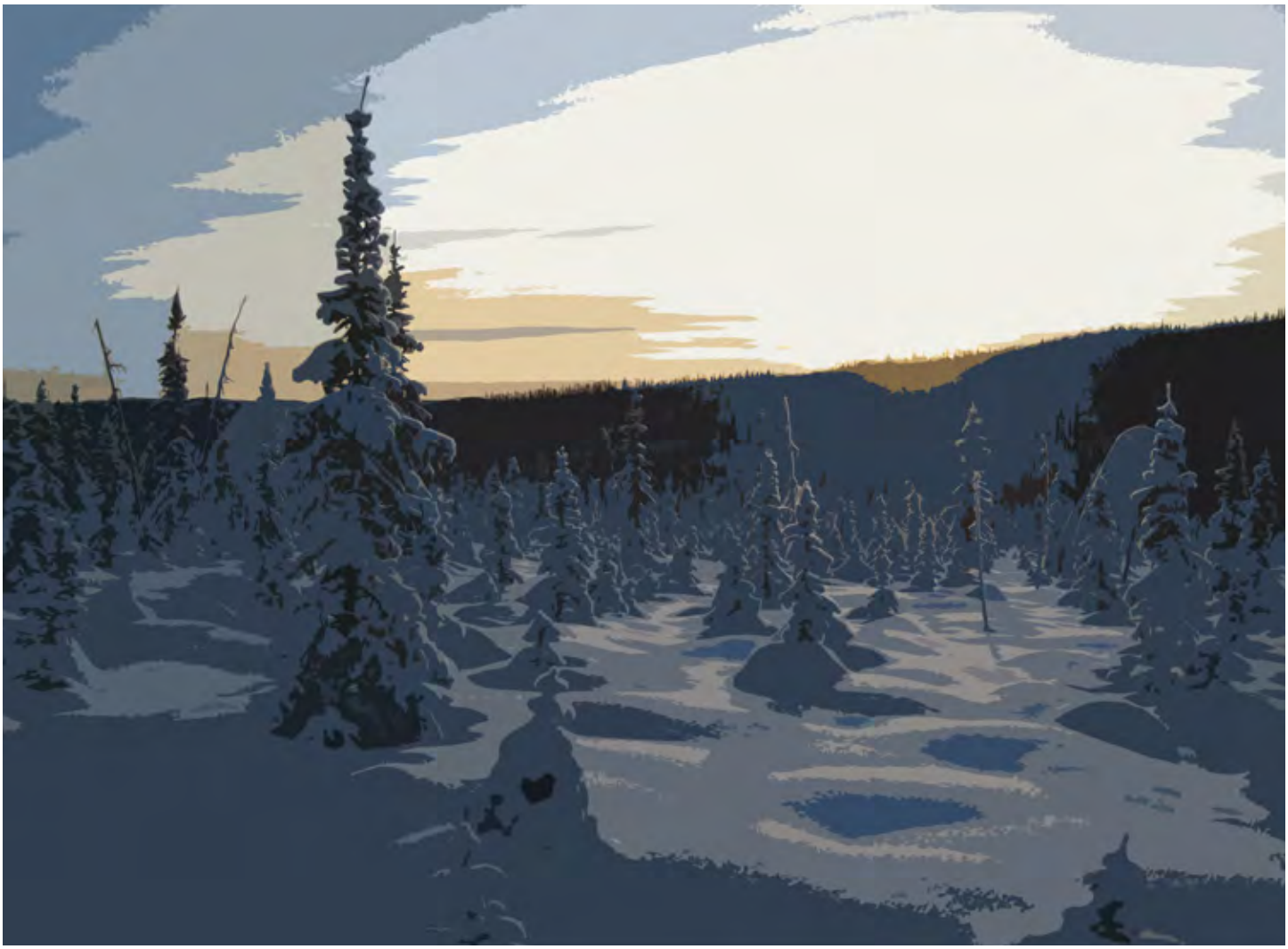
2011–2017

Alaska Center for Climate Assessment & Policy

PHASE II FINAL REPORT



Alaska Center for Climate Assessment and Policy

Alaska Center for Climate Assessment and Policy (ACCAP):
Interactive Climate Science for Alaska Award NA11OAR4310141

September 2011–September 2017

ACCAP
Alaska Center for Climate Assessment and Policy
A NOAA RISA TEAM

Green Lake Dam at low water, Sitka, AK. (KCAW Public Radio)

Wildland fire, Interior Alaska. (Scott Rupp)

Wild Alaska sockeye salmon. (Lisa Hupp/USFWS)

Contents

Our Team

Current team

- **Sarah Trainor,** Principal Investigator
- **John Walsh,** Principal Investigator
- **Nathan Kettle,** Co-Investigator
- **Tina Buxbaum,** Program Manager
- **Lindsey Heaney,** Communications
- **Davin Holen,** Joint with Sea Grant
- **Carolyn Rosner,** Design
- **Craig Stephenson,** Web Support
- **Alison York,** Editor

Postdocs

- **Brian Brettschneider**
- **Norm Shippee**

Students

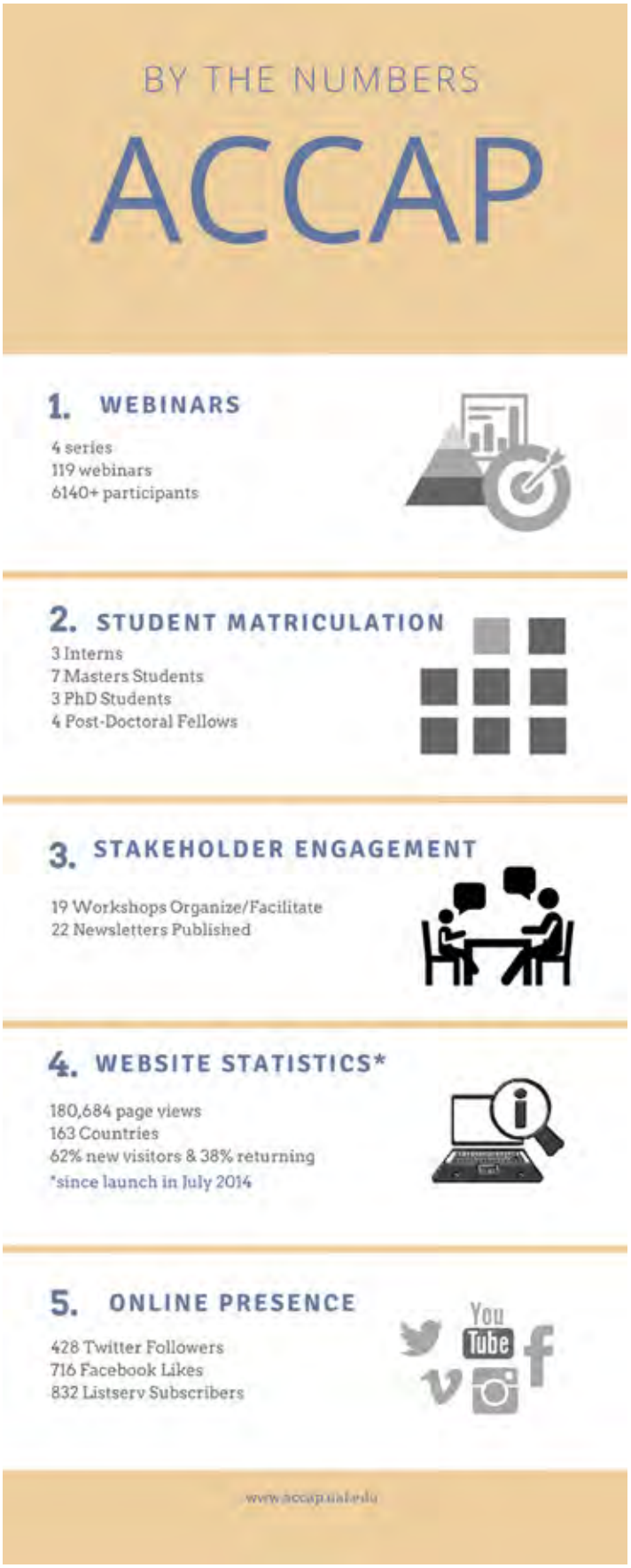
- **Casey Brown**
- **Rick Lader**
- **Amanda Meyer**
- **Stefan Tangen**
- **Nicole Warner**

Former team

- **Jessica Cherry,** Research Associate
- **Emma Funk,** Research Assistant
- **Brook Gamble,** Program Manager
- **Lena Krutikov,** Research Assistant
- **Phil Loring,** Co-Investigator
- **Jeremy Mathis,** Co-Investigator
- **Scott Rupp,** Co-Investigator
- **Anna Schemper,** Research Assistant

Former students, postdocs, and interns

- **Carson Baughman**
- **Peter Bieniek**
- **Melanie Colavito**
- **Lauren Frisch**
- **Hannah Harrison**
- **Claudine Hauri**
- **Eunkyoung Hong**
- **Corrie Knapp**
- **Katia Kontar**
- **Danielle Meeker**
- **Lindsay Olsen**
- **Harry Penn**
- **Aurora Roth**
- **Josie Sam**
- **Michaela Swanson**
- **Nicole Swanson**




Composite image of a winter sun south of Fairbanks, AK. (UAF photo by Todd Paris)

RISA in Alaska

Alaska and the Arctic are warming more rapidly than any other place on the planet. Climate change is already impacting seas and landscapes, seasons, and life in the North. These changes affect the health, lives, and livelihoods of Alaskans as well as the companies doing business in Alaska. Demand for climate change information and for the interpretation and application of this information is increasing, as are requests for assistance in adaptation planning by Alaskan stakeholders. As a result, there is an evolving need to integrate networks for sharing knowledge and connecting science with users, build climate adaptation capacity, and create climate-resilient communities statewide.

The Alaska Center for Climate Assessment and Policy (ACCAP) is committed to excellence in science and working with partners to make climate related science directly relevant to management and decision-making with the mission goal of improving the ability of Alaskans to respond to a changing climate. To do this, we look for innovative ways to do research, engage stakeholders, and develop and evaluate decision support tools. Our research efforts focused on the following areas:

- Adaptation Assessments
- Arctic Climate
- Extreme Events
- Coastal and Living Marine Resources
- Forest and Wildfire
- Native and Tribal Adaptation
- Sea Ice
- Water, Energy, and Economics
- Evaluation

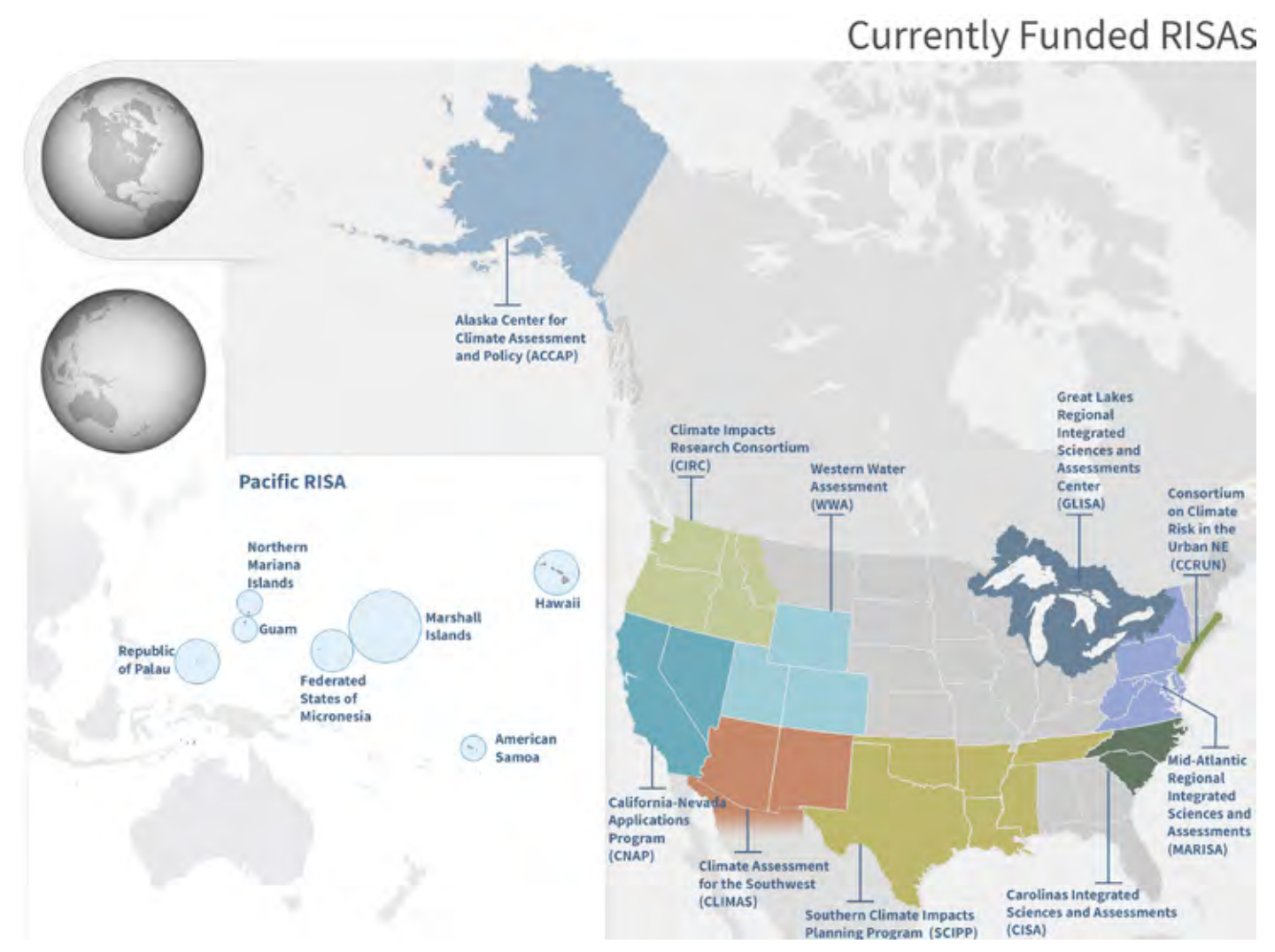
ACCAP is administratively located at the University of Alaska Fairbanks (UAF) in the International Arctic Research Center (IARC) and co-located with the Department of the Interior (DOI) Alaska Climate Science Center (AKCSC), the Alaska Fire Science Consortium (AFSC), Community Partnership for Self-reliance (CPS), and the Scenarios Network for Alaska + Arctic Planning (SNAP). All of the organizations have strong working relationships with each other and the collaboration enhances the reach and capacity of ACCAP. This positions us to be well aligned with other climate research and climate programs at UAF. ACCAP works closely with other federal entities (e.g. NOAA National Weather Service, Alaska Sea Grant, Bureau of Indian Affairs, and the Alaska Ocean Observing System) as well as with other university, state, federal, native and non-profit organizations in Alaska (e.g. Bristol Bay Native Association, Nome Eskimo Community, and the Aleutian Islands Pribilof Association).

Assessing community needs and vulnerabilities, and creating realistic community plans and climate adaptation strategies are ways that we partner with stakeholders throughout Alaska. We study and assess climate change-related impacts on water availability, marine resources, sea ice, wildfire and Alaska Native culture. Other work includes downscaling models as well as developing, testing, and evaluating research products and tools.

ACCAP establishes partnerships among:

- Scientists and engineers
- State and local planners, policy-makers and governments
- Transportation, natural resource and land management agencies
- Native non-profit organizations and Alaska Native tribes
- Industry
- Non-governmental organizations
- Anyone whose decision-making is influenced by climate-related events.

ACCAP has spent the past ten years conducting research, building a network of stakeholder relationships, developing climate adaptation tools, and assessing climate impacts and vulnerability in Alaska.



Key Partnerships within NOAA

ACCAP is located in the Akasofu Building (left) on the UAF campus. (Tina Buxbaum)

National Weather Service Alaska Region

ACCAP and the National Weather Service (NWS) Alaska Region have a mutually beneficial relationship that enhances the reach and compliments the mission of both organizations and is largely attributable to the collaborative work of Rick Thoman, Climate Sciences and Services Manager for the NWS Alaska Region. ACCAP has access to real-time, high-quality NWS information, while NWS leverages ACCAP's outreach capabilities, reputation and network of stakeholders. The collaboration allows for greater credibility and salience across organizations and advances the vision and mission to help Alaskans adapt to a changing climate and to promote a weather-ready nation. This collaboration has grown over the course of ACCAP's existence and continues to build on capacities of both organizations and be a value added partnership. ACCAP and NWS continue to build and enhance this highly productive collaboration.

Climate and Weather Highlights Tool

July 2007–present

ACCAP Lead(s): Tina Buxbaum, Lena Krutikov, with Rick Thoman (NWS)

Designed to provide information about notable weather and climate events. Data reported are preliminary observations and are reported in daily, multi-day, monthly, and longer time scales. Users can select date ranges, filter results, click on individual events for further information, and zoom in/out of the map. Events are added/updated in near real-time. Rick Thoman of the NWS provides the data for this tool and ACCAP provides the online interface that allows stakeholders to access the highlights in a visually appealing and easy to understand manner: http://bit.ly/2iCTTlv

In 2014 we evaluated the user experience for the tool and found people primarily use the Alaska Climate and Weather Highlights for personal information, general information, and research. They tend to access it either yearly or monthly, depending on the data and applications of interest.

Alaska Climate Dispatch Newsletter

September 2010–present
ACCAP Lead(s): John Walsh, Alison York, Tina Buxbaum, with Rick Thoman (NWS)

Published quarterly and written for a non-technical audience, the Dispatch features seasonal weather and climate summaries, articles on topics of current interest, as well as weather, wildfire, and sea ice outlooks: http://bit.ly/2A3lcN3

Rick Thoman of the NWS provides a summary of notable weather events for each issue of the Dispatch.

When the user experience was evaluated we found people primarily use the Alaska Climate Dispatch for general information, personal information and research. They tend to access it quarterly for information.

NWS Alaska Climate Outlook Briefings

July 2014–present
ACCAP Lead(s): Tina Buxbaum, with Rick Thoman (NWS)

Beginning in July 2014 ACCAP partnered with Rick Thoman, at NWS to deliver monthly climate outlook briefings. These briefings present recent climate conditions around Alaska and the predictions for the next month and season. They are accessible both in-person and virtually via the ACCAP webinar interface. This collaboration fosters closer connections between NWS and the UAF research community. There have been 39 webinars in this series thus far with an audience of 900+ participants. Upcoming webinars and past recordings: http://bit.ly/2Ak1JuS

Climate Prediction and Applications Science Workshop (CPASW)

May 2017
ACCAP Lead(s): Tina Buxbaum, with Rick Thoman (NWS)
Partner(s): National Weather Service

Jointly hosted by NOAA National Weather Service Climate Services Branch, ACCAP and other partners, the 15th annual Climate Prediction Applications Science Workshop, was held in Anchorage, AK in May 2017. It brought together over 130 climate researchers, information producers, and users from Alaska and throughout the country to share developments in the research and applications of climate predictions for societal decision-making. Agenda and more information: http://bit.ly/2okkUi9

Quarterly Climate Impacts & Outlook Graphics

December 2015–November 2016
ACCAP Lead(s): Tina Buxbaum, Carolyn Rosner, with Rick Thoman (NWS)
Partner(s): James Partain, NOAA Regional Climate Services Director

As an outgrowth of the collaboration initiated from the Weather and Climate Highlights tool and the Alaska Climate Dispatch, ACCAP provided the NOAA Alaska Regional Climate Services Director, James Partain, with graphics for the quarterly Climate Impacts and Outlook document from 2015–2016. Rick Thoman provided the data for the graphics and ACCAP provided professional graphic design for the figures featured in the final print product: http://bit.ly/1SGwflg

Climate Divisions for Evaluation of Anomalies and Trends in Alaska

August 2012–March 2015
ACCAP Lead(s): John Walsh, Peter Bieniek, with Rick Thoman (NWS)

ACCAP and Rick Thoman of the NWS partnered with NOAA Alaska Regional Climate Services Director James Partain and the University of Alaska Fairbanks to construct climate divisions for Alaska as the basis for an assessment of Alaska temperature and precipitation trends. Climate divisions outline geographic regions with homogeneous climate variability and were previously undefined for Alaska. Divisions are often used for addressing climate trends, drought and other seasonal/annual climate monitoring and prediction applications. Thirteen climate divisions were delineated for Alaska, opening up new avenues of climate and prediction for the region. Subsequently, these divisions were transitioned to operational use by NOAA's National Centers for Environmental Information: http://bit.ly/1ETk8dg

NOAA Ernest F. Hollings Scholar

May–August 2014
ACCAP Lead(s): John Walsh, Tina Buxbaum, with Rick Thoman (NWS)

ACCAP, in partnership with Rick Thoman, hosted a NOAA Ernest F. Hollings scholarship intern (Lauren Zuromski) during summer 2014. Using a database of storm and other extreme weather and climate events, she compiled a catalog of impacts and determined the linkages between extreme events and impacts for six significant weather and climate events. Zuromski delivered both an ACCAP Alaska Climate webinar and a presentation at the Hollings Scholar Symposium in Silver Springs, MD upon completion of her project in August 2014: http://bit.ly/2A1TD9f

This project was an initial step at creating a comprehensive compilation of major weather events in Alaska, which is currently lacking. Creating a repository of the effects of past storms and other extreme weather events on society, together with documentation of the meteorological evolution of the events, is a valuable resource for the NWS and other government agencies. In the future, ACCAP will extend this research to include a broader range of high-impact Alaskan weather events. This work will further serve as a basis for improving strategies, such as sharpening local and state responses to extreme weather and enhancing forecasts for the events.

Alaska Ocean Observing System

Alaska Ocean Acidification Network

December 2016–present
ACCAP Lead(s): Davin Holen, Tina Buxbaum
Partner(s): Alaska Sea Grant, Alaska Ocean Observing System

Launched in 2016, ACCAP is on the steering committee of the Alaska Ocean Acidification Network (AOAN). The mission of AOAN is to engage with scientists and stakeholders to expand the understanding of OA processes and consequences in Alaska, as well as potential adaptation strategies. In November 2016 AOAN held a two-day State of the Science Workshop composed of State and National researchers and policy makers. This workshop was broadcast online via ACCAP's webinar platform. ACCAP continues to be part of the small steering committee for the AOAN and will continue providing outreach and education support and leadership for the network. Workshop agenda and presentations: http://bit.ly/2hSDlJ5

Alaska Sea Grant

In 2015, ACCAP, Alaska Sea Grant, and the Alaska Ocean Observing System (AOOS) collaboratively partnered to hire a Coastal Community Resilience Specialist for Alaska (D. Holen). ACCAP continues to partially fund this position. This position is physically housed with Alaska Sea Grant in Anchorage, as part of the Alaska Sea Grant Marine Advisory Program. The primary responsibilities of this position are to assess and prioritize the community resilience and adaptation needs of coastal Alaska, and design, coordinate, deliver and evaluate programs based on those priorities.

Coastal Resilience Specialist

December 2015–present
ACCAP Lead(s): Davin Holen
Partner(s) and Leveraged Funds: Alaska Sea Grant, Alaska Ocean Observing System

Key activities:

- **Coastal Resilience & Adaptation Workshops.** Four workshops, in partnership with the U.S. Fish and Wildlife Service Landscape Conservation Cooperatives (LCCs), were held in 2016 in the Bering Sea communities of Nome, Unalaska, King Salmon, and Kotzebue. The collective input was used to produce workshop reports, a data-base of local research needs, four posters that describe aspects of a changing climate, and a coastal resilience toolbox that links coastal communities and managers to information and resources they need to adapt to climate change in Western Alaska.
- **Collaborating with Tribes on Adaptation Planning**. Partnership with the Central Council Tlingit Haida Indian Tribes of Alaska, Sitka Tribe of Alaska, and Nome Eskimo Community resulted in two regionally base tribal adaptation plans, one in Southeast Alaska and one in the Nome region. The Southeast Alaska Climate Adaptation Planning Summit was also held in Ketchikan, Alaska, in September 2016. Leveraged funding for these efforts came from the North Pacific LLC and the Bureau of Indian Affairs.
- **Statewide Outreach.** Activities included partnerships with State of Alaska agencies on citizen science coastal monitoring programs, creating a community-based shoreline erosion monitoring and decision-support tool, participating in the new Alaska Ocean Acidification Network steering committee, and helping to organize the December 2016 State of the Science workshop on ocean acidification.
- **Adapt Alaska.** This effort is a collaboration of communities, Tribes, agencies, and nonprofit organizations, with the goal of enabling communities to adapt to rapidly changing ocean and climatic conditions and changing terrestrial landscape from Southeast Alaska to the Arctic. It includes an internet website that provides a means for compiling and sharing information on the nature and magnitude of climate change and related impacts. This website also serves as a portal for climate change adaptation and resilience tools, case studies, and Alaska specific resources. It also supports existing networks and collaborations: http://adaptalaska.org

Other Partnerships and Capacity Development

Alaska tundra in fall. (Katie Cullen/National Park Service)

US Department of the Interior

US Department of the Interior (DOI) Tribal Climate Science Liaison

October 2016–present
ACCAP Lead(s): Nathan Kettle
Partner(s): Malinda Chase (DOI Tribal Climate Science Liaison)–Aleutian Islands Pribilof Association, DOI Alaska Climate Science Center, Bureau of Indian Affairs

With leveraged funds from the Bureau of Indian Affairs, ACCAP is partnering with the Aleutian Islands Pribilof Association and the Alaska Climate Science Center to support a tribal climate science liaison to improve the capacity of the 229 federally recognized tribes in Alaska for climate adaptation. The liaison is providing extension support, conducting research, and coordinating with other tribal climate science liaisons across the US. Extension support includes the identification of climate science needs, support of climate adaptation planning, and development of links between tribal needs and research capacity. ACCAP also collaborates with the tribal liaison on climate adaptation research, including the analysis of barriers to climate adaptation and assessment of best practices for connecting climate science and tribal science needs to support climate-sensitive decisions and adaptation. This position is housed in the Alaska Climate Science Center and is funded by the Bureau of Indian Affairs via the Aleutian Islands Pribilof Association.

Current Coastal Change Research/Management Projects and Priority Information Needs in Western Alaska and in Cook Inlet and Southeastern Alaska

May 2014–March 2017
ACCAP Lead(s): Sarah Trainor, Casey Brown, Michaela Swanson, Nicole Warner
Partners, Leveraged Funds: Western Alaska, North Pacific Landscape Conservation Cooperatives (US Fish, Wildlife Service)

Research on coastal change in Western and Southeast Alaska has increased rapidly in recent years, making it challenging to track existing projects, understand their cumulative insights, gauge remaining research gaps, and prioritize future research. The goal of this effort is to help the Western Alaska Landscape Conservation Cooperative (WALCC) and the North Pacific Landscape Conservation Cooperative (NPLCC) meet their mission of coordinating, developing, and disseminating applied science to inform conservation in the context of climate change.

The project identified current coastal research and management research projects taking place in these regions, complied a searchable database of projects, and synthesized the information into a report for each region. Existing projects were compared with identified regional information needs, revealing both gaps and synergies. The audience for this project is communities facing change, decision-makers navigating change, researchers pursuing projects, and agencies, such as the LCCs, prioritizing where to allocate resources. The project was presented in ACCAP webinars and at the Western Alaska Science Workshop. More information:

- WALCC: http://bit.ly/2z8Vndk
- NPLCC: http://bit.ly/2iDuKXS

An evaluation of the Western Alaska database was conducted by graduate student Nicole Warner with a relevant finding that interactive graphical representation, such as in map format, can make these types of decision-support tools more useful and effective.

US Department of Agriculture

Linking Alaska to the USDA Climate Change Hub System

June 2016–present
ACCAP Lead(s): Sarah Trainor
Partner(s): USDA, University of Alaska School of Natural Resources and Extension
Leveraged Funds: US Department of Agriculture (USDA)

ACCAP partners with the University of Alaska Fairbanks (UAF) School of Natural Resources and Extension to coordinate with the USDA Pacific Northwest Climate Change Hub on research and outreach in Alaska.

UAF is a recognized leader in Arctic climate change research and partnership with the USDA Pacific Northwest Climate Change Hub makes research findings more accessible to stakeholders. Specific activities include providing technical expertise, conducting research, developing data analysis protocols, and collaborating on projects, evaluation, presentations and publications. This partnership has expanded and lead to the USDA Climate Adapters project, started July 2017, which raises climate literacy and assesses tribal adaptation needs statewide.

Joint Fire Science Program

Alaska Fire Science Consortium

March 2010–present
ACCAP Lead(s): Sarah Trainor, Alison York
Partner(s) and Leveraged Funds: Joint Fire Science Program

ACCAP partners closely with the Joint Fire Science Program (JFSP) funded Alaska Fire Science Consortium (AFSC). AFSC is one of fifteen regional consortia supported by the JFSP and is part of a national fire science knowledge exchange network. ACCAP PI S. Trainor is PI for AFSC, ACCAP editor A. York is AFSC coordinator, and the two programs are co-located within the International Arctic Research Center at UAF. AFSC strengthens the link between fire science research and practical application by promoting communication and collaboration between managers and scientists, and providing an organized fire science delivery platform. This partnership expands ACCAP's communication and outreach with wildfire management stakeholders and provides them with cutting edge climate science and translation. The relationship is on the forefront of knowledge co-production.

More information:. http://bit.ly/2AGAF99

Nenana Ridge research burn near Fairbanks, AK. (Dale Haggstrom)

University of Alaska Fairbanks

Center for Global Change Student Grant Competition

July 2015–December 2016
ACCAP Lead(s): John Walsh
Partner(s): UAF Center for Global Change

ACCAP (Walsh) served on the review team for the 2015 Center for Global Change (CGC) student grant competition at the University of Alaska Fairbanks UAF). CGC annually funds students through a variety of sources and funding agencies (federal and state) as well as University of Alaska general funds. ACCAP provided funding for two CGC student projects whose projects' aligned with the greater ACCAP mission and foci.

One project was focused on the subsistence halibut fishery in SE Alaska. It assessed long-term trends in subsistence halibut harvest and evaluated the mechanisms driving changes in harvest. The other project investigated the morphology of the Beaufort Sea coastline during the last interglacial period as a potential historical analog for predicted future sea level change.

ACCAP Mini-Grant Projects

May–September 2015
ACCAP Lead(s): John Walsh, Tina Buxbaum

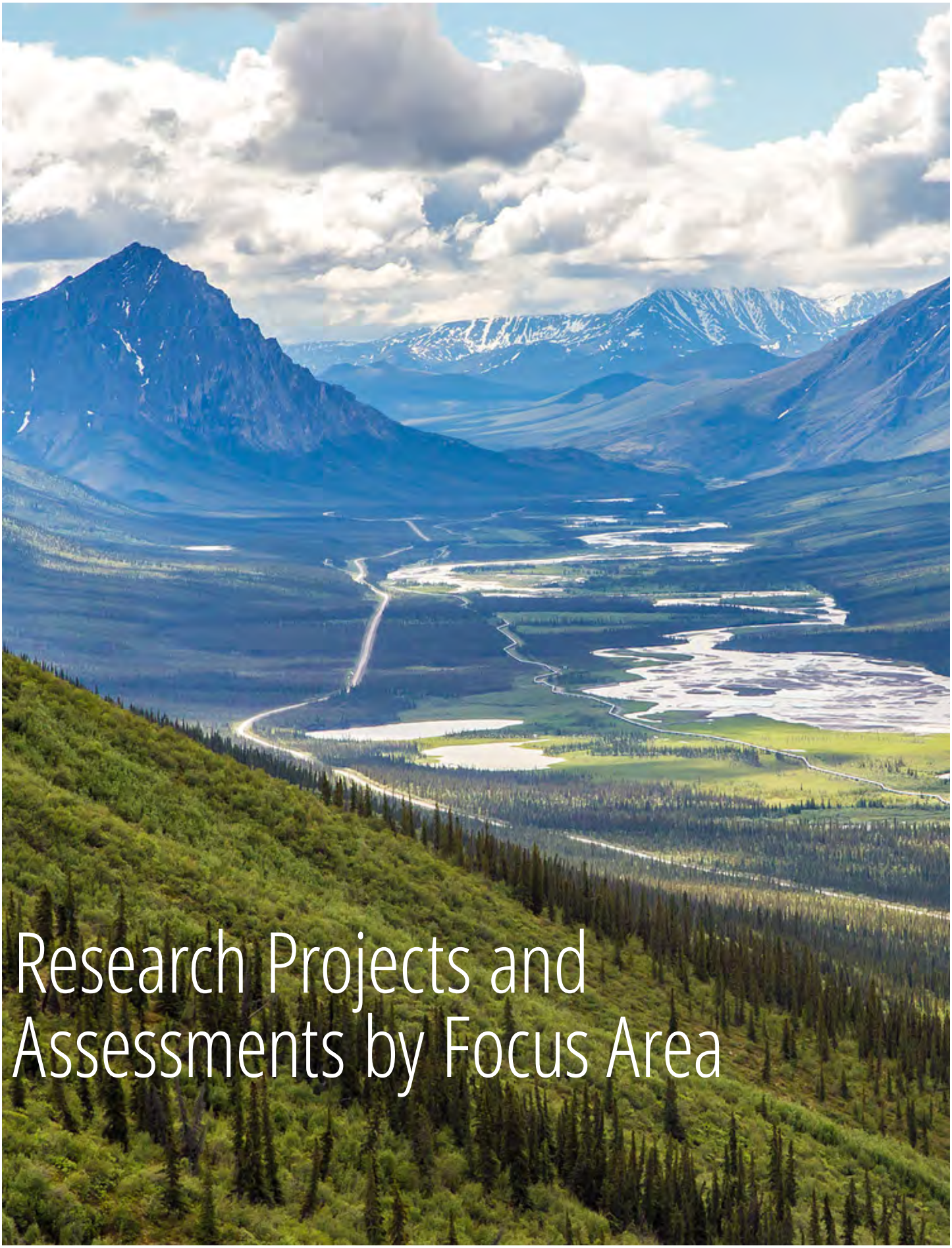
ACCAP solicited research proposals as part of a mini-grant competition in spring 2015. For each of the selected projects, ACCAP provided summer salary support (one month for faculty or three months for graduate students). Each of the six funded projects was required to have significant stakeholder engagement aimed at promoting action-oriented science.

Funded projects were:

- Informing fisheries adaptation to a changing environment
- Improving understanding of ringed and spotted sea ice habitat for resource managers
- Improving scientific understanding of the changing hydrologic system of the Jarvis Creek watershed and its impacts on the ecosystem
- Blue carbon: the role of marine predators in carbon storage and sequestration
- Climate-induced changes to trophic interactions of top predators and forage fish species in a sub-Arctic ecosystem
- Sustainable engineering techniques for rural and traditional Arctic infrastructure

More information: http://bit.ly/2BaC050

Autumn in the boreal upland white spruce-birch-aspen forest, Fairbanks, AK. (Tina Buxbaum)



Research Projects and Assessments by Focus Area

The Trans-Alaska Pipeline follows the Dalton Highway in the Brooks Range. (UAF photo by Todd Paris)

ACCAP's Nathan Kettle works with community residents on adaptation strategies. (ACCAP)

Adaptation Assessment

In Alaska, average annual statewide temperatures have risen almost 4°F from 1949 to 2005, so Alaskans are already responding to a changing climate. As oceans, landscapes, and ecosystems continue to change in the coming decades. Individuals and communities will need tools and information to help them adapt—responding to the current impacts as well as trying to increase resilience to future impacts.

Adaptation Actions for a Changing Arctic, Bering-Chukchi-Beaufort Region

October 2016–present
ACCAP Lead(s): John Walsh, Sarah Trainor

John Walsh and Sarah Trainor were key contributors to the Arctic Council Report, "Adaptation Actions for a Changing Arctic, Bering-Chukchi-Beaufort Region," due to be published by the Arctic Monitoring and Assessment Programme (AMAP) in December 2017.

John Walsh served as one of three scientific editors, lead author for the Introduction and Synthesis chapters, and contributing author for the *Regional Drivers of Change* chapter. Sarah Trainor was lead author for the Adaptation chapter and contributing author for the Synthesis chapter.

Overview report: http://bit.ly/2zq1fmE

Key publications

Hinzman, H.D. , J. Gamble, A. Klepikov, P. M. Outridge, L. Thorsteinson, S. F. Trainor, and J. E. Walsh. (Expected Dec 2017). Synthesis Chapter. In: Hinzman, L. D., et al. Adaptation Actions for a Changing Arctic (c), Bering, Chukchi, and Beaufort Region. The Arctic Council.

Trainor, S.F, L. Abruitina, F. Stuart Chapin III, Valery Chashin, David Driscol, Lawrence Hartig, Nathan Kettle, et al. (Expected Dec 2017) Adaptation Chapter. In: Hinzman, L. D., et al. Adaptation Actions for a Changing Arctic, Bering, Chukchi, and Beaufort Region. The Arctic Council.

Conceptualizing the Science-Practice Interface: Lessons Learned from a Collaborative Network on the Front-line of Climate Change

September 2012–June 2016
ACCAP Lead(s): Nathan Kettle, Sarah Trainor,, Phil Loring
Partner(s) and Leveraged Funds: DOI Alaska Climate Science Center

This social network analysis maps the relationships, communication channels, and information exchange among federal, state, tribal, industry and non-profit entities engaged in climate science, application, and services in Alaska.

Key findings: Our findings identify key actors as well as significant differences in the level of networking within and across roles (researchers, service providers, decision makers)—all of which inform recommendations for adaptive capacity and the co-production of usable knowledge. Some individuals engaged in multiple roles in the network suggesting that conceptualizing science policy interactions with the traditional categories of science producers and consumers oversimplifies how experts engage with climate science, services, and decision making. Our research reinforces the notion that the development and application of knowledge is a networked phenomenon and highlights the importance of centralized individuals capable of playing multiple roles in their networks for effective translation of knowledge into action.

Key publication

Kettle, N., S. Trainor, and P. Loring. Conceptualizing the science-practice interface: lessons learned from a collaborative network on the front-line of climate change. 2017 Frontiers in Environmental Science 5:33. DOI 10.3389/fenvs.2017.00033. http://bit.ly/2mOGMSB

Toksook Bay, AK. (Patricia Buxbaum)

Meta-analysis of Needs Assessments

March 2012–December 2013
ACCAP Lead(s): Corrie Knapp, Sarah Trainor

Climate change is complicating the variables that Alaskans consider when planning for the future. Communities, agencies and other entities have begun to grapple with both the information that they need to adapt to a changing climate and how the processes and practices of science should change to make science more useful. We reviewed and coded documents that expressed practical research needs related to climate change in Alaska. Our goals were to document stakeholder-defined research needs, assess whether there are spatial or topic-related gaps in needs assessment, and understand what stakeholders suggest about how science might be more relevant and useful in a changing climate.

Key findings: Overarching themes include the need for more baseline data to understand change, an interest in the social impacts of climate change, and a need to incorporate local perspectives. Research needs that were most frequently mentioned related to infrastructure, economics costs of climate change, adaptation planning, policy, and impacts to subsistence. Gaps included inadequate engagement of local perspectives and few examples of community-level assessments. Documents nearly unanimously expressed that science, as it is currently practiced, is unable to meet the challenges of climate change. They call for processes that are more transparent, collaborative, and accessible. They recommend changed practices including maintaining accessible data-sharing archives, building networks for knowledge sharing, and creating place-based long-term partnerships with communities.

This review complements the climate-change literature by providing concrete suggestions about stakeholder relevant research needs as well as how to increase the utility of science from a region that is experiencing some of the most dramatic climatic change on the planet.

Key publications

Knapp, C. & Trainor, S.F. (2015): Alaskan stakeholder-defined research needs in the context of climate change. Polar Geography. http://bit.ly/2zq2NgB

Knapp, C. & Trainor, S.F. (2013): Global Environmental Change, Volume 23, Issue 5, p. 1296–1306. http://bit.ly/2zpprFG

National Climate Assessments

September 2011–present
ACCAP Lead(s): Sarah Trainor, John Walsh, Phil Loring,, Nathan Kettle
Partner(s): US Global Change Research Program

For the Third National Climate Assessment (NCA), ACCAP provided substantial contributions to both the Alaska Regional Technical Report and the Climate Science and Alaska chapters. Trainor served as Contributing Lead Author (CLA) for the Alaska and Arctic Regional Chapter. J. Walsh served as a CLA for the Climate Science chapter. Loring served as a contributing author to the Marine chapter and as a member of the technical working group for the Rural Communities chapter. The Third NCA was released in 2014: http://bit.ly/1iTmlen

Sarah Trainor is a chapter author and Nathan Kettle is a contributor for the Alaska chapter of the Fourth NCA.

Key publications

Markon, C.J., Trainor, S.F., and Chapin, F.S., III, eds. 2012, The United States National Climate Assessment— Alaska Technical Regional Report: U.S. Geological Survey Circular 1379, 148 p. https://on.doi.gov/2hSd65y

Chapin, F. S. I., S. F. Trainor, P. Cochran, H. Huntingon, C. Markon, M. McCammon, A. D. McGuire and M. Serreze (2014). Alaska. Climate Change Impacts in the United States: The Third National Climate Assessment. J. M. Melillo, T. T. C. Richmond and G. W. Yohe, U.S. Global Change Research Program: 514-536. doi:10.7930/J00Z7150.

Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville 2014: Ch. 2: Our Changing Climate. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T. C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program,19-67.doi:10.7930/J0KW5CXT.

Integrated Arctic Management Report to the President

April 2012–April 2013
ACCAP Lead(s): Sarah Trainor, Scott Rupp
Partner(s): Scenarios Network for Alaska + Arctic Planning (SNAP), Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska
Leveraged Funds: Department of the Interior

The United States is an Arctic nation, one of only eight such nations worldwide that are responsible for the stewardship of a region undergoing dramatic environmental, social, and economic changes.

In consultation with the National Ocean Council, the National Security Staff, and the Arctic Research Commission, the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska (Alaska Interagency Working Group) initiated this report to describe challenges as they relate to the management of natural resources in the U.S. Arctic. The report presents recommendations for advancing a common management approach that provides coordinated, forward-thinking solutions. ACCAP and the Scenarios Network for Alaska + Arctic Planning (SNAP) provided research, writing, and editorial assistance for this report as well as maps and graphics depicting ecologically and culturally important areas, biota, and processes, natural resources, and key drivers of environmental changes in the Arctic.

Key publication

Clement, J. P., J. L. Bengtson, and B. P. Kelly. 2013. Managing for the future in a rapidly changing Arctic. A report to the President. Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska (D. J. Hayes, Chair),Washington, D.C., 59 p. http://bit.ly/2hSzKL1

Climate Change Adaptation in Alaska: Science, Planning and Action

October 2010–September 2012
ACCAP Lead(s): Sarah Trainor, John Walsh,, Brook Gamble

This work reports the results of a multi-sectoral synthesis of climate adaptation in Alaska. We engaged semi-structured interviews with key informants in conjunction with document analysis and literature review.

Key findings: Our investigation revealed three major categories of response to environmental change in Alaska. These are 1) community and institutional strategic planning and related funding mechanisms, 2) research and monitoring of environmental variables and 3) on-the-ground actions such as community re-location. This synthesis reveals that adaptive actions and activities are often initiated and motivated in response to immediate environmental conditions rather than as implementation of pre-meditated, deliberate or planned adaptations to climate change per se. In addition, people, communities, and governments are responding to climate impacts as part of an assemblage of many different environmental and social changes, which may or may not be definitively linked to climate change. This work reveals that, while planning and monitoring can occur at the statewide or regional level, adaptation actions occur most notably at the local scale.

Key publication

Trainor, S. F., Walsh, J. E., Gamble, J. B. (2017). Human Adaptation to Climate Change in Alaska: Overview and Recommendations for Future Research and Assessment. Technical Report #16-1. International Arctic Research Center, University of Alaska Fairbanks. http://bit.ly/2mO66Z4

ACCAP All-Hands meeting. (Tina Buxbaum)

Permafrost polygons in the Arctic. (National Park Service)

Arctic Climate

Sparsely populated, the Arctic has few weather stations and lacks a long record of climate observations, but even these limited data show that the region is undergoing rapid environmental change.

Temperatures in the Arctic are warming faster than any other region on Earth, especially in winter. The resulting dramatic losses of sea ice and thawing permafrost, glaciers, and ice sheets feed back to the global climate and amplify the effects of warming.

At the same time, the region's climate varies widely from year to year and from place to place, making it challenging to predict the future and critical to make the most of the information we have.

Downscaling of Climate Information for Alaska

January 2014–present
ACCAP Lead(s): John Walsh, Peter Bieniek
Partner(s) and Leveraged funds: DOI Alaska Climate Science Center (CSC) and the UAF Department of Atmospheric Sciences

In partnership with the Alaska CSC and the UAF Department of Atmospheric Sciences, ACCAP undertook a dynamical downscaling project for Alaska. This project used the WRF regional climate model, forced by two global climate models (GFDL and CCSM4) and two different RCP forcing scenarios through 2100. The forcing scenarios are the same ones used in our statistical downscaling work. Hindcasts for the post-1979 period and the 21st-century simulations are now complete.

Key findings: Western and southeastern Alaska show the greatest potential for marked changes from snow-dominated to mixed precipitation regimes, although these areas also exhibit a wide range of future conditions arising from the spread of climate model projections. Additionally, based on the rate of divergence of future scenarios of greenhouse gas and aerosol forcing, opportunities for human responses to future warming projected by global climate models can be distinguished by an adaptation phase through 2050–2060, and a mitigation phase from 2060 onward.

ACCAP has participated in statistical downscaling for Alaska and western Canada through a partnership with the Scenarios for Alaska and Arctic Planning (SNAP) of the DOI's Alaska Climate Science Center.

Key accomplishment: A user interface provides decadal downscaled temperature and precipitation, together with uncertainties, for more than 4,000 communities in Alaska and western Canada under three RCP future emission scenarios: http://bit.ly/2x2Qket

Key publications

Bieniek, P. A., U. S. Bhatt, J. E. Walsh, T. S. Rupp, J. Zhang, J. R. Krieger and R. Lader 2016: Dynamical downscaling of ERA-Interim temperature and precipitation for Alaska. J. Appl. Meteor. Climatol., 55, 635-654. http://bit.ly/2jexWZA

Lader, R., J.E. Walsh, U.S. Bhatt and P. Bieniek 2017: Projections of 21st century climate extremes for Alaska via dynamical downscaling and quantile mapping. J. Appl. Meteor. Climatol., 56(9), 2393–2409, DOI: 10.1175/JAMC-D-16-0415. http://bit.ly/2z87h7b

Climate Divisions for Evaluation of Anomalies and Trends in Alaska

August 2012–March 2015
ACCAP Lead(s): Peter Bieniek, John Walsh
Partner(s): NOAA National Weather Service

Climate divisions outline geographic regions with homogeneous climate variability. Divisions are often used for addressing climate trends, drought and other seasonal/annual climate monitoring and prediction applications.

In this project, monthly divisional average temperature, precipitation and snow were calculated using Global Historical Climatology Network-Daily data for 1920–2012. Analysis shows that divisional average temperature reasonably represents monthly variability at historical stations within each division; precipitation is less representative. Evaluation of divisional extreme events also seems plausible if employing daily data.

Key accomplishment: Thirteen climate divisions were delineated for Alaska, opening up new avenues of climate and prediction for the region. Results show that monthly divisional average temperature and consecutive-day precipitation enhance Alaska climate information, opening new potential research directions. Climate divisions have been transitioned to operational use by the NCEI.

Key publications

Bieniek, P., J. E. Walsh, R. L. Thoman, U. S. and Bhatt 2014. Using climate divisions to analyze variations and trends in Alaska temperature and precipitation. Journal of Climate. http://bit.ly/2zqcDz2

Bieniek, P. A., U. S. Bhatt, R. L. Thoman, H. Angeloff, J. Partain, J. Paipneau, F. Fritsch, E. Holloway, J. E. Walsh, C. Daly, M. Shulski, G. Hufford, D. Hi.., S. Calos and R. Gens. 2012. On revising the climate divisions for Alaska, Journal of Applied Meteorology and Climatology, 51, 1276-1289.

Yukon River breakup floods and damages the village of Galena, AK. (Ed Plumb)

Extreme Events

Understanding past extreme events, both the cause and effects, and the future projects of extreme events in Alaska are of great interest and importance for future adaptation measures. Unfortunately, evaluations of historical trends and future projections of extreme events in the Alaskan region lag behind such studies for other regions.

More importantly, in the context of adaptation planning, product and information needs on extreme events in Alaska have yet to be addressed in a user-targeted framework.

Projecting Changes to Extreme Weather and Climate for Alaska during the 21st Century

September 2015–present
ACCAP Lead(s): Rick Lader, John Walsh

Extreme events are rare by definition, and because ecosystems are often not adapted to rare or unobserved conditions, rapidly changing extreme weather patterns can make these systems vulnerable. Using dynamically downscaled regional climate model simulations that cover a historical period (1976–2005) and a future RCP8.5 scenario (2006–2100) we are examining changes in extremes. This research has been instrumental in several climate change attribution studies.

Key findings: The 2015 Alaska wildfire season, which burned more than five million acres, was made 34-60% more likely due to anthropogenic effects. Additionally, Alaska's record warm winter of 2015/16 is likely to become normal by mid-century. This research also showed that less than half of the anomalous winter warmth in Alaska during the 2015–2016 is directly attributable to the atmospheric circulation (including effects of El Niño). The largest portion of the remainder appears to have resulted from abnormally warm ocean temperatures south of Alaska, unusually low sea ice coverage west of Alaska, and a deficient snow cover over the land. The latter effect explains the fact that the largest "excess" warmth occurred during the late winter and early spring when more solar radiation is available to be absorbed by the darker surfaces no longer covered by snow as they have been in the past.

Further results from this project include documenting an asymmetric warming of extremes. The observed ratio of record high maximum to record low minimum temperatures set now routinely exceeds 3:1 Simulations by climate models project an increase of growing season length by nearly 50 days, and a 50% increase in the maximum consecutive day precipitation by 2100.

All of these findings have implications for land management decisions that are both short and long term in scope.

Key publications

Partain et al. 2016. An assessment of the role of anthropogenic climate change in the Alaska fire season of 2015. DOI:10.1175/BAMS-D-16-0149.1. http://bit.ly/2hQLxJE

Walsh, J.E., P.A. Bieniek, B. Brettschneider, E.S. Euskirchen, R. Lader, and R.L. Thoman 2017: The Exceptionally Warm Winter of 2015/16 in Alaska. J. Climate, 30 2069–2088, DOI: 10.1175/ JCLI-D-16-0473.1. http://bit.ly/2kMEezy

Bieniek, P. A., and J. E. Walsh 2017:. Atmospheric circulation patterns associated with monthly and daily temperature and precipitation extremes in Alaska. International Journal of Climatology. doi:10.1002/joc.4994. http://bit.ly/2kyktuj

Bennett, K. E., and J. E. Walsh 2014: Spatial and temporal changes in indices of extreme precipitation for Alaska. International Journal of Climatology, doi: 10.1002/joc.4067. http://bit.ly/2jcFv2I

Lader, R., J. E. Walsh, U. S. Bhatt and P. A. Bieniek 2017: Projections of twenty-first century extremes for Alaska via dynamical downscaling and quantile mapping. J. Appl. Meteor. Climatol., 56(9), 2393–2406. http://bit.ly/2z87h7b

Establishing a Targeted, Functional Storminess Indicator for the Alaska Region

August 2015–present
ACCAP Lead(s): Norm Shippee, John Walsh
Partner(s): David Atkinson, University of Victoria

Marine operators in Alaskan coastal waters and adjacent seas are sensitive to weather constraints. Among the stakeholder groups affected are commercial shippers (including barge operators), coastal communities, fishing vessel operators and the offshore oil and gas industry. There is a need for products that would enable "go/no-go" decisions over timescales of several days, as well as monthly to seasonal outlooks that would facilitate decisions related to scheduling and routing. This means that integrating data about wind speed, direction, and duration to create a metric that provides information integral to support the decision making process.

ACCAP is partnering with marine shipping communities to understand thresholds for strong wind events and integrate this information into applied storminess forecast indicators and tools for marine stakeholders. There has been engagement of stakeholders at the planning level, with participation in workshops and teleconferences with other stakeholders providing ways to integrate the new indicator information into planning. The storminess indicator is just now being used for general planning activities.

Key accomplishments: Development of seasonal storm event and lull event climatology for the circum-Arctic. Additionally the Lull and Storm Winds (LSW) algorithm, developed using hindcast weather and climate information, has been modified to use forecast products from the current generation of global weather forecasting systems in the US. Additionally, this project has led to the establishment of an extended extratropical cyclone climatology for the Gulf of Alaska and Bering Sea back to 1920, which allows for a better understanding of how cyclones have changed within the recent past.

Strategies for Flood Risk Reduction and Fostering Socioeconomic Wellbeing in Northern US and Russian Communities

January 2015–May 2017
ACCAP Lead(s): Katia Kontar, Sarah Trainor
Partner(s): DOI Alaska Climate Science Center and US Department of State's P2P (Peer to Peer) program

In Alaska, US and Yakutia (Sakha Republic), Russia, spring is known as a flood season. Rapid warming can force river ice to break up quickly and pile in tremendous jams at narrow and sharply curved points of the rivers, flooding nearby settlements. Both Alaskans and Yakuts are prepared for ice jams, but not for the severity of their consequences. Significant funds are spent on challenging annual disaster response and recovery efforts. In addition to the financial losses, spring floods lead to injuries and loss of life, displacement and long-term evacuation of population, damage to cultural or heritage sites, loss of means of livelihood, and ecosystem resource loss. Crippling costs may be reduced, and community well being improved, through a cross-society and cross-disciplinary approach to mitigating the problem.

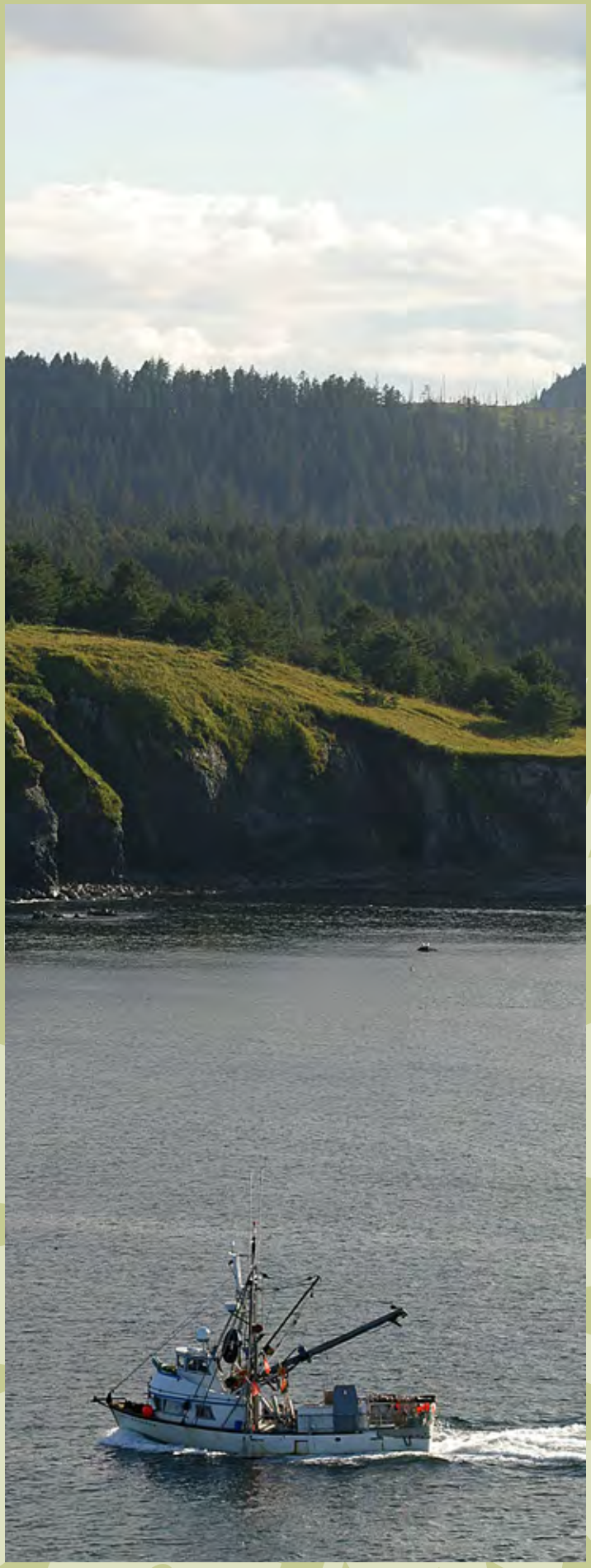
Key findings: In Alaska, the outcomes of this project in partnership with the US Department of State's P2P (Peer to Peer) program included decisions not to implement several measures attempted in Russia because their effectiveness has not been rigorously proven and costs could easily run into the hundreds of thousands of dollars. Other outcomes include a shift away from a policy of evacuation and a shift towards more proactive flood management in both communities. In Alaska, the project led to an agreement among various governmental entities to coordinate and invest in planning and mitigation efforts to minimize damage from future floods.

Key publications

Taylor, K., R. Hum and Y. Kontar (2016). Comparative Analysis of Virtual Relief Networks and Communication Channels During Disaster Recovery After A Major Flood in Galena, Alaska, Spring 2013. Advances in Natural and Technological Hazards Research, Springer. 45: 151-171.

Kontar, Y.Y., Trainor S.F., Gavrylieva, T.N., Echelberger, J.C., and Tananaev N.I. (In Press). Advancing Springtime Flood Risk Reduction in the Arctic through International and Interagency Collaborations. Global Change and Future Earth: The Geodetic and Geophysical Perspective. Cambridge University Press.

Sea ice off the coast of Nome, AK. (David Atkinson)



Commercial fishing boat, coastal Alaska. (Brook Gamble)

Coastal and Living Marine Resources

Longer than all the other states' coastlines combined, Alaska's coast borders three distinct marine regions: the Arctic Ocean, Bering Sea, and Gulf of Alaska. Connected to the global oceans, all of these regions—and their ecosystems—are undergoing profound changes that make it difficult to predict the future.

Communities that depend on Alaska's productive waters are facing impacts from warmer ocean temperatures, coastal erosion, ocean acidification, loss of sea ice, and changes in marine ecosystems.

Ocean Acidification Vulnerability Index (OAVI)

September 2012–December 2013
ACCAP Lead(s): Jeremy Mathis
Partner(s) and Leveraged Funds: NOAA Pacific Marine Environmental Laboratory (PMEL) and the University of Alaska Ocean Acidification Research Center

The overall goal of this project was to assess the potential risk of ocean acidification on marine resources within the state of Alaska, using the best available and most recent chemical, biological and socio-economic data.

Key findings: Results show that Southeastern Boroughs and Boroughs around Fairbanks and Anchorage are more resilient towards a collapse in important industrial sectors as their financial resources, educational attainment and job diversity allow for a potential shift to alternative industries, whereas other boroughs do not have as many resources to rely on. Also, these less resilient and more rural areas, such as Wade Hampton or Bethel, are highly dependent on subsistence fisheries and could therefore be greatly affected by an ocean acidification-induced decrease in fish harvest. Boroughs like Kodiak Island are greatly dependent on the commercial fisheries revenue, however have a moderate resiliency and are more likely to be able to rely on other resources.

Key accomplishment: We have combined socio-economic data with our current knowledge about ocean acidification to develop an overall index assessing the risk from ocean acidification for Alaska. This preliminary assessment creates the foundation for future research on this large-scale, multi-disciplinary issue with potential consequences for Alaska's marine ecosystems, people and economy

Key publication

J.T. Mathis, S.R. Cooley, N. Lucey, S. Colt, J. Ekstrom, T. Hurst, C. Hauri, W. Evans, J.N. Cross, R.A. Feely, Ocean acidification risk assessment for Alaska's fishery sector, In Progress in Oceanography, Volume 136 2015, Pages 71-91, ISSN 0079-6611. http://bit.ly/2zWHH8p

Gauging Public Perceptions of Ocean Acidification in Alaska

June 2013–December 2014
ACCAP Lead(s): Lauren Frisch, Nathan Kettle, Jeremy Mathis,, Sarah Trainor
Partner(s): University of Alaska Ocean Acidification Research Center

Ocean acidification (OA) has important implications in Alaska because of potential impacts on the fishing industry. The purpose of this project was to better understand public perception in Alaska of OA, ocean health, and related research and policy.

Key findings: Alaskan residents believe they have a limited knowledge and awareness of OA. Although, participants with a higher level of self-assessed understanding of OA associate OA with human activity, but do not associate OA with natural variability. Among factors assessed, ocean acidification is the second greatest perceived threat to Alaska fisheries, only behind overfishing. Finally, concern for OA increases from the near term (present to 10 years from now) to the future (50-100 years).

Key publication

Frisch, L. J. Mathis, N. Kettle, and S. Trainor. 2015. Gauging perceptions of ocean acidification in Alaska. Marine Policy. 53:101-110. http://bit.ly/2zpvGJU

Fisheries, Food Security, and Climate Change in the Kenai Peninsula

September 2011–February 2013
ACCAP Lead(s): Phil Loring, Hannah Harrison

We distributed a survey to residents in the Kenai Peninsula region of Alaska, to determine the prevalence of food security, and to elicit the role of locally caught seafood in household food security.

Key findings: We found that access to locally caught seafood plays a significant role in providing for household food security, especially for the lowest-income households. A great majority of households report fishing, but nearly a quarter report that sharing is in fact the primary way that they obtain local seafood. Thus, both income and access to seafood play primary roles in determining household food security outcomes.

These results serve to underscore the importance of local seafood to Alaskans, an essential step in understanding if and how communities are vulnerable to changes in those fisheries. Results also highlight a gap in the equitable access to locally caught seafood.

Key publications

Loring, P. A., Gerlach, S. C., & Harrison, H. L. (2013): Seafood as local food: Food security and locally caught seafood on Alaska's Kenai Peninsula. Journal of Agriculture, Food Systems, and Community Development, 3(3), 13–41. http://bit.ly/2jLEKl8

Loring, P. A., Gerlach, S. C., & Harrison, H. L. (2013): Local Perceptions of the Sustainability of Alaska's Highly Contested Cook Inlet Salmon Fisheries, Society & Natural Resources: An International Journal. http://bit.ly/2mPWxc9

BioMap Alaska

July 2012–August 2013
ACCAP Lead(s): Phil Loring
Partner(s): Alaska SeaLife Center and Arctic Landscape Conservation Cooperative
Leveraged Funds: Arctic Landscape Conservation Cooperative (US Fish, Wildlife Service)

The BioMap project tested a web-based citizen-science initiative to collect information on marine species of concern and local ecological knowledge of the marine ecosystems along the Alaska region of the Chukchi and Bering seas. We engaged community members in Kotzebue, Barrow, and Kaktovik to test and evaluate a reporting system for uploading observations and developing maps that are useful for management and education purposes.

We hope that from these efforts we can improve collaborations among managers, scientists, and local stakeholders through a forum of continuous exchange of information. Non-scientists can offer important observations where a planned scientific monitoring program is absent or marginal in location, duration, and seasonality. Residents of coastal communities have a vast knowledge of the marine ecosystem and marine species, and their use of marine resources provides an invaluable opportunity to obtain observational data not otherwise available.

Key accomplishment: BioMap Alaska online tool: http://www.biomapalaska.org/

Coastal and Marine Downscaling and Visualization Tools for the U.S. Arctic and Alaska

December 2011–June 2013
ACCAP Lead(s): John Walsh
Partner(s): Alaska Ocean Observing System (AOOS) and Scenarios Network for Alaska + Arctic Planning (SNAP)
Leveraged Funds: Alaska Ocean Observing System (AOOS)

Climate downscaling in Alaska has focused on terrestrial areas. This work provided important new data relevant to offshore and coastal locations impacted by variations in surface temperature, winds, and sea ice. This project is part of the larger AOOS Spatial Tools for Arctic Mapping and Planning (STAMP) project.

Key findings:

- Analysis of surface winds and temperature indicates that by the late 21st century, coastal and offshore Alaska will experience major increases in the number of extremely "warm/hot" days and major decreases in the number of extremely "cool/cold" days relative to present-day thresholds. Changes are especially large in fall and winter.
- By late century, high-wind events are projected to increase in Alaska's northern coastal waters in summer and autumn; projected trends are weak in other coastal sectors.
- The open water season length, and hence the vulnerability to coastal flooding and erosion, is projected to increase by several months at most coastal locations in western and northern Alaska by late century. This increase results from the retreat of sea ice more than from changes in storminess.

Key accomplishment: We developed a quantile-mapping algorithm and applied it to daily historical fields and climate model output for the Alaska region. This project provides gridded downscaled data sets for sea ice, wind, and sea surface temperature for Alaska coastal area, as well as an analysis of the projected changes, their potential impacts, and adaptation implications. Users can explore and analyze historical data and SNAP climate projections with this set of dynamic presentation tools powered by R and Shiny: http://bit.ly/2z9ngBZ

Spawned-out salmon have completed their journey. (Brook Gamble)

Forests and Wildfire

Heavy smoke blankets the region during a summer wildfire. (UAF photo by JR Ancheta)

The forests that cover one-third of Alaska are burning more widely and frequently. Wildfires are a natural part of the boreal forest, but warmer temperatures, longer snow-free seasons, changes in vegetation, and insect outbreaks have led to longer and more active fire seasons in Alaska. In addition, recent tundra fires have raised the attention of fire managers, ecologists, and local residents.

The area burned in Alaska was twice as large in the 2000–2009 decade than in any decade in the previous 40 years (1960-1999); 6.6 million acres burned in the peak year of 2004. Models project that the area burned per decade will double again by the middle of the century, with implications for ecosystems, landscapes, communities, wildlife and wildfire management.

Understanding how the changing fire regime will impact wildfire management is among the top five research needs identified by fire managers in Alaska.

Modeling the Effects of Fire Severity and Climate Warming

January 2013–December 2014
ACCAP Lead(s): Scott Rupp
Leveraged Funds: Department of Defense Strategic Environmental Research and Development Program, DOI Alaska Climate Science Center, USFWS Arctic and Western Alaska Landscape Conservation Cooperatives.

The integration of the fire severity model into an ecosystem process-based model allowed us to document the relative importance and interactions among local topography, fire regime and climate warming on active layer and soil carbon dynamics. For this project, we have completed two model simulation experiments analyzing future landscape change under multiple climate change scenarios.

Key findings: Simulations of future fire regimes in Alaska indicate that declines in the quantity of core winter caribou range in the future due to larger and more frequent fires could impact caribou abundance through decreased forage and/or competition with moose. These impacts would likely be detrimental to subsistence users that rely on this resource. Additionally, changes in fire regime and caribou abundance could amplify feedback mechanisms, such as decreasing albedo, by facilitating shrub growth that may hasten climate-driven changes to the composition and structure of vegetation communities in the low Arctic. Other results include:

Lowlands were more resistant to severe fires and climate warming, showing smaller increases in active layer thickness and soil carbon loss compared to drier flat uplands and slopes.

Fire was primarily responsible for a reduction in organic layer thickness by 2100 that led to an increase in active layer thickness by 2100.

Our analysis suggests that ecosystem carbon storage in boreal forests in interior Alaska is particularly vulnerable, primarily due to the combustion of organic layer thickness in fire and the related increase in active layer thickness that exposes previously protected permafrost soil carbon to decomposition.

Tongass National Forest Climate Change Vulnerability Assessment

January 2011–June 2012
ACCAP Lead(s): Sarah Trainor, Scott Rupp
Partner(s): US Forest Service, Scenarios Network for Alaska + Arctic Planning (SNAP), and University of Alaska Southeast (UAS) Alaska Coastal Rainforest Center
Leveraged Funds: US Forest Service

The future climate in the Tongass National Forest will likely be different than both what we see now, and what we have seen in the past. A changing climate in southeast Alaska influences social, ecological, and economic systems that interface with the environments managed by the US Forest Service (USFS). In order to better prepare the Tongass for what the uncertain future might hold in terms of climate change in Southeast Alaska, the USFS and the University of Alaska Fairbanks (UAF) initiated the first of a three-phase vulnerability assessment. In this preliminary phase, we collaborated with Tongass National Forest staff and regional stakeholders in southeast Alaska to identify priority resources at risk under projected future climate scenarios. A workshop was organized and hosted in Juneau to identify social, ecological, and economic resources in and around the Tongass NF that are vulnerable to climate-related changes; using a set of climate scenarios. We discussed how climate change may impact these resources, and prioritized a list of candidate resources for a more detailed analysis during later project phases.

Key findings: Under all scenarios, the Tongass is projected to warm and receive slightly more precipitation over the next century, and changes in temperature are expected to result in a longer growing season, later or no anticipated freeze date, and earlier or no anticipated thaw date. According to the prioritization process, it was evident that water-related resources were top priorities for a vulnerability assessment in the Tongass.

Reports and other related resources: http://bit.ly/2hS9uk7

The tiny coastal Alaska community of Little Diomede. (Richard Brahm/US Coast Guard)

Native and Tribal Adaptation

Twenty-five percent of all Alaskans, and 46 percent of Alaska Natives, live in communities of fewer than 1,000 people. Most of these communities are accessible only by boat or aircraft. Dependent on local resources, rural Native communities in Alaska are among those most directly impacted by the changing climate.

ACCAP continues its focus on conducting research, building adaptive capacity, and developing decision support for these vulnerable and underserved communities. Balancing societal needs with research priorities, we work to innovate new approaches to involving residents in identifying concerns and adaptation tools and processes can be effective ways to engage communities and tribes in urgent public issues such as resource development.

Supporting Climate Change Adaptation Planning in Northwest Alaska

January 2016–December 2017
ACCAP Lead(s): Nathan Kettle, Sarah Trainor,, Josie Sam
Partner(s): Glenn Gray and Associations, Alaska Sea Grant

ACCAP partnered with Glenn Gray and Associates to identify best practices for supporting climate adaptation planning in Northwest Alaska. Our analysis was based on interviews with community members involved in two recent coastal climate adaptation planning efforts in Shaktoolik and Nome, Alaska. We explored the specific decision and cultural contexts of Northwest Alaska Native communities that must be considered in the design of effective climate adaptation planning efforts, including the role of traditional knowledge, governance, values, and barriers.

Key findings: Lessons learned for supporting climate adaptation planning in rural indigenous communities include the importance of building trusted relationships, conducting preliminary scoping, engaging communities in the design and implementation of strategies, focusing on the outcomes of plans, respecting local knowledge side by side with climate science, respecting tribal sovereignty, supporting capacity building in the planning and design of climate adaptation strategies, and supporting formal and informal networking and partnerships.

Key publication

Kettle, N., J. Sam, G. Gray, T. Johnson and S. F. Trainor (Expected 2018). Supporting Climate Adaptation Planning in Northwest Alaska. Addressing Climate Change at the Community Level in the United States. P. R. Lachapelle and D. Albrecht, Routledge.

Tribal Climate Adaptation Planning in Nome

October 2015–September 2017
ACCAP Lead(s): Nathan Kettle
Partner(s): Nome Eskimo Community
Leveraged Funds: Bureau of Indian Affairs

Key accomplishment: The Nome Eskimo Community (NEC), in collaboration with ACCAP, developed a climate adaptation plan for the Nome based tribes. This includes tribal members of NEC, Native Village of Solomon, Native Village of Council, and King Island Native Community.

The project goals were to build climate literacy, including familiarity with climate science and local knowledge, provide a forum to identify and discuss climate impacts and adaptation strategies, develop a plan, and share information with other rural Alaska and Native communities. This process consisted of interviewing community members to scope the planning process; facilitating four community workshops to identify impacts of concern, share goals and visions of success, and identify and prioritize adaptation actions; drafting the climate adaptation plan; evaluating the adaptation planning process; and participating in outreach activities such as conference presentations and public information sessions. This process led to the identification of eight climate adaptation initiatives.

Key publication

Kettle, N., J. Martin, and M. Sloan. 2017. Nome Tribal Climate Adaptation Plan. Nome Eskimo Community and The Alaska Center for Climate Assessment and Policy. Fairbanks, AK. http://bit.ly/2zWRhsA

Synthesis of Tribal Climate Adaptation in Alaska

March 2017–August 2017
ACCAP Lead(s): Danielle Meeker, Nathan Kettle
Partner(s): SCRIPPS Research Institute

Key accomplishment: The project synthesized tribal climate adaptation needs assessments, workshop reports, and adaptation plans in Alaska to document barriers to climate adaptation planning, understand the current level of support for climate adaptation planning, examine the extent to which climate science and traditional knowledge are being used in tribal climate adaptation plans, and identify climate science needs related to climate adaptation planning among Alaska Native tribes. This work was designed to inform the recently hired BIA tribal climate science liaison for Alaska. ACCAP Intern Danielle Meeker has subsequently been hired as a Sea Grant Fellow in the State of Alaska Lieutenant Governor's Office to work on state climate change initiatives.

Key publication

Meeker, D., and N. Kettle. 2017. A synthesis of climate adaptation planning needs in Alaska Native Communities. Alaska Center for Climate Assessment and Policy; Fairbanks, AK. http://bit.ly/2zXSAao

The captivating and dynamic shapes of sea ice. (Edmand Falk)

Sea Ice

Satellite records show continued summer loss of Arctic sea ice. The eleven lowest seasonal minimum ice extent in the summer as soon as the 2020s.

We need more detailed pictures of what to expect—and when—so we can better prepare and adapt to such changes.

Analog Forecasting of Arctic Sea Ice

September 2015–present
ACCAP Lead(s): John Walsh, Brian Brettschneider

Estimating the maximum and minimum sea ice extent, before it occurs, is an important tool for developing and implementing near-term public policy. Examples include: subsistence food harvest planning, biological monitoring, shipping schedules, other commercial activities, regulatory implementation, and national security planning.

Most sea ice projections for the period two to nine months in advance are generated by dynamic or statistical climate models. These models have widely varying success (verification) rates. An alternative method is to forecast sea ice extent based on similar years in the past. An analog forecast tool developed under NOAA funding has been used to forecast geographical areas ranging from hemispheric down to synoptic scales. In an abstract sense, the initiative represents a sophisticated form of pattern matching. In a rapidly changing environment, analog forecasting is a key tool in the climate forecasting toolbox.

Key accomplishment: ACCAP used the analog tool to prepare seasonal forecasts of pan-Arctic sea ice for two recent Septembers, 2016 and 2017. In both cases the forecasts were contributed in June (with subsequent updates) to the Sea Ice Prediction Network, which compiles and distributes the forecasts provided by several dozen groups worldwide. In both years, ACCAP's analog-derived forecasts were within 0.4 million km2 of the observed September sea ice extent. Tool: http://bit.ly/2wZ8i3A

Historical Sea Ice Atlas for Alaska Waters

September 2011–present
ACCAP Lead(s): John Walsh
Partner(s): Alaska Ocean Observing System (AOOS), and Scenarios Network for Alaska + Arctic Planning (SNAP)
Leveraged Funding: Alaska Ocean Observing System (AOOS)

Coastal communities, marine navigation, industry (fishing, tourism, offshore resource extraction), the military, and Earth/Arctic system science research have all expressed a clear need for an Alaska sea ice atlas. Indeed, many requests for historical and climatological sea ice information for Alaska coastal waters previously went unanswered because such an atlas did not exist. The availability of GIS software, in-house expertise and historical databases extending back to the 1850s made the construction of an Alaska sea ice atlas timely and feasible. This atlas is the first ever consolidated, digitized, historical record of sea ice concentrations in coastal and offshore waters of Alaska, spanning the time period from the 1850s through present.

Key accomplishment: The atlas consists of digitally stored sea ice concentration data on a grid covering all Alaska coastal waters to a distance of ~500 km (300 mi) from shore, with a spatial resolution of 25 km. The time resolution is monthly for the period 1850s-1950s, and weekly for the period from the early 1950s onward.

The Atlas is updated twice annually, with the most recent update through 2016: http://bit.ly/2vK6l7K

Key findings: Scientific results from an analysis of the Sea Ice Atlas data include:

- The recent (post 2007) period is unique in its retreat of summer sea ice in Alaska seas. No month since 1850 has had as little sea ice in Alaska waters as did September 2012.
- The open water season length has increased by 1 to 3 months since 1950 in most coastal seas of Alaska; the increase is even greater at some locations in the Chukchi and Beaufort Seas.
- The trend of Alaska sea ice loss over the past 100-150 years has been much larger in summer than in winter. The corollary is that Bering Sea ice cover has decreased much more slowly than sea ice in the Chukchi and Beaufort Seas.

Additionally in 2014 ACCAP evaluated the user experience of the Sea Ice Atlas. We found people primarily use the Historical Sea Ice Atlas for research, general information, and personal information. They approach the data from a wide variety of fields including natural resources, wildlife, local and cultural activities, engineering, transportation, emergency response, and health. They tend to access it either annually or monthly depending on the data and applications of interest.

Often a single respondent used the tool in several ways:

"I have used it to field information requests from policy-makers and stakeholders at the federal, state and local levels with regards to how sea ice extents have impacted coastal erosion and coastal flooding in Alaska. I have used it as a research tool to extract location-specific sea ice extents for use in the preparation of scientific manuscripts. I have also used it as a teaching tool both in and outside of the classroom."

Wind is a great source of renewable energy for Alaska. (Patricia Buxbaum)

Water, Energy, and Economics

Climate models predict that precipitation is likely to increase overall in Alaska in the coming decades.

Alaska has some of the largest and fastest-changing glacier systems on earth, and about 80 percent of its land is in permafrost zones. As the climate gets wetter and as warmer temperatures will thaw these massive ice reserves, patterns of runoff will change across the landscape, impacting water systems and water management in many ways.

Understanding the impacts of climatic factors on water is important for developing hydroelectric power, predicting river ice breakup, and managing our natural resources.

Regional Assessments of Health Vulnerability and Environmental Security (RAVENS) Phase I: Water Security in Bristol Bay

October 2011 — July 2013
ACCAP Lead(s): Phil Loring, Henry Penn
Partner(s): Alaska Native Tribal Health Consortium, Bristol Bay Borough, Bristol Bay Native Association
Leveraged Funding: NOAA Climate Program Office (CPO), Climate and Societal Interactions (CSI) Coastal and Ocean Climate Applications (COCA) Program

This project conducted spatial analysis and testing of an adaptive capacity/assets framework used to evaluate water/wastewater resources and infrastructure among communities of the Bristol Bay region. The general premise is that climate change is a spatially explicit challenge, with trends that can be described at large spatial and long temporal scales, but with impacts that can only be observed and understood at the local level.

Key findings: Community water/wastewater infrastructure in multiple Bristol Bay communities is presently being impacted by climate change, a trend common across all of Western Alaska, but most pronounced in communities with infrastructure built near the coastlines, or in communities in areas of discontinuous permafrost. Existing carrying capacity regarding the provisioning of community water/wastewater services is limited year round and is stressed even more during times of year when human resources are depleted (e.g., fishing and hunting seasons), and/or when community infrastructure experiences increased demand (e.g., during commercial fishing seasons, when community populations can double). These patterns of community capacity have a distinct seasonal pattern, with some seasons of vulnerability and other seasons of resilience. Regional coordination for water security is more or less non-existent, shipping of replacement materials/equipment is cost-prohibitive, and many communities do not have sufficient revenues to fund operation and maintenance of water/wastewater systems.

Project outputs included a seasonally explicit decision support calendar for viewing human resource capacities and possible climate-risks simultaneously. This project was conducted with the support of the City of Dillingham, the Bristol Bay Native Association, and the Bristol Bay Borough.

Key publications

Penn, H.J., S.C. Gerlach, and P.A. Loring, 2016: Seasons of Stress: Understanding the Dynamic Nature of People's Ability to Respond to Change and Surprise. Weather. Climate Soc., 8, 435–446. http://bit.ly/2aJljkZ

Penn, H.J., Philip A. Loring, William E. Schnabel, Diagnosing water security in the rural North with an environmental security framework, Journal of Environmental Management, Volume 199, 1 September 2017, p. 91–98. http://bit.ly/2hJvY2M

Bristol Bay Borough is a group of rural Alaska fishing communities in Southwest Alaska situated at the mouth of the Kvichak River. (Bristol Bay Borough)

Vulnerability of Hydropower Production in Alaska to Climate Variability and Change: Best Practices for Communication and Application of Climate Science

October 2012–January 2017
ACCAP Lead(s): Sarah Trainor, Jessie Cherry
Partner(s) and Leveraged Funding: NOAA National Marine Fisheries Service, NOAA Earth System Research Laboratory

Many operators of existing hydropower facilities in the state of Alaska manage their water resources with little or no information about water stored in the snowpack or streamflows feeding the reservoirs. They also lack the capacity for making use of seasonal forecasts of temperature and precipitation that may be linked to known modes of climate variability (i.e. El Niño-Southern Oscillation and the Pacific Decadal Oscillation). Scientifically credible longer-term projections of climate change are also currently underutilized in planning, managing and licensing hydropower facilities.

This work reviewed hydroclimate changes in the Alaska and their impacts on hydropower; it provides a template for application of current techniques for prediction and estimating uncertainty, and it describes best practices for integrating science into management and decision-making.

Key findings: The growing number of hydrologic impacts studies suggests that information resulting from climate change science has matured enough that it can and should be integrated into hydropower scoping, design, and management. Continuing to ignore the best-available information in lieu of status quo planning is likely to prove costly to society in the long term.

Key publication

Cherry, J. E., Knapp, C., Trainor, S., Ray, A. J., Tedesche, M., and Walker, S.:2017. Planning for climate change impacts on hydropower in the Far North, Hydrol. Earth Syst. Sci., 21, 133-151. http://bit.ly/2Bb6Dax

Analysis of Current and Projected Future Economic Effects of Climate Change in Alaska

November 2015–September 2017
ACCAP Lead(s): Sarah Trainor, John Walsh
Partner(s): University of Alaska Anchorage, Institute of Social and Economic Research (ISER)

Although much has been written about potential physical and ecological effects of climate change in Alaska and their consequences for people, relatively little research has specifically addressed economic effects. ACCAP partnered with ISER on a preliminary analysis to fill the information gap by describing the potential nature and scope of economic effects of climate change likely to become manifest in Alaska over the next 30–50 years.

The objective was to synthesize information about what is known and what is not known about the economic effects and to outline what additional research, data collection or information gathering would be necessary to fill in the unknowns. Effects arising through a broad spectrum of drivers and mechanisms were considered using a common framework and common set of scenarios and assumptions. Order of magnitude quantitative estimates of economic effects were made in cases where the effects are known and data are available. Primary uncertainties about the nature and magnitude of economic effects, as well as potential data sources and known data gaps were considered.

Key findings: Largest costs were associated with costs to prevent damage, relocate, and replace infrastructure threatened by permafrost thaw, sea level rise, and coastal erosion. These costs were partially offset by an estimated reduction in space heating costs of $100–150 million annually. The estimated net cost of relatively certain, large, quantifiable effects was $340–$700 million, or 0.6 to 1.3 percent of Alaska GDP. We note large regional disparities in the economic impacts: most of the large projected costs will fall on rural communities in northern and western Alaska.

Muskox and Greater White-fronted Geese on vegetated beach ridges in front of the Igichuk Hills. (Doug Demarest)

ACCAP Project Evaluation

Within our focal areas, our objectives are to: understand the diverse decision contexts for using climate information; develop integrated, actionable, interdisciplinary knowledge; develop and maintain a diverse, flexible network for sharing actionable climate knowledge; and innovate climate services to enhance the use of science in decision making. All our activities involve relationship and trust building, and iterative two-way communication between scientists and decision makers. Ongoing reflection and evaluation will inform future activities. In this project period, we began with a series of project-level evaluations.

Evaluation of ACCAP Climate Webinar Series

April 2013 – July 2015

ACCAP Lead(s): Nathan Kettle

We evaluated the role of ACCAP's long-term Alaska Climate webinar series in supporting knowledge to action networks for climate adaptation in Alaska. An expanding, fluid, and diverse network of participants characterizes participation in the ACCAP climate webinar series. Participation per webinar has nearly tripled since the inception of the webinar series in June 2007.

Semi-structured interviews with webinar participants and speakers were used for this evaluation. Our findings highlight how the ACCAP webinar series supports knowledge-to-action networks in Alaska.

Key findings: We found that webinars provide opportunities for participants to learn about climate science, impacts, and decision support, and webinar participants report that they use this information in their education and outreach, and planning. Webinars also provide a venue for participants and participant organizations to connect with new constituents, learn about their priorities, concerns, and needs, and expand their networking capacity. The webinars also promoted cross-scale linking by creating a platform for scientists to engage with managers and decision-makers with experience and jurisdiction on the local, state, national and international levels.

Key publication

Trainor, S., N. Kettle, and B. Gamble. 2016. Not another webinar! Regional webinars as a platform for climate knowledge to action networking in Alaska. In: Climate in Context. Editors: A. Parris, G. Garfin, K. Dow, R. Meyer, and S. Close. Wiley. p. 117-142. http://bit.ly/2hJyPc0

Evaluation of the Alaska Climate Outlook Briefing Series

June 2016
ACCAP Lead(s): Tina Buxbaum
Partner(s): National Weather Service

In 2016 ACCAP undertook an evaluation of our Alaska Climate Outlook Briefing webinar series using an online survey sent to Briefing participants.

Key findings: Feedback was overwhelmingly positive (n=31, 14 percent response rate). 100 percent of respondents said they learned something from the webinar series and 80 percent of respondents used the information for their job responsibilities. Over 90 percent of respondents said they have or would recommend the webinar series to others. When asked what motivates participation in the Briefings, respondents cited:

- *"We are working with tribal villages in Norton Sound and want to understand their weather trends and projections."*
- *"As a military weather forecaster in Interior Alaska I find the analysis applicable."*
- *"I am new to the 'NOAA family' and my job as Gulf Watch Alaska science coordinator requires that I stay current with oceanographic forecasts. Alaska is in my region and the briefing is useful for staying informed on weather and climate of the region. "*
- *"I am an avalanche forecaster, I use these briefings to plan my winters."*

Feedback was generated on future topics and the depth and breadth of current topics was considered by respondents to be appropriate and well communicated. Overall the value of the Briefings was confirmed through the survey responses.

Evaluation of Three ACCAP Decision Support Tools

March 2014 – November 2015
ACCAP Lead(s): John Walsh, Nathan Kettle, Sarah Trainor,, Tina Buxbaum
Partner(s): Goldstream Group Inc.

In 2014 ACCAP contracted with the Goldstream Group Inc. in designing and implementing an evaluation of three ACCAP products or tools: the Historical Sea Ice Atlas for Alaska Waters, the Climate and Weather Highlights Tool, and the Alaska Climate Dispatch.

The purpose of this evaluation project was to describe user experiences with, and provide opportunities for improvement of, these decision support tools. The evaluation questions guiding the project are:

- What are the characteristics of people who use the decision support tools?
- Why do people use the decision support tools?
  - » What do people want to accomplish with the decision support tools?
- How satisfied are people with the content of the decision support tools, and how can it be improved?
  - » Are they satisfied with the information generated by the tool?
  - » Are they satisfied with the tool's data quality?
  - » Are they satisfied with the tool's data documentation?
- How satisfied are people with the user interface, and how can it be improved?

In addition to addressing the evaluation questions, the results also include information on access, learning, sharing, and suggestions for each level of familiarity and use for each tool.

Key findings: For all three ACCAP decision support tools we found consistent results. Those who use the tools are mostly satisfied with them and use them regularly when the content is connected to their own work or for general and personal interests. Demographics of users are similar. For those who are non-users of the tools, they tend to not use them because they didn't know about them or because the content is not connected to their own work. Most learned about access to each of the tools through the ACCAP website or list serve. Most respondents identified at least a little learning concerning the topic of interest, with very few stating they learned nothing at all. Lastly, referrals are made most by those who use the tools to access data rather than just for information.

Highlighted Outreach Activities

Arctic fishing gear near Wainwright, AK. (Todd Brinkman)

Webinars

Alaska Climate Webinar Series

June 2007 – present
ACCAP Lead(s): Tina Buxbaum

As part of our flagship webinar series, ACCAP has been hosting monthly webinars on topics relevant to climate change in Alaska since June 2007. We regularly organize these opportunities for dialogue and information exchange among stakeholders both within and outside of Alaska. Presented on a wide variety of Alaska climate-related topics, webinars consist of 30–40 minutes of presentation followed by discussion and questions from participants. During the reporting period we have held 68 webinars in this series with 4,850+ participants (statewide, national, and international reach).

Upcoming webinars and past recordings: http://bit.ly/2zdc7A3

National Weather Service Alaska Climate Outlook Briefings

July 2014 – present
ACCAP Lead(s): Tina Buxbaum
Partner(s): NOAA National Weather Service

Growing out of our relationship with the National Weather Service Alaska region, ACCAP and the NWS collaborate on this webinar series. NWS Alaska Region meteorologist Rick Thoman reviews recent climate conditions around the state, highlights interesting climate topics or anomalies, and presents the Climate Prediction Center's forecast for the next few months. There have been 39 webinars in this series thus far with an audience of 900+ participants.

Upcoming webinars and past recordings: http://bit.ly/2Ak1JuS

Virtual Alaska Weather Symposium Webinar Series

March 2017 – present
ACCAP Lead(s): Tina Buxbaum
Partner(s): Geographic Information Network of Alaska (GINA), National Weather Service

ACCAP, National Weather Service (NWS), and the Geographic Information Network of Alaska (GINA) located at UAF created this new webinar series with the goal to bring presentations on cutting-edge satellite based products and applications to a broad statewide audience, while avoiding the costs of an in-person symposium.

The partnership leverages ACCAP's webinar infrastructure and list serve, and complements GINA's and NWS's deep pool of potential speakers and topics. In this period six webinars have been held reaching 140+ participants. Upcoming webinars and past recordings: http://bit.ly/2AdgOhh

Alaska Policy & Climate Adaptation Webinar Series

October 2015 — May 2016
ACCAP Lead(s): Tina Buxbaum
Partner(s): Water Policy Consulting, LLC

Together with Water Policy Consulting, LLC and tribal environmental and climate change professionals throughout the country, ACCAP offered the Winter 2015–16 Policy & Climate Adaptation Mitigation and Planning for Alaska Natives webinar series. The series demonstrated how Native Villages and other communities in Alaska can apply state, federal and tribal policies to address climate change impacts on water and subsistence resources through water resource management and protection, land and water rights, sovereignty and other resiliency and mitigation strategies. Six webinars were held in this series with 270+ attendees.

Recordings of the webinars: http://bit.ly/2zodq3n

Permafrost Forecasting: 2015 Stakeholder Listening Session

October 2015
ACCAP Lead(s): Tina Buxbaum
Partner(s): NOAA National Weather Service, Geophysical Institute (UAF)

The ability to make predictions on permafrost activity (freeze, thaw, date and depth) is improving, especially on a seasonal scale. National Weather Service and the research community gathered stakeholder and community input about what potential forecast information is most useful and needed by stakeholders for the decisions they are making. On October 21, 2015 stakeholders discussed what forecast information and on what time scale they would find most useful. The discussion was led by Rick Thoman (Climate Science and Services Manager, NWS Alaska Region) and Vladimir Romanovsky (Professor of Geophysics at the Geophysical Institute, University of Alaska Fairbanks).

Listening session recording and summary report: http://bit.ly/2zZZjAQ

Alaska Climate Dispatch

ACCAP Lead(s): Tina Buxbaum, Alison York,, John Walsh
Partner(s): National Weather Service, Alaska Climate Research Center (UAF)

Starting in 2010 and written for a non-technical audience the Alaska Climate Dispatch Features seasonal weather and climate summaries as well as Alaska weather, wildfire, and sea ice outlooks. To date 24 issues (19 this period) have been published: http://bit.ly/2A3lcN3

Changing Ice - Cryosphere Hazards Newsletter

ACCAP Lead(s): Tina Buxbaum
Partner(s): Alaska Division of Geological and Geophysical Surveys and AK Climate Science Center (DOI)

Building on a Cryosphere Hazards Workshop in June 2011, ACCAP continued its partnership with scientists at UAF and the Alaska Division of Geological and Geophysical Surveys and AK CSC by producing several issues of a newsletter on cryosphere hazards in Alaska, covering sea ice, river ice, permafrost, and glaciers. The inaugural issue, titled "Changing Ice," was unveiled in December 2012 and aimed to link the research and management communities by highlighting projects and discoveries led by Alaska scientists engaged in cryosphere research. To date three issues have been published: http://bit.ly/2zW9ZA9

Visitors are dwarfed by Shoup Glacier near Valdez, AK. (Lena Krutikov)

Workshops

Climate Prediction and Applications Science Workshop (CPASW)

May 2017
ACCAP Lead(s): Tina Buxbaum
Partner(s): National Weather Service

Jointly hosted by NOAA National Weather Service Climate Services Branch, ACCAP, and other partners and held May 2–4, 2017, the 15th annual Climate Prediction Applications Science Workshop (CPASW), was held in Anchorage, AK. It brought together over 130 climate researchers, information producers, and users from Alaska and throughout the country to share developments in the research and applications of climate predictions for societal decision-making. Anchorage provided a unique venue for convening Alaska scientists and decision makers from around the nation.

The theme for the 2017 CPASW was Understanding Extreme Events and Decision-Maker Needs in the Context of Climate Variability and Change. Key focus areas included:

- Climate information applications at local, regional, and global scales related to preparedness and management for weather and climate extremes
- Climate services for coastal and indigenous communities in high-latitude areas, including the Arctic
- Best practices of observing, documenting, and communicating climate information relevant for national, tribal and international collaborations
- Service delivery coordination and decision support for planning, resource allocation, sustainable development, and environmental management needed for building resilient communities
- Changes in climate and weather extremes

Short-term climate variability and long-term climate change as well as attribution science were crosscutting concerns for all of the focus areas, especially in preparedness activities for extreme events and supporting critical decision-making for several socio-economic sectors. Agenda and presentations: http://bit.ly/2okkUi9

Ocean Acidification in Alaska Workshop & Network Building

December 2014
ACCAP Lead(s): Tina Buxbaum
Partner(s): Alaska Ocean Observing System (AOOS)

In December 2014, ACCAP partnered with AOOS to conduct a one–day ocean acidification workshop. Over 100 interested citizens, stakeholders and experts came together to discuss ocean acidification (OA) and the latest research, policy implications, community perspectives, and potential impacts to Alaska. Another 70 people joined by webinar individually or from satellite stations hosted across Alaska in Craig, Fairbanks, Homer, Seward, and Unalaska. Workshop agenda, presentations, and recordings: http://bit.ly/2zpXgXg

A smaller group of about 30 stakeholders convened the following day to define statewide needs for OA monitoring, research, education and outreach within Alaska.

Arctic Science Summit Week (ASSW)

March 2016
ACCAP Lead(s): Tina Buxbaum
Partner(s): University of Alaska Fairbanks College of Liberal Arts

ASSW is an annual gathering of international organizations involved in Arctic research, which is designed to strengthen collaborations across academia, government agencies, local communities, industry, and non-governmental organizations.

The 2016 Summit was held in Fairbanks, Alaska. As part of the free public events held in conjunction with ASSW, ACCAP helped fund and coordinate the "Dark Winter Nights: North Through Our Eyes" live storytelling event and "Arctic Perspectives" art show, which showcased art inspired by the Arctic and research to improve Arctic understanding.

- **Dark Winter Nights: "North Through Our Eyes"**
  An evening of storytelling showcasing stories about observed changes in the North. Over 400 people attended, which allowed ACCAP stakeholders (scientists and community members) to share their experiences related to Arctic change with the general public and ASSW participants. This event was part of the ongoing Dark Winter Nights storytelling series produced by the University of Alaska Fairbanks: http://professorprince.com/darkwinternights
- **Art show: Arctic Perspectives**
  The exhibit showcased art inspired by the Arctic and research to improve Arctic understanding. Contributors included researchers and artists from the University of Alaska Fairbanks as well as members of the community. Artists and scientists were given travel funds to visit one another and various field locations with the goal of facilitating mutual understanding and promote meaningful dialogue on Arctic science. The interaction between artists and scientists can promote understanding and awareness of the scientific basis in the context of Alaska's and the Arctic's changing ecosystems. The art was displayed during the entire week of ASSW.