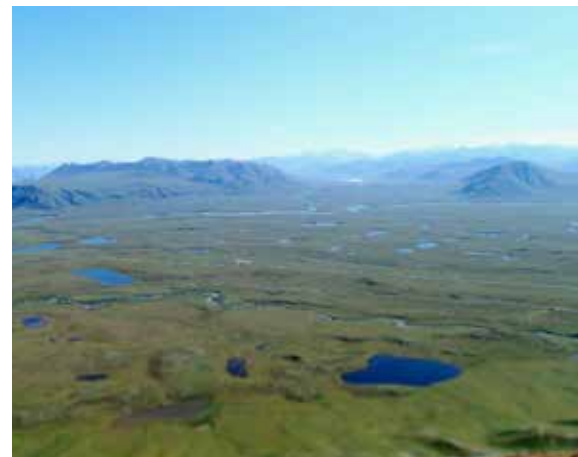
Tyler King enjoying some of Utah's legendary snowpack in the Bear River Range.

*Photo: Nick Gottlieb*





## Utah and the Arctic: From One Desert to Another



Left: Desert landscape of Canyonlands National Park, Utah. Right: Desert landscape of Arctic Alaska. Photos: Tyler King

### About the Authors



Dr. Bethany Neilson is an Associate Professor of Civil and Environmental Engineering at Utah State University. She has researched river temperature dynamics around the globe and has been conducting research in Arctic Alaska since 2009. Dr. Neilson is also an associated scientist with the Arctic Long-Term Ecological Research Station at Toolik Lake. Photo: Tyler King



Tyler King is a Ph.D. student at Utah State University. Tyler got his start in Alaskan hydrology through an internship at the Alaska-Pacific River Forecast Center in Anchorage. He went on to study the impacts of hydropower production on river temperature at the Norwegian University of Science and Technology before joining Dr. Neilson at Utah State University. Photo: Bethany Nielson

When compared with the hot desert landscapes of Utah, the cool tundra landscapes of northern Alaska hardly seem like a desert. However, the tundra of northern Alaska is part of the world's second-largest desert, which covers an area nearly twice as large as the entire continental United States. The differences between the deserts of Utah and the Alaskan Arctic arise from the all-important environmental variable—temperature.

As one of the most significant factors in nearly all environmental processes, temperature controls how fast biological and chemical processes occur, dictates how much water vapor can be held in air and how much oxygen can be held in water, and even influences the physical form that elements take in our natural environment. In the Arctic, historically cool temperatures have allowed a lush tundra landscape to flourish despite low levels of precipitation. While it is well known that air temperatures are rising in the Arctic faster than the rest of the globe, it is unclear how these changes in climate will impact Arctic rivers—a key component of the Arctic desert landscape.

During most of the year, Arctic rivers are frozen, leaving only a few months for aquatic plants to grow, aquatic insects to complete their life cycles, and fish to migrate, spawn, forage, and return to overwintering lakes. During the warm season, as rivers run and the landscapes drain, a tremendous amount of dissolved carbon is released from thawing carbon-rich soils and transported through Arctic lakes, streams, and rivers. How much of this carbon is released into the atmosphere as greenhouse gases is in part dictated by the temperature of the water in which it is transported. And there is plenty of carbon

in the Arctic; it is estimated that frozen Arctic soils contain twice the amount of carbon that is currently in circulation in our atmosphere.

While the importance of Arctic river temperature is acknowledged, our understanding of the processes that control these temperatures, and therefore how these temperatures will respond to climate change, remains at the frontier of scientific discovery. Some of the most cutting-edge research in this field is happening at Utah State University, in Logan, Utah. Dr. Bethany Neilson and her Ph.D. student Tyler King have studied river temperature dynamics from numerous locations including the far northern reaches of Alaska. Most recently, data collected from the North Slope of the Brooks Range in Alaska are being coupled with computer models to understand what controls Arctic river temperatures and how these mechanisms may change in the future. So far their results indicate that the controls on river temperatures are directly related to the hydrology of this high-latitude desert.

The connections between Utah and the Arctic go beyond having similar landscape classifications and the personal connections that some of Utah's locals have with the region. Global climate change signals created predominantly by human activity at lower latitudes are amplified in the Arctic and returned to lower latitudes. In Utah, these amplified climate change signals have very real impacts and are manifested as increased air temperatures, lengthened wildfire seasons, and decreases in Utah's snowpack. Understanding connections between human actions, the Arctic, and global climate is vital if we wish for Utah's legendary snowpack to be more than just a memory by the end of this century.

# 46 VERMONT

The author on Little Diomed  
Island in the Bering Strait  
between Russia and Alaska.  
*Photo: Lee Cooper*





## A Lifelong Science Educator Connects Vermont with the Arctic... via the Arctic Ocean



Left: Dr. Jackie Grebmeier (left) and Betty Carvellas prepare a sediment core taken from the Bering Sea during the 2009 RUSALCA expedition. Photo: RAS-NOAA; Right: Canadian Coast Guard ship Sir Wilfrid Laurier, a light icebreaker where the author conducted scientific research. Photo: Canadian Coast Guard

### About the Author

Betty Carvellas retired after teaching science for 39 years in Massachusetts, New York, and Vermont. She currently works part time as the Teacher Leader for the Teacher Advisory Council of the National Academies of Sciences, Engineering, and Medicine. From 2002–2012 she participated in eight research cruises to the Arctic on board the U.S. Coast Guard Cutter Healy, the Canadian ship Sir Wilfrid Laurier, and the Russian vessel Professor Khromov. She lives in Colchester, Vermont. You can reach her at bcarvellas@yahoo.com. Photo: Jackie Grebmeier



While living and working in Vermont for over 40 years has not made me a real “Vermonters” (that takes generations), my connections to this beautiful state run deep. I taught science here for 33 of my 39 years of teaching, primarily at the high school level.

During my career, I endeavored to relate the science I was teaching in the classroom to the real world. By participating in eight Arctic research cruises over ten years, I was able to bring the Arctic to my students directly—whether by sharing my journal postings while on board my research cruises or by filling my biology curriculum with examples from the Arctic and with stories of real scientists at work.

My first experience in the Arctic was in 2002 when I participated in the National Science Foundation’s Teachers Experiencing the Antarctica or Arctic (TEA) program. Through TEA I was paired with Dr. Jackie Grebmeier, an internationally recognized Arctic researcher who studies marine ecosystem dynamics, especially as related to Arctic megafauna like walrus. We spent six weeks aboard the U.S. Coast Guard Cutter Healy, our country’s largest icebreaker, in the Bering Sea and into the Beaufort Sea, Chukchi Sea, and adjoining Russian waters of the Arctic.

In 2009 and 2012, I was on board the Russian ship Professor Khromov for two U.S.-Russian collaborative multidisciplinary missions as a part of the Russian-American Long-Term Census of the Arctic mission (RUSALCA). RUSALCA is documenting the long-term ecosystem health of the Pacific Arctic ecosystem through periodic research cruises that visit both U.S. and Russian waters. Both cruises included more than 40 scientists from the United States, Russia, and Korea.

One of my most memorable Arctic visits was to Little Diomed Island in the Bering Strait, where fewer than 150 live on a small area of the rocky coast. The residents hunt beluga and

bowhead whales, seals, walrus, and polar bears. Additionally, they supplement their diet with fish, crabs, local wild greens and vegetables; this subsistence lifestyle is threatened by shifting ice patterns.

Part of being an Arctic nation is realizing that we’re only one piece of the puzzle; we’re part of a global Arctic community. What we do here in Vermont impacts those living on Little Diomed and elsewhere in the circumpolar region. Throughout the Arctic, temperatures are rising, sea and land ice are melting, permafrost is thawing, Arctic ecosystems are changing, and life is changing for the people who live there.

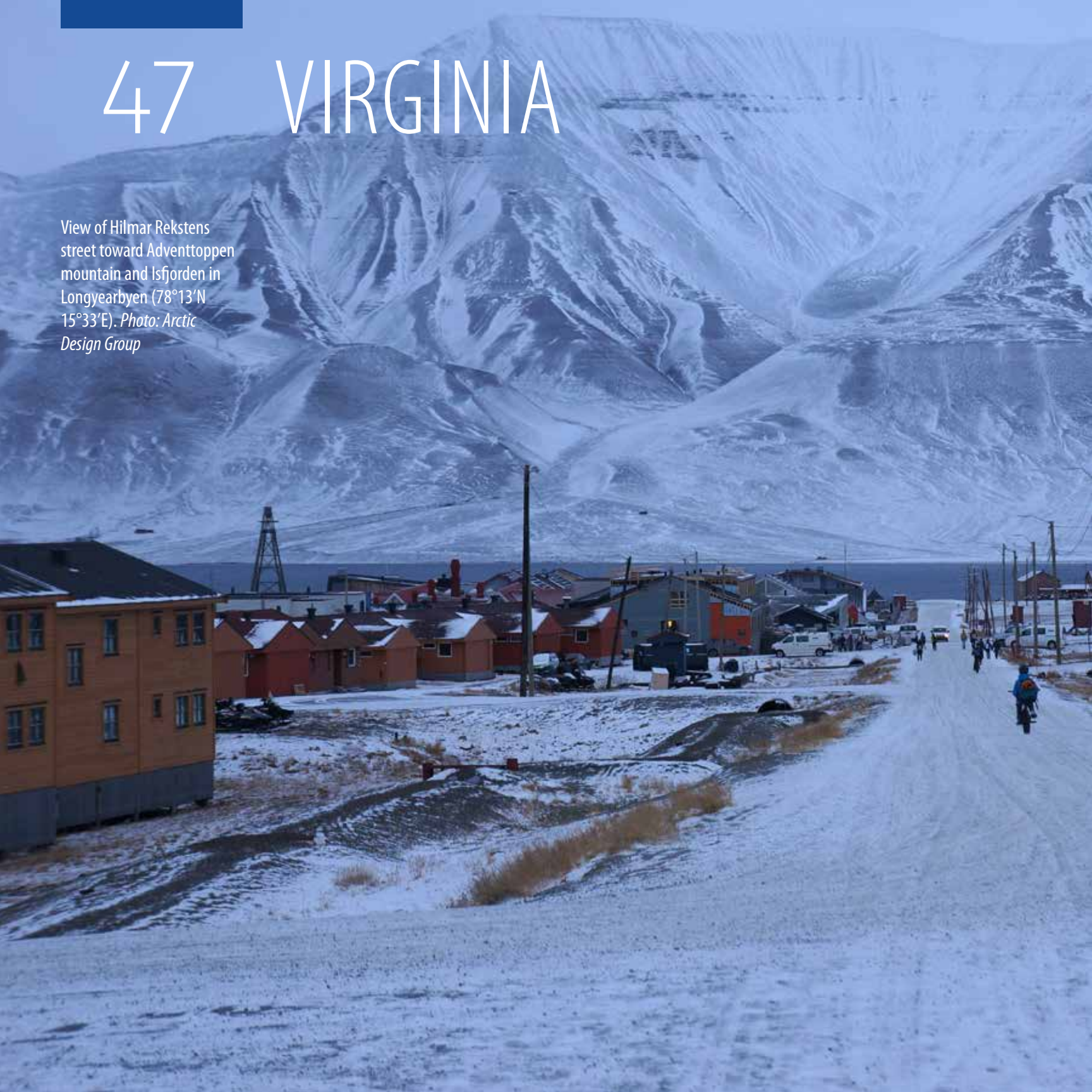
In 2010 I participated in a research cruise on board the Canadian Coast Guard ship Sir Wilfrid Laurier. In one journal entry I wrote about a conversation I had with the Ice Observer, who helped direct the ship through the ice. He wryly described himself as the “last Ice Observer” because today, Arctic ice cover is decreasing. When I asked him if he felt that the changes he was seeing were human caused, he said simply, “definitely.”

While I’ve retired from the classroom, I stay involved with teaching and science through my work as the Teacher Leader for the Teacher Advisory Council of the National Academies of Sciences, Engineering, and Medicine. The National Academies are working on communicating what is happening in the Arctic with the wider population, including through the 2015 publication from the National Research Council called *Arctic Matters: The Global Connection to Changes in the Arctic*.

Vermont has a variety of other Arctic connections—including our official state fossil, the Charlotte Whale, an 11,000-year-old beluga found here in our state, a relic from when Vermont was covered by the sea at the close of the last ice age. For me, however, the strongest Arctic connection will always be between scientific research and the classroom.

# 47 VIRGINIA

View of Hilmar Rekstens  
street toward Adventtoppen  
mountain and Isfjorden in  
Longyearbyen (78°13'N  
15°33'E). *Photo: Arctic  
Design Group*





## Virginia Reaches North: Designing Future Arctic Cities



Final presentations of student projects from the Arctic Design Group / Svalbard studio at the University of Virginia School of Architecture, December 15, 2015. Photo: Arctic Design Group

While we may be closer to the Mason-Dixon line than the Arctic Circle in Virginia, we have been actively investigating the design of building, cities, and landscapes in this extreme northern environment; with climate change and economic development, the region is poised to become a new frontier.

Our work is driven by two key questions:

*What role can architecture, urban design, and landscape architecture play in mediating the transformation of this vast northern frontier?*

*Through the lens of extreme environmental conditions, what alternative architectural and urban typologies and systems can we develop in order to attain more resilient urban futures in the region?*

We started the Arctic Design Group (ADG) in 2013 at the University of Virginia (UVA) School of Architecture to bring together designers from a wide range of perspectives to start to answer these questions and to join the conversations ongoing about the Arctic in Virginia, in Washington, D.C., and around the world on this vast region—a place often identified with isolation, cold, darkness, wind, and light that are unlike anything most of us ever have experienced.

As the indigenous peoples who have lived in the Arctic for thousands of years know, shelter is one of the most central and critical aspects of life in the Arctic. A shelter that is well-designed both inside and out can facilitate not just the survival of the human body, but the flourishing of the human soul. As designers, our goal is to explore and develop new designs that are innovative, functional, and sustainable; designs that allow individuals and communities to flourish and may provide new models of how we can design buildings and cities in the South.

We are fortunate to be able to tap into a network of well-established scientific research, policy expertise, and arts related to the Arctic at UVA. In the recent past, and with generous funding support, we have created public exhibitions on the work of the ADG, brought Arctic-focused designers and spatial thinkers from around the world to UVA, and run a series of undergraduate- and graduate-level studios and research seminars. Through our efforts, we aim to foster student interest in the Arctic, promote collaboration, and further develop the body of knowledge needed to develop sustainable and resilient built environments in the Arctic.

It is important to give students an opportunity to experience the Arctic first-hand. In the fall of 2015, we raised \$40,000 for a group of architecture and landscape architecture students from UVA to visit the Arctic archipelago of Svalbard in Norway—the first traveling studio in the United States to bring design students to the High Arctic. Our students documented their daily activities in text, sketches, and short videos that are now available online. By the end of the semester, they had produced 13 design proposals focusing on Arctic-related design challenges like wastewater treatment, coal power plant building renovation, outdoor public space master-planning, and university expansion; all addressed specific constraints and opportunities inherent in the Arctic environment. Each proposal aimed to expand and renew cultural identity via the lens of built environment—a conversation that is lacking in much of the current Arctic discourse worldwide.

The Arctic is not simply a cold and frozen realm, but a dynamic and vibrant region inhabited by people of many different cultures. Through our work and that of our students at the ADG, we believe in proactive design solutions to build better futures for Arctic cities and communities. It is critical to think of not only the environmental, economic, and sovereignty issues, but also the human element and cultural legacies in this northern frontier.

### About the Authors



Matthew Jull, Ph.D., Assistant Professor of Architecture, and Leena Cho, Assistant Professor of Landscape Architecture, are founding directors of the Arctic Design Group at the University of Virginia School of Architecture. Cho received her B.A. at Wellesley College and M.L.A. at Harvard Graduate School of Design. Jull received his B.Sc at McGill University, Ph.D. in geophysics from University of Cambridge, and MArch at Harvard Graduate School of Design. Both have worked professionally in the design field in the Netherlands. Cho and Jull are also directors of the award-winning design office KUTONOTUK. You can reach Dr. Jull at [mjull@virginia.edu](mailto:mjull@virginia.edu) and Ms. Cho at [lcho@virginia.edu](mailto:lcho@virginia.edu).

Photo: Matthew Jull

# 48 WASHINGTON

Congressman Larsen speaks in front of the U.S. Coast Guard Cutter Polar Star, which is home-ported in Seattle, about the importance of investing in new icebreakers to protect U.S. interests in the Arctic.  
*Photo: Office of Congressman Rick Larsen*





## What Happens in the Arctic Matters for Washington State

### About the Author

Congressman Rick Larsen represents the Second Congressional District of Washington state, which includes portions of Snohomish, Skagit and Whatcom counties and all of Island and San Juan counties. He is committed to protecting natural resources for recreation and tourism, a major economic driver. He has led efforts to preserve public lands, restore critical salmon habitat, and combat climate change through investments in clean energy. You can contact him at his D.C. office at (202) 225-2605 or his Everett, Washington office at (425) 252-3188. *Photo: Office of Congressman Rick Larsen*



The U.S. Coast Guard Cutter Healy is the United States' newest and most technologically advanced polar icebreaker. It is homeported in Seattle. *Photo: U.S. Coast Guard/DoD*

When I talk with people about my interest in the Arctic, they don't always understand the importance of the region. But what happens in the Arctic matters for my home state of Washington. The Arctic is increasingly opening up to shipping traffic. It is experiencing the dramatic environmental effects of climate change. And the Arctic is a growing focal point of international cooperation. Washington state intersects with the Arctic on each of these critical issues, which means the future of the Arctic and of Washington state are linked together in important ways.

All of these reasons led me to create the Congressional Arctic Working Group in 2014 with Congressman Don Young of Alaska. Through meetings and briefings with Arctic officials from around the world, we are helping our colleagues understand that out of sight should not mean out of mind when it comes to the Arctic.

With melting Arctic ice, more ships are traversing the region's waters. An increase in shipping traffic means that ports in the Pacific Northwest will become more frequent stops for ships journeying through the Arctic, boosting economic activity along our waterfronts. Maritime activity in the Arctic requires specialized equipment like icebreakers, which could mean more work for Northwest shipbuilders and mechanics. Washington state is well-positioned geographically and well-prepared with infrastructure to support busier Arctic shipping lanes.

Melting ice is a symptom of the complex and urgent challenges of climate change, and the Arctic region is facing its impacts today. We need to take strong action to address it. Northwest Washington is already a hub of renewable energy innovation and jobs. Itek Energy in Bellingham is the largest solar panel producer in Washington state. Local public utilities

are building smart grids using cutting-edge battery storage technology that is also manufactured in my district. Innovative clean energy efforts like these will be a critical component of reducing our country's greenhouse gas emissions and fighting the effects of climate change in the Arctic and globally.

International cooperation and partnership in the Arctic can help our country advance its foreign policy goals. The Arctic is one of few regions in the world where so many countries have such a direct stake in the game. There are eight member countries of the Arctic Council, creating a cooperative bond among these nations that might not otherwise exist.

All of these activities—increased shipping, environmental stewardship, and international cooperation—require that the United States have the right infrastructure in place to be able to participate fully in the Arctic. Without ships that can safely traverse icy waters, we lose the ability to protect our interests. Currently the United States has two active icebreakers, one heavy duty and one medium duty. Our country's other heavy-duty icebreaker is "mothballed" in Seattle, being kept in good condition until it can be used again. I will keep working to invest in icebreakers so our country can meet its responsibilities as an Arctic nation.

The Arctic is a place that connects to us in Washington state through its emerging economic, environmental, and strategic importance. I see these connections in the ports of my district, in the promise of clean energy, in the fight against climate change, and in our country's engagement with other nations. What happens in the Arctic matters for my state and for our country. We have the opportunity to commit to strong engagement in the Arctic, and I will keep working to make sure we seize it.



# 49 WEST VIRGINIA

Bear Rocks, Dolly Sods  
Wilderness, West Virginia.  
*Photo: iStock.com*





## Finding Common Ground Between West Virginia and the Arctic



Coal miners of Nuttallburg, West Virginia, one of about 50 coal mining towns found throughout the New River Gorge. Today, the town is part of the New River Gorge National River (part of the National Park Service) and has been transformed into a historic townsite. *Photo: NPS*

### About the Author

Joseph Hankins joined The Conservation Fund in 1992 to develop aquaculture, sustainable rural economic development, and technology outreach in Appalachia. The Conservation Fund is a national nonprofit that aims to increase conservation by balancing economic and environmental goals. Today he leads the Freshwater Institute in West Virginia, an internationally recognized research and consulting program focused on water reuse technology in food production. Mr. Hankins holds an M.S. in Environmental Biology from Hood College and a B.S. in General Science from Purdue University. *Photo: Ginger Hankins*



The Arctic is a far away concept for most residents of West Virginia yet we share some of the Arctic's history of remoteness. The rugged high elevations of the eastern and central regions of West Virginia were largely unsettled until late into the 19th century. The Canaan Valley in the High Alleghenies is the highest-altitude valley east of the Mississippi, and the Dolly Sods Wilderness represents a muskeg, heath barren, and sub-alpine remnant disconnected by glacier retreat from similar expanses of boreal and Arctic habitat now far to the north. Today one can find plants and wildlife here that are as imperiled and stranded by geographic circumstance and climate change as their Arctic brethren.

West Virginia and the Arctic share attributes in our physical remoteness, the resilience of our people, and our natural resource wealth. A parallel can be drawn to Alaska, where the discovery of oil on Alaska's North Slope fueled the previously unimaginable economic development of America's Arctic. The familiar pattern of discovery and rational development in the Arctic is tempered today with a better understanding of the consequences of our actions built upon what we learned in the West Virginia coalfields.

The natural resources in the Arctic are a siren's song today to the world's economy; the early call from Appalachia was just as attractive to those entrepreneurs and workers who came to Coal Country in the early 1800s. The resulting exploitation of the mineral and timber wealth of West Virginia powered America's industrial revolution through two world wars, steam-powered rail, the gas light era, and now the electrification of rural homes and cities from New York to Atlanta.

Today we are still counting the costs and benefits of that exploitation. One of my favorite apocryphal contributions to the tabulation, often retold in the West Virginia coalfields, is the notion that the discovery and development of coal oil, and later the common gasification of coal for gas lights "saved the whales," whose oil was previously used for household lighting. By this accounting, but for displacement of whale oil in the 1860s by the cheaper and more abundant mineral options, commercial whaling would have continued until total biological extinction. This proudly told story may be imperfect logic to an economist but I like it just the same. The environmentalist in me finds a believable perspective to be found in how the good intent of our actions and the advancements of our time will be measured tomorrow with more complete and consequential understanding.

My work today is largely focused on the southern coalfield counties of West Virginia. It is a rugged landscape of industrial ravage and promising recovery. The desperate human poverty and ecological ruin are juxtaposed with a still striking beauty and natural wealth. There are coalfield communities lost and assets stranded as our national economy pivots toward new frontiers and energy sustainability.

As the arc of the Arctic and West Virginia story lines advance toward the future, these are places surely connected by rapid change and large opportunity. The conservation challenge of blending economic potential and environmental protection will require our best effort in both places.

# 50 WISCONSIN

Expedition Denali climbers  
on the approach to Denali in  
2013. Photo: Ascent Media,  
Hudson Henry





## The Lure of Pure Adventure from Wisconsin to the Arctic



**Left:** Ice caves at the Apostle Islands National Lakeshore in Wisconsin. *Photo: James Edward Mills*; **Center:** African American Arctic explorer Matthew Henson. *Photo: Library of Congress*; **Right:** The author during a visit to the Arctic National Wildlife Refuge in Alaska in 2016. *Photo: James Edward Mills*

I didn't grow up in Wisconsin, but after 25 years of my life spent in the perpetual sunshine of California, I was eager to try something different. The transitions of seasons from cold weather to warm and back again had for me an inexplicable appeal that I can only ascribe to the primal rhythms of the globe as it makes its way around the sun. In Wisconsin, a bit closer to the polar ice cap of the Northern Hemisphere than the sunny beaches of California, I found myself somehow that much nearer to my own humanity.

For the sake of pure adventure, I make my home where even America's greatest lakes freeze solid and bicycle tires can require metal studs to keep from slipping on the ice. Here, even a stroll to the grocery store can be an act of defiance against the elements that aim to draw from every drop of blood the warmth of your beating heart and the very air you breath makes your face hurt as it seers your lungs. The daily chores of winter, shoveling snow from the driveway and sidewalks, training on cross-country skis, and long dog walks though the woods prime my mind and body for some new trip farther north to climes less hospitable in the wilds of Alaska, or maybe one day if all goes according to plan, the North Pole itself.

Inspired by the first African American Arctic explorer, Matthew Henson, and with few geographical frontiers left to explore, I am personally challenged to face my own fears and physical limitations. Like Henson, I have learned to navigate and even thrive in the hostile environments of the northernmost latitudes. Tutored by the cold of Wisconsin winters, I have learned to travel with confidence over ice and snow. Trained by the National Outdoor Leadership School, I have become proficient in the use of ice ax and crampons in glacier travel and roped alpine ascension.

I trained with fellow mountaineers throughout much of 2012 in preparation for an attempt in 2013 to summit Denali, part

of the Alaska Range in our Arctic state of Alaska. It was our goal to inspire a new generation of young people to experience and enjoy the wonders of nature through a story of pure adventure. This project—called Expedition Denali—brought together a group of six men and three women to do something extraordinary and unprecedented. Following in the legacy of Matthew Henson, we aimed to create a compelling narrative of courage and excitement by putting the first team of black climbers on the highest peak in North America.

Facing the rigors of frigid temperatures and dizzy heights, this team ascended together with style to come within just 700 feet of the summit. While I was unfortunately unable to join the actual climb due to medical reasons, I know that although they did not reach the top of the mountain, they accomplished their most important mission: returning home safely to communities across the nation to share their stories and inspire others to find adventures of their own. Through speaking engagements, articles, books, and even a documentary film, *An American Ascent*, this journey continues to inspire people from all walks of life to pursue their dreams wherever they might lead.

Like Matthew Henson to the Arctic, I am drawn to the new experiences and insights offered by adventure. While I dream of making a great expedition to the North Pole itself one day, for the moment, I find the same sense of wonder right here in Wisconsin that Henson surely felt when forging across virgin snow in the Arctic. I am inspired and moved when simply touring the ice caves of the Apostle Islands off the shores of Lake Superior, or hiking with snowshoes through the Ridges Sanctuary along the Ice Age Trail. Whether here in Wisconsin or at the top of the globe, the unknown wilds of natural lands frozen throughout the winter offer the possibility to each of us to discover who we truly are.

### About the Author

James Edward Mills is a journalist, media producer, outdoorsman, and author. He specializes in stories about outdoor recreation, environmental conservation, acts of charitable giving, and practices of sustainable living. He has worked in the outdoor industry since 1989 as a guide, outfitter, independent sales representative, and writer. Learn more about him at [joytrippproject.com](http://joytrippproject.com). *Photo: James Edward Mills*





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A glacial stream flowing through a remote mountain valley in Gates of the Arctic National Park. The Muries' work to preserve land in Alaska helped lead to the creation of parks like this one, which is slightly larger than Belgium. *Photo: Paxson Woelber*





## A Lifelong Passion for Place and Conservation: Wyoming, Alaska, and the Muries' Arctic Love Affair

### About the Author

Dan McIlhenny has been an avid enthusiast for Mother Nature all of his life. He has been an entertainer, storyteller, and songwriter for more than forty years, performing across the west under his stage name, Dan'I. He has shared his nature-focused music with fans at Yosemite, Kings Canyon, and Sequoia National Parks, published a CD of his music, and previously worked at Artichoke Community Music in Portland, Oregon. He retired in 2012 and now serves as the Docent for The Murie Center of Teton Science Schools in Wyoming. *Photo: The Murie Center*



**Left:** Mardy and Olaus Murie near Jackson Hole, Wyoming, 1956, when their ranch was headquarters for The Wilderness Society. **Center:** Olaus and Mardy Murie in the fur parkas they wore on their honeymoon in Alaska in 1924. **Right:** A painting of eider ducks by Olaus Murie. *Photos: The Murie Center*

One of the stories connecting Wyoming with the Arctic begins with Olaus and Margaret Murie. Olaus is known by many as the “father of modern elk management.” His wife, Margaret “Mardy” Murie is seen as the “grandmother of the conservation movement.” In her many years of work in the outdoors with Olaus, she gained wide recognition as a naturalist, author, adventuress, and conservationist.

The story begins when Olaus Murie saw an ad in a newspaper advertising a position studying caribou in Alaska. In 1920, Alaska was still decades away from becoming America’s 49th state but it was already being scouted by the U.S. Biological Survey. Olaus learned the position would involve following the migratory paths of the caribou, which required living in the same kind of conditions as the caribou themselves. Olaus was the perfect man for the job as he was a Minnesota native and son of Norwegian immigrants, which left him unafraid of the wilderness.

While he spent most of his time following caribou in the state to determine where populations were the largest, he returned monthly to Fairbanks to mail off his work reports. On one such occasion he met a young woman named Margaret Thomas.

Margaret “Mardy” Thomas was born in Seattle, Washington, but moved to Fairbanks when she was young. Growing up in Alaska, Mardy spent her days living in a log cabin in the birch woods and spruce forest. Over time, Olaus and Mardy’s friendship became romantic. However, they did not marry until 1924, and only after Mardy became the first woman to graduate from the University of Alaska.

Olaus then invited Mardy on a three-month honeymoon—complete with fur boots and parkas—into the wilds of Alaska’s Brooks Range. Together they traveled via boat and dogsled, and camped out in the cold, all while Olaus collected specimens for his work. Although he followed the science, prepared detailed reports, and took photographs whenever

possible, Olaus did one thing most biologists don’t do: he sketched and painted the flora and fauna he studied in great detail producing some beautiful works of art.

In 1927, Olaus was reassigned to Wyoming. He and Mardy left Alaska with reluctance, but the move was necessary as Olaus was keen to continue working and studying outdoors. Olaus and Mardy were passionate about each other, but they also had a passion for place. While they spent the rest of their lives living in Wyoming, both of them made many trips back to Alaska and continued to work to protect it, fueled by their passion.

Their love affair with Alaska had a great impact on its lands. Olaus and Mardy’s efforts to convince Justice William Douglas of the importance of the region influenced President Eisenhower’s decision to designate an area of northern Alaska as part of the Arctic National Wildlife Refuge. This refuge was built around the idea of preserving an entire ecological system within the boundaries of a park.

Even after Olaus’s death in 1963, Mardy worked tirelessly to save even more of the Alaskan wilderness that she and her husband cherished. In 1975, Mardy’s work advocating for the protection of Alaskan land created a report which Congress then used to pass the Alaska National Interest Lands Conservation Act. This Act protected millions of acres of Alaskan wilderness and more than doubled the size of the Arctic National Wildlife Refuge. She would also earn the Audubon Medal, the Sierra Club’s John Muir Award, the Wilderness Society’s Bob Marshall Award, and the Presidential Medal of Freedom, the nation’s highest civilian award.

We owe the Muries for their work preserving our lands for future generations. We can look to their legacy and be reminded that highly focused passion can bring about wonderful things—in Wyoming and in the Arctic.







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