

# 1. Administrative

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University of Alaska Fairbanks

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Alaska CASC Host Agreement

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## 2. Purpose and Objectives

The purpose and objectives of the Alaska Climate Adaptation Science Center (AK CASC) five-year host agreement revolved around the tenets of the national CASC network: to generate science and decision-making tools to help Alaska respond to novel resource management challenges brought on by climate change. The below section highlights how the center embarked on these efforts over the last host agreement.

### Co-produced Science

The AK CASC proposed a number of objectives in the realm of co-produced science during this host agreement including two phases of co-production pilot projects, other products to serve evolving state needs, and continued coordination in project planning with the United States Geological Survey (USGS) CASC Regional Director. Products and results were delivered from all proposed phase 1 and phase 2 co-production projects across the 6 years of the host agreement and from smaller projects designed to meet specific management needs. Greater detail is provided in Section Four. Project scoping and design incorporated direct input from USGS AK CASC Regional Administrator Steve Gray as well as with guidance from other AK CASC scientists at the USGS through weekly meetings detailed in section three.

Co-produced science goals agreed upon in the award which were either changed or removed included the conducting of co-production meetings and summits and the retention of a co-production coordinator. As a result of the Covid-19 pandemic in-person co-production of science meetings in 2020 were canceled and the center instead organized a working group which presented a list of recommended changes and approaches to improve co-produced science in 2021. Further details are provided in section three. The primary co-production stakeholders of the AK CASC being Alaska Native Tribes, the decision was made to support additional Tribal Liaison capacity at the AK CASC in place of a dedicated co-production coordinator position. Changes to the International Arctic Research Center (IARC) personnel directory and into the University of Alaska Fairbanks (UAF) Experts Guide rendered the development of a UA system topical experts list proposed in the initial agreement unnecessary.

### Capacity building

The primary capacity building objectives were the continued support of the AK CASC Fellows Program and of Inspiring Girls\* Expeditions (IG\*E, formerly Girls on Ice). Fellows funded directly by AK CASC science projects were supported in Year 1. Starting in Year 3, the AK CASC added a monthly skill-building seminar, aimed at Fellows, focused on topics including science communication, grants, and meeting facilitation. Under the lead of our University Deputy Director in year 5 efforts were expanded including the Fellows thematic seminar, monthly skill-building seminars, and Early Career Researcher workshops.

The AK CASC has continued to support Inspiring Girls\* Expeditions Alaska, who have expanded from offering one expedition per year to three. Modeled on Girls\* on Ice Alaska, a unique mountaineering and glacier-based science experience for young women and gender-expansive youth, in 2019 the organization launched Girls on Water, which follows the

same model for a sea kayaking expedition based out of Homer, Alaska. 2021 saw the first Girls\* in the Forest expedition which integrates packrafting with an exploration of Alaska's fire ecology.

## Data Management

UAF's data management objectives were to support a data steward, and to continue developing Alaska-based data archive services and innovative web-based technologies for data exploration. The AK CASC has supported alternately individual data stewards or a data stewardship team, by utilizing the skills of our co-located group the Scenarios Network for Alaska + Arctic Planning (SNAP). The data managers or data management team assist AK CASC researchers and staff in crafting and revising USGS-compliant data management plans, managing large data sets, and delivering data to USGS repositories including ScienceBase.

The AK CASC partnership with SNAP has allowed for the leveraging of significant skills and assets to support innovative downscaling techniques to serve decision-makers and other data users in our region. The team stores and delivers quality-controlled data in the formats usable and familiar with climate researchers but also by broad, non-scientific user groups. The construction of web tools (detailed in section 5) for exploring and visualizing AK CASC science outputs has made accessing and understanding AK CASC research easier for researchers, co-production partners, and decision-makers.

## Science Communications

The science communications objectives agreed upon in the award to UAF included the retention of two half-time science communication specialists, the establishment of a Communications Advisory Group, and the provision of communication product grants. Additionally, it has been the responsibility of the UAF-based science communication team to manage promotion of AK CASC activities, maintain an AK CASC website, and to complete annual projects to translate AK CASC science to meet stakeholder needs.

The AK CASC has maintained two half-time science communications personnel at UAF and the University of Alaska Southeast (UAS) for the majority of the host agreement. The co-location of the UAS-based communicator with the Alaska Coastal Rainforest Center (ACRC), the co-location of the UAF-based communicator with SNAP, and the integration of both personnel into the communications team at the International Arctic Research Center has improved communication efficiency. A communications advisory group was established early in the first year of the host agreement but dissolved as the result of the restructuring of some partner agencies. Small communications product grants have been provided for researchers to attend exhibitions of translations of science into art as well as to fund outside communicators to assist with communicating AK CASC science.

Public relations maintained via meetings with UA public relations team and CASC network communications team, creation of products including the [Glacial Lake Outburst Flooding storymap](#) and [video series](#), the "[Climate Change in Arctic Environments](#)" Massive Open Online Course, and the launch of [Alaska Voices podcast](#). The AK CASC communications team works with a web developer to update and maintain the [AK CASC website](#).

### 3. Organization and Approach

The AK CASC invests heavily in all members of its collaborative team creating an organization of success. This section describes the organization of that team as it expanded over the course of the five-year host agreement.

#### Management Team, Staff and Scientists

The structure of the Management Team changed over the course of the host agreement, but was consistently led by PI Rupp and the AK CASC CO-Is. At the outset of year 1 PI Rupp and Co-Is Bidlack, Trammell and Bolton served as the Management Team responsible for budget tracking, grant reporting, project oversight, outreach and communications efforts, data management, staff supervision, and overall AK CASC administration. The Management Team was supported by a half-time Program Coordinator, Jane Wolken, and a quarter-time Administrative Assistant, Mimi Lesniak. As proposed, the Leadership Team consists of the Management Team and the Senior Scientists. Each Co-I serves as a liaison between the Leadership Team and one of the primary components (and associated staff) of the AK CASC hosting agreement.

Adjustments to leadership structure and personnel included the departure of CO-I Trammel early in Year 1 of the agreement, followed by CO-I Bidlack and Program Coordinator Jane Wolken in Year 4. Wolken's duties as Program Coordinator were partially absorbed by other staff and partially assigned to the new University Deputy Director Dr. Jessica Garron who joined the AK CASC in 2021. CO-I Fellman joined the leadership team in Year 4. The Management Team also expanded to include input from two half-time communication staff Molly Tankersley and Mike DeLue as well as Bureau of Indian Affairs (BIA) Tribal Resilience Liaisons first with Malinda Chase and later with 3 new BIA-funded Tribal Resilience Liaisons and Chase's move to a university-funded liaison position. AK TRLN Coordinator Krista Heeringa has also contributed to the management team since the formation of the Alaska Tribal Resilience Learning Network (AK TRLN). CO-I Bidlack returned in year 5 and in year 6 CO-I Bolton departed the AK CASC, though he remains a collaborator.

At the conclusion of the hosting agreement PI and University Director Scott Rupp (UAF), Co-Investigators Allison Bidlack (UAF) and Jason Fellman (UAS), and University Deputy Director Jessica Garron (UAF) served as the Management Team. The Management Team continued to be supported by an Administrative Assistant, Mimi Lesniak (UAF); one Science Communicator, Mike DeLue (UAF); and a Data Steward team, Charlie Parr (UAF) and Kyle Redilla (UAF). Year 6 included the continued support of the AK CASC's AK TRLN, led by AK CASC Tribal Liaison, Malinda Chase (UAF), AK TRLN Coordinator, Krista Heeringa (UAF), and AK TRLN Assistant Coordinator, Megan Pittas (UAF). The network expanded in Years 5 and 6 to include three BIA Tribal Resilience Liaison Program-funded Tribal Liaisons Kaitlyn Demoski with the Native American Fish and Wildlife Society (NAFWS), Tess Hostetter (NAFWS) and Jerilyn Kelly (NAFWS). The AK CASC has supported approximately 13 consortium scientists and their graduate students via USGS actionable science funding. These researchers along with the Management Team, compose our broader Research Team.

## Operational Meetings

The Management Team, Tribal Liaisons, and Science Communicators implement the AK CASC science vision and projects, actively engage with AK CASC Scientists (both university and USGS) in work with co-production partners to develop research projects, and deliver actionable results. Coordination among the AK CASC is facilitated through a variety of in-person and Zoom meetings

- *Bi-weekly Communication Meetings* focus on AK CASC communication projects/activities. The Management Team, Science Communicators, Tribal Liaisons (both UAF and BIA-funded), and AK TRLN Coordinator participate in these meetings.
- *Weekly AK CASC University-USGS Meetings* involve a discussion of project milestones, weekly activities, and time-sensitive events that may be important to communicate to partners and the National CASC. The weekly 30-minute meetings involve participation by the Management Team, Science Communicators, Tribal Liaisons, AK TRLN Coordinator, and AK CASC USGS personnel.
- *Monthly All AK CASC Meetings* are intended to improve internal communication and foster greater collaboration within the AK CASC. These monthly 30-minute meetings include all AK CASC university (students, staff, and faculty) and USGS members.

AK CASC leadership also organized a small number of in-person (or virtual as needed) strategic planning meetings at various points during the host agreement.

- 08/2017 AK CASC Leadership Workshop for Early Career Women in Science
- 09/2017 AK CASC hosted the National CASC Meeting
- 05/2018 AK CASC Leadership Workshop (ANC)
- 08/2018 AK CASC Cooperators Annual Review
- 05/2019 AK CASC Annual Meeting (Taiga Center, Fairbanks)
- 10/2019 AK CASC Cooperators Annual Meeting (Zoom)
- 05/2020 AK CASC Co-Production Meeting - CXL due to onset of COVID
- 09/2020 AK CASC Cooperators Meeting (Zoom)
- 08/2021 AK CASC Business Meeting (ANC)
- 02/2022 AK CASC External Review with Donna Silverberg (5 Year Review)
- 08/2022 AK CASC Cooperators Meeting (Zoom)
- 11/2022 AK CASC Leadership Workshop (ANC)

## Strategic Goals and Themes

### Co-Production of Knowledge

Co-production of knowledge, the process of developing research projects and products from idea to delivery in close partnership and collaboration with user-groups or interested parties, is a core goal of the AK CASC. These projects fall on a spectrum from fully-informative to fully-co-productive but a shift in the direction of greater user engagement improves the depth of scientific context, ease of access, respect for information sovereignty of partners, and uptake of use of resulting data by decision-makers. The primary co-production of knowledge partners

for the AK CASC are Alaska Tribes, government agencies addressing adaptation projects, Alaska's Landscape Conservation Cooperatives, the National Park Service, and others.

Though the AK CASC has been assessed as very successful in the use and development of co-production methodologies at the AK CASC, there remains significant room for growth. In 2022 the AK CASC Coproduction of Knowledge Working Group approved a set of internal recommendations to improve co-production efforts and outputs moving forward. Many of these guiding principles were incorporated into the AK CASC hosting agreement rebid in 2023:

1. Develop and publish an explicit AK CASC Tribal Engagement Strategy document.
2. Support the work needed to maintain and foster sustained relationships over the long periods necessary for successful future co-production of science work.
3. Address funding challenges and power structures by building capacity among co-production partners and supporting researchers who work in this space.
4. Provide training and continuing education on successful co-production approaches and methods to current and early career researchers.
5. Work within the University system to address academic incentives and reward structures which may discount or discourage participation in co-production research.
6. Support evaluation and in particular Indigenous evaluation where appropriate.

## Actionable Science

The AK CASC is committed to regionally relevant climate science for the betterment of decision-making by all of our collaborators, partners, and stakeholders. The integrative research portfolios of related projects, co-location with related programs, and long-standing relationships with partners has led to science that improves efficiency, increases productivity, and bolsters impact while leading the way for climate science in Alaska and the nation. The explicit incorporation of evaluation at multiple steps of the process has helped correct course when necessary and reminded all participants in CASC research that climate science for use and action is our stated goal.

Critical research developed using co-production methodology includes the Suicide Basin outburst flood modeling and monitoring project, developed with local stakeholders producing results used by those affected by these warming-driven events for local decision-making. The Building Resilience Today project is another example of actionable science which took existing dynamically downscaled climate data and, in a co-productive Traditional Ecological Knowledge-forward process, delivered that data to local communities for planning and decision-making. The Integrated Ecosystem Modeling work, and other work which utilizes user-friendly tools for data query, fill gaps which exist for our users and geography, while also delivering that data in meaningful ways.

## 4. Results

This section highlights key results from collaborative research and center collaborations of the 5-year AK CASC host agreement.

### Partnerships

#### BIA Tribal Climate Resilience Liaison program

In 2017 the AK CASC became host to a BIA-funded Tribal Climate Resilience Liaison, as part of a nationwide network of liaisons funded in an effort to improve the access of Native American and Alaska Native Tribes to climate adaptation science. Funding for these positions is distributed through a Tribal host organization and through an initial partnership with the Aleutian Pribilof Islands Association ([APIA](#)) the AK CASC hired Malinda Chase as its first Tribal Climate Resilience Liaison.

The BIA announced in 2022 that the Alaska Tribal Climate Resilience Liaisons in partnership with the AK CASC would be hosted through an agreement with the Native American Fish and Wildlife Society ([NAFWS](#)), and NAFWS assumed this new role in spring of that year. A Senior Alaska Tribal Climate Resilience Liaison, Justin Leon, was hired and a graduate intern position was accepted by Hannah Juliussen. In 2023 three assistant liaison positions were hired - Jerilyn Kelly in the Yukon-Kuskokwim Delta, Tess Hostetter in Juneau, and Kaitlyn Demoski in Anchorage, while Justin and Hannah departed the team for other positions. The NAFWS liaisons are embedded directly within the AK CASC through the AK TRLN.

#### PI-AK Collaboration

The AK CASC participated in a joint workshop with the Pacific Islands Climate Adaptation Science Center (PI CASC) in Honolulu, HI on 2-3 April 2019 to explore opportunities for cross-CASC research collaborations around the complementary research themes of Icefields to Oceans (AK CASC) and Ridge to Reef (PI CASC). A key component of the workshop was focused on engaging the CASC Fellows and providing opportunities for Fellows cohorts to experience the research and management issues of the other region, while building career networking opportunities. In year 4, staff from the AK and PI CASCs coordinated virtually to offer a request for proposals in June 2020. Seven projects from PIs at the AK and the PI CASCs were awarded funding to support concurrent research between the CASCs on changes in hydrology, precipitation, and native species response in both regions. In year 5 The AK CASC communications team and web developer Carolyn Rosner led the development of a [website for the Pacific Islands-Alaska Collaboration](#) to feature projects, activities, and highlight researchers and students associated with the effort. The website launched in March 2022.

#### AK DGGS Cryospheric Hazards

AK CASC Senior Scientist Gabriel Wolken holds a position as both scientist at UAF and manager of the Climate & Cryosphere Hazards Program at the State of Alaska Division of Geological & Geophysical Surveys (DGGS). In this position Wolken has worked with other AK

CASC scientists on glacial lake outburst floods in Juneau and avalanches across Alaska. In 2018 Wolken was awarded an international research fellowship to study and map Alaska's snow avalanche hazards. Wolken collaborated with the Swiss Institute for Snow and Avalanche Research (SLF) in Davos, Switzerland for six-months from September 2018 to February 2019. This collaboration leveraged Wolken's unique joint position, bridging university and agency sectors, and led to the development of a research-focused memorandum of understanding between SLF and UAF and has led to several follow-on projects, including the development of large-scale snow avalanche hazard maps for Southeast Alaska for modern and possible future climate scenarios. These products are helping to further our understanding of how changes in climate and avalanches may impact society and the landscape, including animal habitat, and are empowering decision makers with critical information to develop science-based adaptation and response strategies to avalanches.

## Other actionable science partnerships

- Jeremy Littell supplied climate projections and ecosystem summaries for U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), and U.S. Forest Service (USFS) management units in Alaska.
- Stephanie McAfee taught a graduate course on Arctic change that introduced students to the Arctic ecosystem, co-production and scientific colonialism.
- Bob Bolton, Go Iwahana and Ross Spicer worked with USFWS on a project to describe the impacts of ice roads on landscape degradation, hydrologic pathways, and vegetation green-up on the central Arctic Coastal Plain using satellite imagery.
- Joshua Walston (former AK CASC Fellow), McAfee and Dan McEvoy, a collaborator at the Desert Research Institute, provided data and drought indices to the CASC for release, and a manuscript analyzing the data was submitted in 2022.
- Steph McAfee and Jeremy Littell led a joint effort with the University of Nevada, Reno to develop a better understanding of changing Alaska snow conditions, better understand the stationarity of 30-year average temperatures in the CMIP5 ensemble, assess the stability of synoptic drivers of Alaskan temperature and precipitation extremes, and assess decadal variability in temperature and precipitation across the Arctic.
- The Landscape Conservation Cooperatives (LCCs) which covered Alaska were key project and research topic development partners while they held significant convening power from 2008 to 2019.
- The AK CASC continues to be hosted by UAF at the International Arctic Research Center alongside a number of leading researchers and units to leverage resources and human capital from downscaling to communications.

## Science

### Publications

AK CASC scientists published [87 publications](#) over the course of the host agreement, mostly as peer-reviewed manuscripts published in the scientific literature.



## Pilot Projects

### Wildfire Projections in Interior Alaska

In years 1 and 2 PI Rupp convened half-day stakeholder meetings that informed a research collaboration effort to produce daily gridded climatologies for the wildfire season (April 1-September 30) at 1-km and 20-km spatial resolution. Primary variables of interest were 2m temperature, precipitation, 10m winds, and relative humidity. In year 3, AK CASC Scientists Peter Bieniek and Uma Bhatt explored historical Fire Weather Index (FWI) data from the ERA5 atmospheric reanalysis of the global climate and determined the ERA5 data to be a close match to Alaska. Building off this discovery, in year 4 Bieniek and Bhatt used the ERA5 data to produce gridded climate data for the Alaskan fire management community. Due to difficulties hiring during COVID-19 the group hired a joint postdoctoral fellow, Chris Waigl, with the Alaska National Science Foundation Established Program to Stimulate Competitive Research (EPSCoR) boreal fire component and AK CASC Wildfire Projections in Interior Alaska pilot project. Waigl dynamically downscaled ERA5 to 4-km using WRF for the 1950-present time frame. A need was identified for an ERA5 FWI product that is regularly updated to support research into climate drivers of fire as well as for fire managers. The code is being distributed via github and a pan-Arctic set of indices will be available in 2024 for 1950 to present.

In year 6 a broad WRF-based downscaling effort was initiated to provide reanalysis for building future projections. To enhance the snow inputs, a combined product was created merging ERA5 and the JRA55 reanalysis product, which has more realistic high-altitude snow water equivalent data. Downscaling went into production in July 2023. The first 10 years of downscaled data, at 12 km and 4 km, have been produced.

### Long Term Climate Monitoring

The long term climate monitoring pilot project was launched in year 2 as a joint effort of Co-I Jamie Trammell and Senior Scientist Steph McAfee at the University of Nevada, Reno (UNR). This collaboration developed three main research tasks critical to improving our understanding of where the weather station network in Alaska needs to be strengthened and/or protected: documentation of existing weather stations using publicly available data by undergraduate students at the UNR; evaluation of which weather stations are being regularly used for different purposes alongside AK CASC Scientists McAfee, Trammell and key National Park Service stakeholders; and an assessment of uncertainty in Alaska's past and future climate.

In year 4 the database documenting existing weather stations with publicly available data was completed and is available for sharing with interested users. Progress was made on the web-based interface to evaluate which weather stations are being regularly used for different purposes. As a result of COVID-related delays and through conversation with the key National Park Service stakeholders, the scope of the survey was reduced to focus on NPS-managed stations. During the remainder of year 4 the survey map was revised, NPS partners were provided a chance for final input on the survey, the survey was beta tested, and underwent Institutional Review Board review at UNR. The weather station user survey was released at the end of summer 2021. Daymet, PRISM, and WorldClim climatologies were acquired,

cross-compared, and their range of uncertainty compared to the ensemble of observations prepared by Newmann and others at the National Center for Atmospheric Research (NCAR). This allowed for the gaging of the degrees of uncertainty in Alaska climate related to station coverage available through NCAR to that contributed by other differences in gridded datasets. UNR graduate student Antoinette Serrato assisted in the analysis of the datasets during 2021.

In year 5, an assessment of uncertainty among gridded datasets covering Alaska was completed, and the preliminary results were presented at the 2021 Annual Fall Meeting of the American Geophysical Union. Key findings were that differences among datasets are largest in winter where there are notably few weather stations, in mountains and along the coasts. Finally, progress was made on comparison of Arctic decadal temperature and precipitation variability across datasets, Kaitlyn Weber's MS thesis. A thesis submission was completed in summer of 2022.

### Streamflow Models in Southeast Alaska

In year 1 Co-I Bidlack convened an initial stakeholder meeting in Juneau. A resulting survey helped project partners develop a comprehensive list of regional weather and stream gauge stations to inform the Alaskan downscaling effort. In year 2, Rick Lader was hired as a postdoctoral Fellow on the Streamflow models in Southeast Alaska pilot project. Lader developed a workflow for the project and ran the requisite climate model downscaling simulations. These new downscaled data cover historical (1981-2019) and projected (2031-2060; RCP 8.5) periods at higher spatial (1- and 4-km) and temporal resolution than were previously available for Southeast Alaska. The output variables from these dynamical downscaling simulations (e.g., winds, snow, clouds, radiation and heat fluxes) continue to enable scientists to explore climatic issues that require more than temperature and rainfall.

During year 3, Lader continued to refine Alaskan downscaling protocols with input from Co-I Bidlack and AK CASC Scientists Uma Bhatt and Peter Bieniek. In year 3 a manuscript about the new 4-km downscaled products was submitted to and published by the Journal of Applied Meteorology and Climatology (JAMC) describing the projected changes in mean and extreme temperature, precipitation and snowfall across Southeast Alaska from 2031-2060. The paper identified the plausible risk of an amplified hydrological cycle such that future years could bring more severe summer drought and more intense atmospheric river events in the autumn and early winter. The JAMC paper provides a technical overview of how the downscaling was performed. A second paper, which investigated hydrological extremes in Southeast Alaska, particularly in the context of drought and flooding impacts, was submitted and published by the journal Earth Interactions. Lader continued his work on the Streamflow models in southeast Alaska project through years 4 and 5. A project webpage was developed by AK CASC Communications Specialist Molly Tankersley, with input by Lader, providing climatological maps, and model descriptions of the new data. All of the hourly and daily files remain publicly available through ScienceBase, providing stakeholders with direct access.

As a result of this project, these data are being leveraged in support of current and proposed research in Southeast Alaska. Lader delivered customized temperature, relative humidity, wind and precipitation data to Dr. David Hill, Professor in Civil and Construction Engineering at Oregon State University as part of his North Pacific Research Board (NPRB) discharge modeling project. The 4-km downscaled data are currently supporting the Sitka

Sound Science Center (NSF project number 2052972), by providing the gridded meteorological information required for the calculation of quantities associated with atmospheric rivers in Southeast Alaska. Lader has also conducted analysis of historical and projected values of the Standardized Precipitation Index and Standardized Precipitation Evapotranspiration Index for all ten census and borough areas in Southeast Alaska, in support of a U.S. Department of Agriculture (USDA) National Resources Conservation Service project on drought conditions.

### Arctic LCC and Western AK LCC Landscape Change Projects

The primary goal of this pilot project was to characterize the vulnerability of the Alaskan landscape to future climate change and the potential impacts on the landscape and waterbird populations. This project involved the development of fine-scale land-cover maps and simulation of future projections using the Alaska Thermokarst Model (ATM) of the landscape for both the Alaskan Arctic Coastal Plain and the Yukon-Kuskokwim Delta previously developed by AK CASC researcher Bob Bolton. An initial stakeholder meeting involved researchers from the University of Alaska Fairbanks (including Scott Rupp (PI), Bob Bolton (Co-I), Jane Wolken (Program Coordinator), Hélène Genet (modeler)), US Fish and Wildlife Service, Arctic and Western Alaska Landscape Conservation Cooperatives, and the USGS Alaska Science Center (Jeremy Littell). In year 2 the Arctic and Western Alaska LCCs were dissolved as part of a USFWS reorganization. This resulted in a further shifting of focus and priorities for co-production partners on this project.

Over the course of year 2, M.S. student Ross's Spicer's efforts focused on improving the efficiency of the ATM code and exploring the concept of "climate predisposition" in order to initiate the thermokarst process. Initial results of the climate predisposition analysis indicate an ecological mechanism/factor that is required for thermokarst initiation to occur. In year 2, Co-I Bolton organized a co-production/stakeholder meeting for the Landscape evolution in Arctic and Western Alaska pilot project at the UAF to share information on potential waterbird habitat changes on the Arctic Coastal Plain in Northeast Alaska. The co-production partners expressed interest in this area due to the potential for resource development in the near future.

In year 4, Co-I Bolton and AK CASC Fellow Julian Dann, in coordination with and guidance from the USFWS, adjusted their research activities to focus on developing a regional assessment of risk factors associated with seismic exploration on the Coastal Plain of the Arctic National Wildlife Reserve. The goal of this risk assessment was to provide information to land managers to identify regions that are vulnerable to landscape degradation and of the factors that lead to landscape degradation following exploration activities. In extension, Dann and Bolton developed Google Earth Engine tools to calibrate, index, and visualize landscape changes with LANDSAT time-series imagery at locations where seismic exploration activities took place in the winters of 1984/1985. Understanding the locations and conditions that result in more or less resilient landscapes following disturbance helps land managers develop guidelines for future exploration activities.

### Glacier Outburst Flood Modeling

The primary goal of the project was to design a tool to improve forecasting of the timing and magnitude of peak streamflow during a glacial lake outburst flood event from Suicide Basin adjacent to the Mendenhall Glacier in Juneau, Alaska. The project encompasses field work,

during which data is collected to conduct forecasts as accurately as possible. Field work is closely coordinated with the USGS field office (Jamie Pierce) and the National Weather Service (NWS) office (Aaron Jacobs) in Juneau. The first field campaign occurred in mid-May 2018 and field campaigns have continued through 2023. The required field measurements were matched with remotely sensed data from several sources and an undergraduate student working on the project (Molly Dwyer) compiled additional relevant geospatial data. Postdoctoral Scholar Christian Kienholz and PIs Eran Hood and Jason Amundson (University of Alaska Southeast) created an inventory of annual outburst flood events since 2011. They have also developed a forecasting tool in collaboration with the National Weather Service. Field campaigns throughout the project involve the use of time-lapse cameras, GPS units, unmanned aerial vehicles (UAVs) to build Digital Elevation Models (DEMs) and orthomosaics from UAV photos. In year 3, a fixed wing drone was purchased to increase flight times for data collection and in year 4 a pressure sensor was also installed in Suicide Basin to provide a high resolution record of water level changes in the basin over the full summer melt season. In 2019, Christian Kienholz has developed a tool for the Glacier Lake Outburst Flood (GLOF) monitoring/forecasting along Mendenhall River and Suicide Basin. The tool automatically retrieves and plots runoff and lake level data from several USGS web servers and includes telemetered time-lapse imagery when available. Python code produced during this project has been shared via online repositories and made directly available to partner agencies and the public for further use and development. Moreover, all monitoring data related to the outburst flood are made available to the public via a project [website hosted by the National Weather Service](#).

This website allows Juneau residents to track the filling of water in suicide Basin and thus provides real-time status updates related to the flood. In 2019, a glacier outburst flood model was produced in collaboration with personnel from the National Weather Service in Juneau. The model allows for real-time forecasting of the Suicide Basin flood. A collaboration was also developed with PhD student Dina Abdel-Fattah at the University of Alaska Fairbanks, who worked in Juneau with Kienholz and Hood to evaluate how stakeholders affected by the Suicide Basin flood utilize the flood monitoring outreach products developed by AK CASC Scientists and cooperating agencies. In the final year of the project, PIs Amundson and Hood transferred the project tools over to USGS and NWS partners so that they could take over responsibility for real-time monitoring of conditions in Suicide Basin. A wide range of outreach efforts were initiated related to the project. PI Hood gave public talks on the Suicide Basin outburst flood to the Juneau Rotary Club, the Juneau Pioneer Home, and the annual training for the interpreters at the Mendenhall Glacier Visitor Center (in person). Hood and Kienholz also gave a public talk in the USFS Fireside Chat lecture series in Juneau that was attended by over 200 people. Molly Tankersley developed a [storymap](#) in conjunction with PIs Hood and Amundson that is linked through the Suicide Basin website. UAS undergraduate Connor Owens helped organize historical photos of the basin that will be archived and shared through a website designed by Tankersley. Kienholz published a paper detailing the monitoring and modeling techniques developed for Suicide Basin. The paper entitled “Deglaciation of a Marginal Basin and Implications for Outburst Floods, Mendenhall Glacier, Alaska” provides a roadmap that can be used to apply the techniques developed at other locations in Alaska and beyond that are threatened by recurring outburst flood events (Kienholz et al., 2020). Alaska Center for Climate Assessment and Policy, a National Oceanic and Atmospheric Administration

Climate Adaptation Partnership, student Abdel-Fattah also published a paper entitled “User Engagement in Developing Use-Inspired Glacial Lake Outburst Flood Decision Support Tools in Juneau and the Kenai Peninsula, Alaska” in conjunction with PI Hood and others. This effort included fifty-three interviews over two years with homeowners, business owners, and agency personnel in Juneau. Results from the interviews were used to refine the design of the Suicide Basin website and inform the methods used to disseminate information related to the annual outburst flood from Suicide Basin ([Abdel-Fattah et al., 2021](#)).

## Integrated Ecosystem Modeling Project

The Integrated Ecosystem Model (IEM) for Alaska and Northwest Canada project provides scenarios of climate-driven changes in landscape structure and function resulting from the effects of climate change on the interactions among disturbance regimes, permafrost integrity, hydrology, and vegetation succession and migration. Over the first years of the hosting agreement the AK CASC supported the IEM project’s data stewardship, communication material, data hosting, and model development of the Alaska Thermokarst Model (ATM). Later in the hosting agreement the project pivoted toward developing a web portal which allows for dynamic querying of all of the datasets and variables developed through the IEM project. The tool, [Northern Climate Reports](#), is now live and delivers point and area summaries of IEM variables such as precipitation, wildfire return interval, vegetation succession and permafrost thaw depth. It is also serving as an accessible front-end for entirely new datasets, allowing new research results to be presented alongside and in the context of IEM outputs.

## Dynamical Downscaling for Alaska

The AK CASC continued to fund Weather Research and Forecasting (WRF) dynamical downscaling efforts throughout this hosting agreement. The AK CASC dynamical downscaling project began in 2013 with the goal of providing high spatial and temporal resolution climate variables that cover the entire Alaska domain. This was a specific climate data need identified through a meeting of key Alaska stakeholders in 2011. Most Global Climate Model (GCM) and reanalysis products are on coarse spatial (>100-km) and/or temporal resolution and require downscaling to provide locally-relevant climate information. Existing downscaling projects were developed for the contiguous United States and usually cover little to none of Alaska, cover short time periods, or have limited variables. This gap and the expressed critical need for dynamically downscaled climate models for Alaska has led the AK CASC to champion the production of bespoke dynamically downscaled products for Alaska. The AK CASC uses the WRF model as the regional climate model to downscale reanalysis and future GCM projections over the entire Alaska domain to 20-km with hourly data available.

The AK CASC in collaboration with SNAP continues post-processing of WRF dynamical downscaling data for ease of distribution. These efforts include aggregating key variables to be quickly distributed on request, stacking variables into netCDF compliant files, writing metadata, and reprojecting files into user-friendly coordinate systems. Since 2018, the AK CASC has been providing access to the downscaled WRF data via the Amazon Open Data program. This program allows researchers to access and utilize WRF model data directly on Amazon Web Services’ (AWS) infrastructure, negating the need to download and manage large amounts of

data. The AK CASC also provides documentation, metadata, and access to the data via the SNAP data portal. Dynamical downscaling is both critical to the success of modeling and scientific work in Alaska, and a springboard for new projects and early career research opportunities at the graduate and postgraduate levels. The team and its collaborators are now working on the downscaling of new models including those derived from the Coupled Model Intercomparison Project 6 (CMIP6).

## Capacity building

### Alaska Tribal Resilience Learning Network

AK CASC launched the Alaska Tribal Resilience Learning Network (AK TRLN) in the spring of 2021, designed to support Alaska Tribes and Indigenous communities as they respond to and adapt to climate change. In 2021, AK TRLN virtual events and audio-conferences have drawn over 100 individuals representing 28 Alaska Native Tribes, 12 Alaska Native Tribal organizations, and 9 partnering organizations. An important component and goal of AK TRLN is to create forums where Indigenous leaders have the space to learn, explore and share approaches that strengthen community responses to climate impacts. The AK TRLN is a place where Tribal partners in research and climate adaptation come to meet.

In 2022 the AK TRLN hosted seven climate adaptation informational sessions that included participation from 42 Alaska Native Tribes, and 11 Alaska Native Tribal regional non-profit organizations, hosted a 3-day virtual writing workshop to develop Tribal Climate Resilience Program proposals, and co-hosted an in-person workshop titled, *“Elevating Ancestral Practices: Tribal Wellness in Climate Adaptation Planning”* with Aleutian Pribilof Islands Association. 18 participants representing seven tribal governments and two Alaska Native non-profit organizations participated, though much greater interest was expressed. In 2023 the AK TRLN is actively collaborating with the Bureau of Indian Affairs, Tribal Climate Resilience Program to create a curriculum that supports Tribal Resilience Coordinators in Relocation, Managed Retreat, and Protect-in-Place (RMP) efforts. An ongoing series of consultation workshops for this year’s BIA Tribal Climate Resilience Planning funding awards continues, as do monthly information sessions. In collaboration with the Native American Fish and Wildlife Society the AK TRLN is helping to administer the Sustaining Resilience Today grant beginning in Summer of 2023.

### Fellows Program

In order to expand the capacity of agencies and research institutions to do climate-relevant adaptation science the AK CASC has sought to support the self-directed research of early career scientists and build their interdisciplinary skills through a cohort model. The AK CASC Fellow Program (FP) expanded over the course of the host agreement, growing in size and scope. Early FP activity focused on network-building and supporting individual early career climate adaptation researchers. The FP evolved to include exposures and practices to using critical research and synthesis skills for conducting actionable science. These successes were achieved primarily through monthly skill building seminars by national and international experts, followed by supporting thematic weekly seminars with CASC researchers. Critical

components of these explorations include Wellness in Academia, Research Integrity, Data Visualization, and the Science of Team Science. The data products, methodologies, and partnerships produced through the FP have directly benefited the AK CASC and its societal partners while providing a nurturing environment of exploration well beyond the hosting agreement for early career researchers. By the end of the host agreement the group became a holistically integrated component of the work underway by the center.

Some of the critical research conducted by AK CASC Fellows has been incorporated into research projects within the five-year host agreement, and used as the foundation for new initiatives critical to the past, present and future of the center. A non-exhaustive list of Fellows engaged with the AK CASC during the second host agreement follows.

**Joanna Young** was a PhD candidate in geophysics with the AK CASC whose research combined glaciology and environmental education. The first goal of Joanna's PhD research used hydrological modeling tools to partition freshwater runoff from glacier melt, snow melt and rainfall for the heavily glacierized Juneau Icefield in Southeast Alaska. The second goal was to determine the impacts of Girls on Ice Alaska, a unique, free, science immersion program for underserved high school girls from Alaska and the Pacific Northwest on its participants. In addition to instructing, Joanna is also studying the effects of Girls on Ice on the participants' environmental identities and understandings of climate change. Joanna tied together these interdisciplinary elements of her PhD using a conceptual framework she developed this spring based on published frameworks in socio-ecological systems literature. Joanna is now director of the Inspiring Girls\* Expeditions Alaska program and has expanded her research portfolio to include equity in climate science education access.

**Erin Trochim** began working with the Permafrost Action Team as part of the Study of Environmental Arctic Change (SEARCH) in collaboration with the AK CASC as part of her PhD research. Trochim produced two actionable knowledge pyramids, one on permafrost and infrastructure and the other focusing on ecosystem services and their impacts on communities. Trochim collaborated on a project assessing permafrost hazards for all communities in Alaska in collaboration with UAF Institute of Northern Engineering and U.S. Army Corps of Engineers. This assessment represents the first comprehensive effort to evaluate permafrost at the community-level for 187 communities where 48 percent were at moderate or greater risk from thawing permafrost. Trochim is now a Research Assistant Professor at UAF's Alaska Center for Energy and Power.

**Ross Spicer's** MSc research in Computer Science as an AK CASCC Fellow, was conducted from 2018-2020, in support of the Landscape evolution in Arctic and Western Alaska pilot project. Spicer was involved in the Alaska Thermokarst Model development, exploring which factors lead to thermokarst initiation.

**Rick Lader's** research began in supporting the Streamflow models in Southeast Alaska AK CASC pilot project. Lader earned his PhD in Atmospheric Sciences at UAF while researching extreme climate events across Alaska. One of these extremes, thaw-freeze events, is an indicator of widespread mortality risk to yellow-cedar forests in Southeast Alaska. While results of his analysis generally showed an increase in the number of these events and a northward displacement through time, the higher resolution data that are currently being produced can provide land-use managers with more detailed stand-level information. Lader was

funded by a number of AK CASC projects producing information for Southeast Alaska and for the National Park Service and serves on the Dynamical Downscaling team at IARC.

AK CASC supported UAFs graduate students **Claire Delbecq** and **Kevin Fitzgerald** started their field research in April 2021 on a multi-disciplinary project studying the impacts of hydrologic variability on salmon habitat quality in a predominantly rain-fed watershed in Juneau, Alaska. Their research investigated how the sequence, magnitude, and timing of stream flows influences riverine materials export, and in turn, the proportion of juvenile Coho Salmon growth attributed to periods of high and low flow. With the assistance of two University of Alaska Southeast (UAS) undergraduate students (Lucy Franklin and Ezra Grey) and Co-I's Jeff Falke, Ryan Bellmore, and Jason Fellman, stream drift and water samples were collected at least twice per week from late April through October 2021 to complete the analyses. Kevin and Claire defended their theses in 2023 and Claire has moved on to a position with the Alaska Department of Fish & Game.

UAS undergraduate student **Amy Jensen** was supported in summer 2020 to model changes in outburst floods over decadal timescales. She continued to work on the project as a Master's student at Montana State University and presented her findings at the Northwest Glaciologists Meeting in October 2020. She published a modeling study in *The Cryosphere* that describes how remnant ice left in a marginal basin and changes in glacier geometry have important implications for outburst flood magnitude and duration. This study was motivated by work at Suicide Basin and has broadened the impact of the project.



## 5. Outreach

This section highlights successful long-term and innovative efforts by the AK CASC to engage in outreach activities targeting specific populations within the region over the course of the last cooperative agreement.

### Alaska Voices

In collaboration with StoryCorps, Alaska Voices was originally launched as “ScienceTapes” in late June 2017 with a mission to “record and share Alaska’s science and place-based stories to build bridges between people, communities, agencies, and scientists; helping inform our decisions to support a better tomorrow.” Within the mission, the thematic areas of interest are co-production of science; co-projection of knowledge; changing landscape, climate, and wildlife; Engineering, technology, and energy; and the humanity of science. Since its inception, the Alaska Voices team facilitated approximately 60 conversations, with 49 archived with StoryCorps and at the American Folklife Center at the Library of Congress in Washington, D.C. In Year 2 they received a one-time grant of \$35,000 from the UAF Chancellor to support the AlaskaVoices project. The funds were used to develop an Alaska Voices website, produce the 60+ audio conversations; and continue the collaboration with StoryCorps for archiving conversations within the StoryCorps project as well as the National Archives in Washington, D.C. In year 3 the project launched as a podcast. The launch on 7 May 2020 coincided with a revision of a dedicated [Alaska Voices website](#), [YouTube trailer](#), a live digital launch event, and interviews on other Arctic podcasts and local radio. Episodes are published on the website and through podcast platforms. In Summer 2020, the Alaska Voices team produced six 1-hour long radio shows for KUAC (Fairbanks, AK National Public Radio station) that were broadcast statewide. During Year 5, a 10 episode “bridge season” aired in Spring 2021 that focused on additional conversational threads/stories derived from the initial recordings. To date, the Alaska Voices podcast has had over 8,000 downloads.

### Climate Action and Adaptation Plan support

Climate action and adaptation plans have been developed by various levels of government across the state of Alaska. AK CASC personnel Eran Hood, Ryan Toohey and Jessica Garron contributed subject matter expertise during the planning, writing, and adoption phases of Climate Action/Adaptation Plans across the state. Those for the Municipality of Anchorage and the City and Borough of Juneau accepted input from Eran Hood and Ryan Toohey before being adopted. The Climate Action and Adaptation Plan for the Fairbanks North Star Borough included input from AK CASC Deputy Director Jessica Garron but has not been passed by the borough assembly.

### Inspiring Girls\* Expeditions

The AK CASC has been the host of [Inspiring Girls\\* Expeditions Alaska](#) since 2012. The flagship expedition, Girls on Ice Alaska, takes place on a remote Alaska glacier for 12 days

every summer, with a team of professional scientists, artists and mountaineers. 2019 leveraged additional funding from the Alaska Established Program to Stimulate Competitive Research (EPSCoR) to support the launch of a second IG\*E Alaska expedition: Girls on Water. The expedition is based out of Homer, Alaska and teaches field science, art, and wilderness skills on a multi day sea kayaking expedition. Due to restrictions arising from the COVID-19 pandemic, summer 2020 expeditions Girls on Ice Alaska and Girls on Water were canceled. The team pivoted rapidly to offering the alternative experience “Expeditions@Home,” in collaboration with other Inspiring Girls Expeditions branches. This virtual program combined online curriculum, online weekly meetings in small teams, and mailed activity packages including an illustrated field guide centered on the Inspiring Girls Expeditions educational philosophy. In summer 2021, Inspiring Girls Expeditions of Alaska successfully hosted three expeditions for 27 girls and gender-expansive youth aged 16 to 18. This included the launch of the new Girls\* in the Forest expedition, which focuses on the unique boreal forest ecosystem of Alaska's interior through a river packrafting trip. All three Alaska expeditions returned to full in-person delivery in 2022 and 2023. A total of 117 individuals participated in Inspiring Girls\* Expedition programming in-person during the host agreement while another 31 participated in adapted Expeditions@Home programming.

## Looking Forward, Looking Back: Building Resilience Today

AK CASC's Malinda Chase (Tribal Liaison), and USGS Scientists Jeremy Littell and Ryan Toohey developed and led a workshop and training series provided to rural Alaska communities adapting to climate change impacts called, “Building Resilience Today” (BRT). The AK CASC co-hosted the first workshop in the series with the Aleutian Pribilof Islands Association at the International Arctic Research Center in April 2019. Fourteen representatives from five tribes attended and participated in knowledge-sharing activities on climate impacts in their communities, available resources and tools, and climate models. Building on this seminal workshop. Year 3 activities included a series of [onsite workshop events](#) within the rural Alaska communities of Kotlik, Kwigillingok, Iliamna, Quinhagak, and St. Michael. The workshops were intended to assist community members with documenting locally-relevant information and to tailor climate science products to the needs and conditions of each community. In Year 4, a training was held at UAF on January 28-30, 2020 to increase the awareness of the on-line tools, resources, and approaches for climate adaptation planning and decision-making for community participants. The project culminated in the production of [community reports for each participating community](#), synthesizing observed change, available tools for adaptation planning, and climate projections until the end of the century, and training reports for the two trainings in Fairbanks. The AK CASC contributed a significant amount of time and resources to the communication and outreach activities of this project and has built upon the lessons learned and partnerships established during BRT to expand the scope of knowledge for the second phase of the effort funded during Year 6 by the BIA titled, “Strengthening Resilience Today”.

## Web Tools

Through its colocation with the Scenarios Network for Alaska & Arctic Planning (SNAP) at the IARC, the AK CASC is uniquely positioned to develop web tools and information portals to promote easier access to scientific research and data. AK CASC researchers have been leveraging the benefits of this relationship throughout the host agreement. Postdoctoral Researcher Erin Trochim leveraged this relationship during her work assessing permafrost hazards for all communities in Alaska in collaboration with the Institute for Northern Engineering to produce a [Community Permafrost](#) risk tool. The [Alaska Wildfire Explorer](#) and [Wildfire Tally Tool](#) fuse present and historical information with the real time data layers collected from the Alaska Interagency Coordination Center which manages wildfire data across the state. A [precipitation projection tool](#) built to meet the needs of the Alaska Department of Transportation & Public Facilities follows a similar past, current, real-time, technical approach. The [Alaska Garden Helper Tool](#) was developed by Alaska farmers and gardeners in collaboration with the USDA Northwest Climate Hub and AK CASC Researcher Nancy Fresco in 2019. The [Integrated Ecosystem Monitoring Project](#), has also utilized a web tool as a communication mechanism in the form of the [Northern Climate Reports](#) website. The tool delivers information on temperature, precipitation, permafrost, wildfire, and ground cover change projections both for points and for areas of interest for the public and decision makers (Hydrological Units, Park boundaries, boroughs, etc.) This framework was then utilized to build a tool focused on the interplay between shifts in [wildfire and fish habitat](#) with frequent AK CASC collaborator and Alaska Cooperative Fish and Wildlife Research Unit Director, Jeff Falke. It is also being utilized in the development of the [Arctic Environmental & Engineering Data & Design Support System \(Arctic EDS\)](#) which is currently in beta and will replace the print version of the Environmental Atlas of Alaska, a critical engineering reference guide for infrastructure construction in the state. All of these tools leveraged AK CASC funds, skills, data, and digital infrastructure to surpass traditional science outreach websites.

## Massive Open Online Course (MOOC)

During 2021 the AK CASC worked together with Arctic researchers and the center's partner institution the International Arctic Research Center as well as UAF's eCampus to build a Massive Open Online Course (MOOC) on the EdX platform titled [Climate Change in Arctic Environments](#). The course comprises 4 weeks of Climate Science information structured into units presented by a subject matter expert alongside short readings and comprehension checks. One third of the subject matter experts were AK CASC affiliated, including both course lead John Walsh, and project coordinator Mike DeLue. The effort was made possible by UAF's partnership with EdX and provides a more rigorous and contextual approach to climate science dissemination with professional production levels.

## Website

The AK CASC has maintained a website for the duration of the cooperative agreement hosted by UAF at the address [akcasc.org](http://akcasc.org) and also available at [casc.alaska.edu](http://casc.alaska.edu). In Year 3 Molly

Tankersley, Mike DeLue and Carolyn Rosner began the process of evaluating and re-designing the AK CASC website to better serve the needs of its users. The re-design included streamlining the content and presentation of the AK CASC's mission, research, and communication/outreach activities to increase science understanding and access to the information and tools housed on the site. The re-design process was completed in summer 2020 and continues to expand with the additional housing of materials related to the Alaska Tribal Resilience Learning Network and actionable science activities . This AK CASC website provides access to recordings of information sessions, project descriptions and outputs, related adaptation resources, and AK CASC created reports such as documents from the Looking Forward, Looking Back: Build Resilience Today training.

## Logo Redesign

The AK CASC designed a new logo in 2022 to emphasize Alaska's iconic imagery and ever-present position at the forefront of climate change. The new design features sharp-angled colored shapes to symbolize the Northern Lights and ice, and hint at a climate-warming graph. The white mountain shape symbolizes well-known Alaska topography, the cryosphere, a variety of ecosystems, and a climate-warming graph. The blue shapes at the bottom symbolize the coast, freshwater and marine ecosystems, and non-mountain land areas. The hexagonal shape is reminiscent of the blocky surface patterns of permafrost landscapes. This new visual identity reflects ongoing efforts to produce Alaska-specific climate data to meet state needs around climate impacts, adaptation, and resilience.



## Social Media

In 2017, the AK CASC established a social media presence on Facebook and Twitter, adding Instagram the following year. In Year 3 AK CASC social media presences were consolidated under the International Arctic Research Center, the UAF host of the center, and IARC as a whole developed a YouTube page for increased discoverability of video content.

## Presentations

Staff and researchers with the Alaska CASC are frequently asked to serve on panels or give presentations as relates to their expertise. CASC researchers frequently participate in a number of standing webinar series as a result of the colocation with other units within the International Arctic Research Center. These include the Alaska Tribal Resilience Learning Network monthly information sessions, the Alaska Center for Climate Assessment and Policy

webinar series, IARC Salon, and the bi-monthly International Seminar Series on Ocean Sciences.

AK CASC researchers are called upon to explain climate change and resulting phenomena to local and national media outlets, as well as to provide expertise in climate adaptation discussions at all scales of government. CASC scientists provide informal and formal presentations during climate crises and scenarios in Alaska, and help to explain them once they are concluded. This knowledge broker role is critical for CASC science outreach to decision-makers, including the electorate, and activates AK CASC science in real-time.

The AK CASC funded or co-funded several science communication and training workshops for researchers and collaborators during the host agreement including two Alan Alda Science Communication Center trainings, a training for scientists on handling media requests and interviews, and a workshop presented by Ilarion Mercuri and Libby Roderick of UAA's Difficult Dialogues Initiative.

AK CASC researchers and staff have also been consistent participants in the leading scientific conferences such as the American Geophysical Union and the American Meteorological Society annual meetings and the Alaska Forum on the Environment. The AK CASC has also contributed to one-off presentations for more targeted audiences such as the Alaska Coastal Communities Forum presented by Qawalangin Tribe in 2022, the Federal Highway Administration's Ice Road Symposium in Bethel, AK during November of 2022 and the Climate Day of the 2023 Alaska Defense Forum.

## Diversity, Equity, and Inclusion (DEI)

As part of its work the AK CASC engages with Alaska Native knowledge keepers, Elders, and teachers from rural communities throughout Alaska as well as other historically marginalized and underrepresented groups. These efforts synthesized with the tenets of Diversity, Equity & Inclusion (DEI) are incorporated into all stages of AK CASC work. The AK CASC supports the IARC DEI Working Group, co-led by AK CASC administrative assistant Mimi Lesniak during Years 3 through 5 of the host agreement, and was critical in establishing the position of a full-time IARC DEI Coordinator in 2022 to support the needs of the AK CASC.

The AK CASC co-led a poster presentation by the IARC DEI working group on successful DEI strategies in research during the 2021 AGU Fall Meeting in New Orleans. The poster featured AK CASC research efforts, Inspiring Girls\* Expeditions, and multiple AK CASC co-authors with Mimi Lesniak as second author. DEI integration into the AK CASC Fellows Program increased in 2022 with the funding of AK CASC Fellow Megan Pittas to attend the Just Transition Summit in May of 2022, and has expanded to include the DEI coordinator in all Fellows meetings and workshops to offer perspective and guidance for improvement in action. The AK CASC continues to work towards the institutionalization of the research co-production process, inclusive of DEI throughout the entire process. Mimi Lesniak and Mike DeLue, brought the perspectives of the broader IARC DEI Working Group to the AK CASC coproduction working group sessions, culminating in a set of co-production recommendations which are now being implemented at the leadership level to guide the future of AK CASC co-produced science. Different experiences, expertise, and ways of knowing are a strength of the center, allowing for the development and creation of diverse thoughts and ideas.

## 6. Summary

The second hosting agreement for the AK CASC has seen successes in science, capacity building, communication and service to Alaska Tribes and agencies. The pilot projects proposed for the agreement have led to targeted dynamically downscaled data products that serve management needs as well as ongoing monitoring and analyses of geophysical hazards unique to the cryospheric nature of the state. Current externally-funded projects and ongoing management decisions are utilizing the outputs of those pilot projects, and the expanded partnerships developed during their development are forming the foundation of future work at the consortium universities. AK CASC projects which developed alongside the host agreement during the past six years have expanded the portfolio and actionable footprint of the AK CASC to support the CASC's evolution into the next host agreement.

Consultation and service to Alaska Tribes has grown exponentially over the course of the host agreement, first through the hosting of one BIA-funded Tribal Climate Resilience Liaison position in collaboration with the Aleutian Pribilof Islands Association, to the current five liaisons hosted with the University of Alaska Fairbanks and the Native American Fish and Wildlife Society. These liaisons plus support staff and researchers form the core of the Alaska Tribal Resilience Learning Network (AK TRLN) which delivered trainings, webinars, print products and presentations while also assisting in the administration of grants and the development of plans and grant proposals by Tribal entities during the last three years of the host agreement.

AK CASC Communications personnel have developed and strengthened relationships across the International Arctic Research Center (IARC), the UAF research community, and the national CASC network to improve existing communications mechanisms and innovate on new products. These have included storymap translations of research, a successful long-term podcast, the collaborative development of an open online course about Arctic climate change, video products about key AK CASC research, and presentations to both public and targeted audiences.

Capacity-building efforts have succeeded for early career researchers, existing researchers, the next generation of climate scientists, and partners working with the AK CASC. The Inspiring Girls\* Expeditions program grew from one to three expeditions during the past six years and weathered the challenges of COVID travel restrictions by remotely-delivering high quality, climate-based curriculum throughout Alaska. The AK CASC Fellows support has expanded from individual climate-science M.S and PhD students on their journey to becoming post-doctoral researchers and now research faculty both within and outside of the Alaska CASC, to a cohort of early career climate researchers and catalysts of actionable science affecting climate adaptation across Alaska.

The establishment of the AK TRLN and the programs and projects developed in its first three years have permanently increased the breadth of the stakeholders and rights holders working with and served by the AK CASC, as well as the direct application of AK CASC research products.

## The future of the AK CASC

The integrated approach of our leadership, researchers, and communications professionals to provide actionable science solutions to resource management questions will persist in the AK CASC's third hosting agreement which was awarded in 2023 to the current University of Alaska consortium. Training the next generation of climate scientists is central to the role of the AK CASC and is reflected in the new hosting agreement that incorporates the successful programs and strategies from the prior AK CASC host agreements, including Inspiring Girls\* Expeditions, but with greater investment in the Fellows Program, the addition of a faculty Ambassador's Program, and a new capacity building approach for current researchers looking to increase actionable science and coproduction components of their research that we are calling "CASC-aiding". The CASC-aiding approach defined in the new hosting agreement will improve the coproduction process, and build upon the success of the past by creating institutional and permanent space for project partners and researchers to bring questions and research ideas forward for consideration and workshopping. Through these programmatic elements and the high quality research conducted through the USGS CASC science award process, we intend to formalize the process of uniting stakeholder groups with research teams, to understand each other's questions, and to coproduce answers to those questions through actionable science research.

The Alaska CASC will continue to provide localized cross-network leadership in innovative communication products and embedded communication methods in direct partnership with CASC researchers and the beneficiaries of that actionable science. The successful Alaska Voices podcast is planning for the next stages of recording while we maintain past resources such as our Massive Open Online Course, website, and coordinated social media presence.

The AK CASC's ongoing co-location with a powerful data visualization and management team focused on delivering climate data services to Alaskans will allow for the development of more innovative data products to serve decision-makers. The Northern Climate Reports tool, the underlying Application Program Interface (API) and the associated infrastructure are already being leveraged for new AK CASC-related projects with the publicly available API and the Northern Climate Reports tool receiving an official launch in fall 2023.

The AK CASC will continue its leadership in climate services to Tribes. The AK TRLN is expanding its capacity to directly assist tribes in accessing and utilizing climate data for local planning needs through broader training and more direct consultations, while also developing products and strategies for tribal co-learning outside of the bounds of the AK TRLN. The team is also continuing to host spaces for cohorts of Tribes in partnership with the Bureau of Indian Affairs, and climate-focused information sessions on a monthly basis. All of this work is supported by the ongoing relationship between the AK CASC and the Native American Fish and Wildlife Society's Tribal Resilience Liaisons now hosted in the Yukon-Kuskokwim Delta, Anchorage, Juneau, and Fairbanks alongside our university-hosted liaison.

The AK CASC will continue to lead Alaska and the nation in providing actionable climate adaptation services to Department of Interior partners, the State of Alaska, and Alaskans through quality partnerships and the coproduction of climate research.

## 7. Budget

Host agreement award expenditures are compared to the proposed budget in **Table 1** which describes both direct and indirect expenditures of the AK CASC over the five-year host agreement.

Table 1: Direct and indirect expenditure of the AK CASC over the five-year host agreement.

| Account Description    | Budget              | Expended            | Commitments     | Available Balance |
|------------------------|---------------------|---------------------|-----------------|-------------------|
| Personal Services      | 4,212,850.03        | 4,028,233.91        | 0               | 109,077.91        |
| Staff Benefits         | 1,349,538.52        | 1,243,862.90        | 0               | 80,417.31         |
| Travel                 | 11,598.00           | 31,231.00           | 0               | -19,633.00        |
| Contractual Services   | 139,645.99          | 158,878.64          | 1,222.09        | -20,454.74        |
| Commodities            | 20,032.99           | 26,930.97           | 0               | -6,911.93         |
| Student Aid            | 215,713.00          | 218,361.00          | 0               | -2,648.00         |
| F & A cost             | 2,908,363.47        | 2,782,413.65        | 0               | 75,040.67         |
| Miscellaneous Expenses | 0                   | 0                   | 0               | 0                 |
| <b>Grant Total</b>     | <b>8,857,742.00</b> | <b>8,489,912.07</b> | <b>1,222.09</b> | <b>214,888.34</b> |

The University of Alaska Fairbanks received a No Cost Extension from the USGS to expend remaining funds from the host agreement. Those funds will be expended prior to July 30, 2024.



## 8. Appendices

### Appendix I - Term Sheet

**PROPOSAL SUMMARY TO BE USED FOR ANNUAL REVIEWS OF THE  
USGS-UNIVERSITY OF ALASKA FAIRBANKS  
COOPERATIVE AGREEMENT FOR THE HOSTING OF  
THE ALASKA CLIMATE SCIENCE CENTER**

#### **INSTITUTIONAL ARRANGEMENTS**

- Rupp and three Co-Investigators (Co-Is, Bidlack, Bolton, Trammell) will serve as Management Team (MT)

- a. Each Co-I has oversight responsibility for a specific component—science, capacity building, data stewardship etc., communications, administration
- b. Leadership Team will
  - i. implement science vision and projects, and will actively engage and work with co-production partners to develop research projects, deliver and interpret results, and suggest implementation strategies
  - ii. mentor students and postdoctoral fellows
  - iii. and work with AK CSC staff to communicate the science vision and project results effectively
- c. MT is supported by half time Program Coordinator, half time Co-Production Coordinator and quarter time Administrative Assistant
- d. Management Team and Leadership Team (LT = MT + Scientists) meet twice per year in person
- e. Management Team will hold monthly conference calls
- f. Rupp and USGS staff will have weekly calls
- g. Will include efforts to include the BIA-funded Tribal Climate Science Liaison into CSC activities as appropriate

- Physical space

- a. Fellows will be provided with space consistent with other graduate students or post-doctoral researchers at UA-F, and space will be concentrated to encourage interaction and cohesion.
- b. UAF-based CSC staff including the University Director, Administrative Assistant, Program Coordinator, and Communications and/or Co-Production Specialist will be provided with office space phone lines, internet access, access to meeting facilities, etc. in proximity to one another and to other CSC space.
- c. Anchorage-based CSC staff (e.g. USGS, BIA) visiting Fairbanks will be provided with office space, phone lines, internet access, access to meeting facilities, etc. in locations that provide privacy where possible.

#### ***Deliverables / Annual Meeting Topics***

- Projects will incorporate appropriate elements from science, capacity building, and communications in a balanced manner
- Administration of the program will be effectively overseen to ensure timely and efficient implementation, e.g. of new hires and recruitment

- Regular consultations will take place as described
- Appropriate space will be available

### **CO-PRODUCED SCIENCE**

- UAF undertake Phase 1 co-production projects
  - a. Topics/projects include:
    - i. Wildfire projections / Interior AK
    - ii. Long term climate monitoring
    - iii. Streamflow models SE-AK
    - iv. Arctic and W-AK LCC landscape change
    - v. Glacier outburst flood modeling
  - b. Each will include co-production, communications, and capacity building elements and sustained throughout each AK CSC research project
  - c. Projects will be supported by AK CASC Scientists and facilitated by a co-production team at the AK CSC
  - d. An external evaluator will be retained to review pilots

- UAF will work with partners to identify and undertake Phase 2 projects

- a. Project selection to be done in conjunction with C4 committee
- b. Each will include co-production, communications, and capacity building elements and sustained throughout each AK CSC research project

- UAF will conduct the following major meetings

- a. Co-production workshops in Year 2 and 4 [targeted at Fellows]
  - i. will provide intensive science communication training to participants
  - ii. participants will be evaluated
- b. Co-production Summit in Year 3
- c. Science Synthesis in Year 5

- UAF will retain a Co-production coordinator. S/he will meet regularly with C4 and key AK CSC personnel (depending on project) to ensure effective co-production via iterative discussions and:

- a. ensure sustained attention to effective engagement between CSC participants and users
- b. develop a detailed description of the agency roles and responsibilities regarding climate change planning
- c. lead the identification, prioritization, and development of Phase 2 projects.
- d. maintain list of topical experts within UA system
- UA-F will undertake other science activities in response to pressing State needs.

### ***Deliverables / Annual Meeting Topics***

- Conduct at least five Phase 1 projects

- Identify and conduct Phase 2 projects
- Identify and conduct projects that meet “pressing or evolving state needs”
- All Phase 1 and Phase 2 projects will include co-production, communications, and capacity building elements in an appropriate balance, and have engagement from Senior Scientists and the Co-Production Coordinator
- Design and scoping of all projects, including interactions with ACCER and C4, to be done in collaboration with USGS CSC Director
- A detailed description of the agency roles and responsibilities regarding climate change planning will be developed
- A list of topical experts within UA system will be developed

## **CAPACITY BUILDING**

- UAF will implement a Fellows program
  - a. Fellows will include
    - i. postdocs: 1 in Year 1, 2 in Years 2-4, one in Year 5
    - ii. masters student: 1 in years 2-5
    - iii. PhD students: 1.5 in Year 1, 2, 4, and 5 and 3 in Year 3,
  - b. All Fellows will be competitively selected and will work on projects with significant direct connection to Phase 1 or Phase 2 projects or other activities meeting high CSC priorities
  - c. Fellow position descriptions (PD) will be written by research mentor and agency mentor working on relevant project; both will advertise position and select the fellow
  - d. AK CSC leadership team, including USGS personnel will provide input on PD and selection
  - e. Each Fellow will receive a stipend and research funding
  - f. Office space will be provided for Fellows in proximity to one another
  - g. Fellows will have virtual meetings each spring, and an in person meeting once per year along with Leadership Team meeting
  - h. Fellows will be highly involved in AK CSC meetings and events
    - i. UA-F will track fellows activities
    - i. A website portal will be provided to allow for uploads of project related data.
    - ii. AK CSC Program Coordinator will administer evaluation tools.
- UAF will continue to fund Inspiring Girls (formerly Girls on Ice) targeted at underrepresented girls including Alaskan natives.

## **DATA MANAGEMENT**

- UAF will support a data steward, whose duties include:
  - a. reviewing and assisting with development of project data management plans;
  - b. reviewing metadata and providing metadata development assistance;
  - c. transitioning final data and other associated research project products to the approved NCCWSC repositories;
  - d. preparing status reports and tracking documents;
  - e. participating in NCCWSC and CSC Data Management coordination discussions and meetings.

- UAF will

- a. continue developing Alaska-based data archive services to augment the NCCWSC repositories and provide local access
- b. continue the development of data exploration and accessibility web-based technologies

## SCIENCE COMMUNICATIONS

- a. UA-F will retain two half-time science communications specialists (Fairbanks, Southeast), supported by a team at IARC/SNAP with capacity in science writing, graphic design, and website design.
- b. UA-F will establish, jointly with USGS, a communications advisory group
  - i. Strategic plan in year 1
  - ii. Annual implementation plan will outline specific projects to be completed during the year
  - iii. Biennial teleconferences
- c. Provide 1-2 small project-related communications product grants per year
- d. The host institution will
  - i. manage the internal, promotional, marketing, and media relations activities
  - ii. manage the AK CSC website
  - iii. identify and carry out one or more projects each year to translate, integrate, or synthesize existing or new scientific information to meet stakeholder needs

## STAFFING

Information on staffing plans is contained within the U-AF proposal submitted November 8, 2016 (S22921R1-IARC-USGS-Rupp-PROP-20161108-Final.pdf), Attachment C tables, pages 58-67.

Copies of these tables are attached for reference. (Note: these tables were extracted from the proposal and converted to Word form. Slight formatting problems occurred but data were not affected.)

## Appendix II - Personnel Tables

Table 2. Personnel supported by the hosting agreement

| Personnel        | Institution | Role/Responsibilities            | Years Supported* |   |   |   |   |   |
|------------------|-------------|----------------------------------|------------------|---|---|---|---|---|
|                  |             |                                  | 1                | 2 | 3 | 4 | 5 | 6 |
| T. Scott Rupp    | UAF         | University Director/PI/MT/LT     | x                | x | x | x | x | x |
| Allison Bidlack  | UAS         | Co-I/MT/LT                       | x                | x | x |   |   |   |
| Jason Fellman    | UAS         | Co-I/MT/LT                       |                  |   |   | x | x | x |
| Bob Bolton       | UAF         | Co-I/MT/LT                       | x                | x | x | x | x | x |
| Jane Wolken      | UAF         | Program Coordinator              | x                | x | x |   |   |   |
| Jamie Trammell   | UAA         | CO-I/MT/LT                       | x                |   |   |   |   |   |
| Jessica Garron   | UAF         | University Deputy Director/MT/LT |                  |   |   |   | x | x |
| Molly Tankersley | UAS         | Communication Specialist         | x                | x | x | x | x | x |
| Mike DeLue       | UAF         | Communication Specialist         |                  |   | x | x | x | x |
| Amy McPherson    | UAF         | Data Steward                     |                  |   | x |   |   |   |
| Malinda Chase    | UAF         | Tribal Liaison/ AK TRLN Lead     |                  |   |   |   | x | x |
| Krista Heeringa  | UAF         | Learning Network Coordinator     |                  |   |   | x | x | x |
| Charlie Parr     | UAF         | Data Steward                     |                  |   |   | x | x | x |
| Kyle Redilla     | UAF         | Data Steward                     |                  |   |   |   | x | x |
| Mimi Lesniak     | UAF         | Administrative Assistant         | x                | x | x | x | x | x |
| Carolyn Rosner   | UAF         | Designer/Web Designer            | x                | x | x | x | x | x |
| Ruth Rutter      | UAF         | Web Manager                      | x                |   |   |   |   |   |
| Bruce Crevensten | UAF         | Software Developer               | x                | x | x | x | x | x |
| Tom Kurkowski    | UAF         | Data manager                     | x                | x |   |   |   |   |
| Matt Leonawicz   | UAF         | Data Analyst/SNAP                | x                | x |   |   |   |   |
| Robert Torgerson | UAF         | Computational Support            | x                | x | x | x | x | x |
| Uma Bhatt        | UAF         | AK CASC Scientist                | x                | x | x | x | x | x |
| Peter Bieniek    | UAF         | AK CASC Scientist                | x                | x | x | x | x | x |

| Personnel              | Institution                                                 | Role/Responsibilities    | Years Supported* |   |   |   |   |   |
|------------------------|-------------------------------------------------------------|--------------------------|------------------|---|---|---|---|---|
|                        |                                                             |                          | 1                | 2 | 3 | 4 | 5 | 6 |
| Todd Brinkman          | UAF                                                         | AK CASC Scientist        | x                | x | x | x | x |   |
| Nancy Fresco           | UAF                                                         | AK CASC Scientist        | x                | x | x | x | x | x |
| Claudine Hauri         | UAF                                                         | AK CASC Scientist        | x                | x | x | x | x | x |
| Eran Hood              | UAS                                                         | AK CASC Scientist        | x                | x | x | x | x | x |
| Nathan Kettle          | UAF                                                         | AK CASC Scientist        | x                | x | x | x | x | x |
| Kristin Timm           | UAF                                                         | AK CASC Scientist        |                  |   |   | x | x | x |
| Stephanie McAfee       | University of Nevada, Reno (UNR)                            | AK CASC Scientist        | x                | x | x | x | x |   |
| John Walsh             | UAF                                                         | AK CASC Scientist        | x                | x | x | x | x | x |
| Jessie Young-Robertson | UAF                                                         | AK CASC Scientist        |                  |   |   |   | x | x |
| Andy Baltensperger     | UAF                                                         | AK CASC Scientist        |                  |   |   |   | x |   |
| Erik Schoen            | UAF                                                         | AK CASC Scientist        |                  |   |   |   | x | x |
| Gabriel Wolken         | UAF/<br>Alaska Division of Geological & Geophysical Surveys | AK CASC Scientist        | x                | x | x | x | x | x |
| Rick Lader             | UAF                                                         | Fellow/AK CASC Scientist |                  | x | x | x | x | x |
| Julian Dann            | UAF                                                         | Fellow                   |                  |   |   | x | x | x |
| Ross Spicer            | UAF                                                         | Fellow                   |                  | x | x |   |   |   |
| Claire Delbecq         | UAS                                                         | Fellow                   |                  |   |   |   | x | x |
| Erin Trochim           | UAF                                                         | Fellow                   | x                | x | x |   |   |   |
| Kevin Fitzgerald       | UAF                                                         | Fellow                   |                  |   |   |   | x | x |
| Chris Waigl            | UAF                                                         | Fellow                   |                  |   |   |   | x | x |
| Joanna Young           | UAF                                                         | Fellow/AK CASC Scientist | x                | x | x | x | x | x |
| Erica McCall Valentine | The Scholar Ship                                            | External Evaluator       | x                | x | x | x | x |   |
| Christian Keinholz     | UAS                                                         | AK CASC Scientist        | x                | x | x | x |   |   |

| Personnel       | Institution                | Role/Responsibilities            | Years Supported* |   |   |   |   |   |
|-----------------|----------------------------|----------------------------------|------------------|---|---|---|---|---|
|                 |                            |                                  | 1                | 2 | 3 | 4 | 5 | 6 |
| Jamie Trammell  | Southern Oregon University | AK CASC Scientist                | x                |   | x |   |   |   |
| Brian Buma      | UAS                        | Senior Scientist                 | x                | x | x |   |   |   |
| Michael Lindgen | UAF                        | Programmer                       | x                | x |   |   |   |   |
| Lindsey Heaney  | UAF                        | Science Communication Specialist | x                |   |   |   |   |   |

\* Indicates that personnel received some proportion of FTE from host agreement funds in that year. Support for positions varied significantly across personnel and years.

Table 3. Personnel not funded by the hosting agreement who have contributed time and service of value to the AK CASC

| Personnel              | Institution                                         | Role                              | Responsibilities                                                                                                         |
|------------------------|-----------------------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Justin Leon            | Native American Fish and Wildlife Society           | AK CASC BIA Senior Tribal Liaison | AK CASC -BIA Tribal Liaison Year 5                                                                                       |
| Kaitlyn Demoski        | Native American Fish and Wildlife Society           | AK CASC BIA Tribal Liaison        | AK CASC -BIA Tribal Liaison Year 6                                                                                       |
| Tess Hostetter         | Native American Fish and Wildlife Society           | AK CASC BIA Tribal Liaison        | AK CASC -BIA Tribal Liaison Year 6                                                                                       |
| Jerilyn Kelly          | Native American Fish and Wildlife Society           | AK CASC BIA Tribal Liaison        | AK CASC -BIA Tribal Liaison Year 6                                                                                       |
| Malinda Chase          | Aleutian Pribilof Islands Association               | AK CASC BIA Tribal Liaison        | AK CASC -BIA Tribal Liaison Years 1-4                                                                                    |
| Adam Young             | UAF                                                 | CAP Fellow                        | AK CASC Postdoctoral Fellow/NCASC Supported Wildfire Synthesis Cohort                                                    |
| Heather McFarland      | UAF                                                 | IARC Science Communications Lead  | Supports many of the AK CASC communication activities                                                                    |
| Katreen Wikstrom Jones | Alaska Division of Geological & Geophysical Surveys | Collaborator                      | Collaborator on the pilot project in Suicide Basin, and the large-scale avalanche hazard mapping research with G. Wolken |

| <b>Personnel</b>       | <b>Institution</b>                 | <b>Role</b>                               | <b>Responsibilities</b>                                                                                                                                                                                          |
|------------------------|------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| David Hill             | Oregon State University            | Collaborator                              | Collaborator on <i>Streamflow models in Southeast Alaska pilot project</i>                                                                                                                                       |
| Eugenie Euskirchen     | UAF                                | AK CASC Affiliated Scientist; IEM Project | IEM Project                                                                                                                                                                                                      |
| Amy Breen              | UAF                                | AK CASC Affiliated Scientist              | IEM Project                                                                                                                                                                                                      |
| Brian Buma             | University of Colorado Denver      | AK CASC Senior Scientist                  | Senior Scientist/Leadership Team                                                                                                                                                                                 |
| Jessie Young-Robertson | UAF                                | Co-I                                      | Co-I For Alaska Voices project                                                                                                                                                                                   |
| Allison York           | UAF/Alaska Fire Science Consortium | Collaborator                              | Collaborator on the “Wildfire projections in Interior Alaska” project; serves as the co-production liaison between the fire management community and UAF AK CASC                                                 |
| Jamie Trammell         | Southern Oregon University         | Collaborator                              | Collaborator on the “Long term climate monitoring” pilot project                                                                                                                                                 |
| David Hill             | Oregon State University            | Collaborator                              | Collaborator for the “Streamflow models in SE AK” pilot project; Provides feedback on input requirements for existing stream discharge model; models stream discharge when downscaling products become available |
| Vladimir Romanovsky    | UAF                                | AK CASC Scientist                         | IEM Project                                                                                                                                                                                                      |
| David McGuire          | USGS                               | AK CASC Scientist                         | IEM Project                                                                                                                                                                                                      |



## Appendix III - AK CASC Publications for August 1, 2017 through July 31, 2023

Below find a table of scientific publications involving AK CASC projects or authors for the duration of the hosting agreement. Note that publications in 2023 and 2017 may overlap with previous or subsequent hosting agreements.

Table 4. AK CASC Publications

| <b><u>Year</u></b> | <b><u>Title</u></b>                                                                                                                                                              | <b><u>Authors</u></b>                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2023               | Tree-Ring Derived Avalanche Frequency and Climate Associations in a High-Latitude, Maritime Climate                                                                              | Peitzsch, E. H., Hood, E., Harley, J. R., Stahle, D. K., Kichas, N. E., & Wolken, G. J.                                                                                                                                                            |
| 2023               | Hypoxia vulnerability in the salmon watersheds of Southeast Alaska                                                                                                               | Sergeant, C. J., Bellmore, J. R., Bellmore, R. A., Falke, J. A., Mueter, F. J., & Westley, P. A.                                                                                                                                                   |
| 2023               | Redistributing Power in Community and Citizen Science: Effects on Youth Science Self-Efficacy and Interest                                                                       | Clement S, Spellman K, Oxtoby L, Kealy K, Bodony K, Sparrow E, Arp C                                                                                                                                                                               |
| 2023               | A research agenda for the science of actionable knowledge: Drawing from a review of the most misguided to the most enlightened claims in the science-policy interface literature | Jagannathan K, Emmanuel G, Arnott J, Mach KJ, Bamzai-Dodson A, Goodrich K, Meyer R, Neff M, Sjoström KD, Timm KMF, Turnhout E, Wong-Parodi G, Bednarek AT, Meadow A, Dewulf A, Kirchhoff CJ, Moss RH, Nichols L, Oldach E, Carmen Lemos M, Klenk N |
| 2023               | Removing Barriers to Science and the Outdoors for Teenage Youth and Early Career Professionals in the US Arctic and Beyond: An Expedition-Based Model                            | Young J, Clement S, Pettit E                                                                                                                                                                                                                       |
| 2023               | Alaska Terrestrial and Marine Climate Trends, 1957-2021                                                                                                                          | Ballinger TJ, Bhatt US, Bieniek PA, Brettschneider B, Lader RT, Littell JS, Thoman RL, Waigl CF, Walsh JE, Webster MA                                                                                                                              |
| 2023               | Trees in the Stream: Determining Patterns of Terrestrial Dissolved Organic Matter Contributions to the Northeast Pacific Coastal Temperate Rainforest                            | Behnke MI, Fellman JB, D'Amore DV, Spencer RGM                                                                                                                                                                                                     |

| <b><u>Year</u></b> | <b><u>Title</u></b>                                                                                                                                  | <b><u>Authors</u></b>                                                                                                                                                                                                                                           |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2023               | What Does Equitable Co-production Entail?<br>Three Perspectives                                                                                      | Akerlof KL, Tim KMF, Chase A, Cloyd ET, Heath E, McGhghy BA, Bamzai-Dodson A, Bogard G, Carter S, Garron J, Gavazzi M, Kettle N, Labriole M, Littell JS, Madajewicz M, Reyes J, Rivers III L, Sheats JL, Simpson CF, Toohey RC                                  |
| 2023               | Modeling coho salmon population response to streamflow and water temperature extremes                                                                | Bellmore JR, Sergeant CR, Bellmore RA, Falke JA, Fellman JB                                                                                                                                                                                                     |
| 2023               | Glacier runoff influences biogeochemistry and resource availability in coastal temperate rainforest streams: Implications for juvenile salmon growth | Fellman JB, Bellmore JR, Johnson C, Dunkle MR, Hood E                                                                                                                                                                                                           |
| 2023               | Evaluating Drought Indices for Alaska                                                                                                                | Joshua M. Walston, Stephanie A. McAfee, and Daniel J. McEvoy                                                                                                                                                                                                    |
| 2023               | Aquatic biomass is a major source to particulate organic matter export in large Arctic rivers                                                        | Megan I. Behnke, Suzanne E. Tank, James W. McClellan, Robert M. Holmes, Negar Haghipour, Timothy I. Eglinton, Peter A. Raymond, Anya Suslova, Alexander V. Zhulidov, Tatiana Gurtovaya, Nikita Zimov, Sergey Zimov, Edda A. Mutter, Edwin Amos, Robert G. M. Sp |
| 2023               | Climate Indicators of Landslide Risks on Alaska National Park Road Corridors                                                                         | Lader, Rick, Pamela Sousanes, Uma S. Bhatt, John E. Walsh, and Peter A. Bieniek                                                                                                                                                                                 |
| 2022               | A melting cryosphere constrains fish growth by synchronizing the seasonal phenology of river food webs                                               | Bellmore JR, Fellman JB, Hood E, Dunkle MR, Edwards RT                                                                                                                                                                                                          |
| 2022               | Factors Controlling a Synthetic Aperture Radar (SAR) Derived Root-Zone Soil Moisture Product over The Seward Peninsula of Alaska                     | Julian Dann, Katrina E. Bennett, W. Robert Bolton, Cathy J. Wilson                                                                                                                                                                                              |
| 2022               | Projections of Hydroclimatic Extremes in Southeast Alaska under the RCP8.5 Scenario                                                                  | Rick Lader, Uma S. Bhatt, John E. Walsh, Peter A. Bieniek                                                                                                                                                                                                       |
| 2021               | The evolution of stream dissolved organic matter composition following glacier retreat in coastal watersheds of southeast Alaska                     | Holt AD, Fellman JB, Hood E, Kellerman AM, Raymond P, Stubbins A, Dittmar T, Spencer RGM                                                                                                                                                                        |

| <b><u>Year</u></b> | <b><u>Title</u></b>                                                                                                                        | <b><u>Authors</u></b>                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2021               | Climate Change Effects on North American Fish and Fisheries to Inform Adaptation Strategies                                                | Craig Paukert, Julian D. Olden, Abigail J. Lynch, David D. Breshears, R. Christopher Chambers, Cindy Chu, Margaret Daly, Kimberly L. Dibble, Jeff Falke, Dan Issak, Peter Jacobson, Olaf P. Jensen, Daphne Munroe                                              |
| 2021               | Climate Change, Farming, and Gardening in Alaska: Cultivating Opportunities                                                                | Fresco, N.; Bennett, A.; Bieniek, P.; Rosner, C.                                                                                                                                                                                                               |
| 2021               | A Changing Hydrological Regime: Trends in Magnitude and Timing of Glacier Ice Melt and Glacier Runoff in a High Latitude Coastal Watershed | Young, J. C., Pettit, E., Arendt, A., Hood, E., Liston, G. E., & Beamer, J.                                                                                                                                                                                    |
| 2021               | Emerging Anthropogenic Influences on the Southcentral Alaska Temperature and Precipitation Extremes and Related Fires in 2019              | Bhatt, U.S.; Lader, R.T.; Walsh, J.E.; Bieniek, P.A.; Thoman, R.; Berman, M.; Borries-Strigle, C.; Bulock, K.; Chriest, J.; Hahn, M.; Hendricks, A.S.; Jandt, R.; Little, J.; McEvoy, D.; Moore, C.; Rupp, T.S.; Schmidt, J.; Stevens, E.; Strader, H.; Waigl, |
| 2020               | Looking Forward, Looking Back: Building Resilience Today Training Two Report                                                               | Chase M, Heeringa K, Littell J, Toohey R, Tankersley M (eds.)                                                                                                                                                                                                  |
| 2020               | Looking Forward, Looking Back: Building Resilience Today Training One Report                                                               | Chase M, Littell J, Toohey R, Tankersley M (eds.)                                                                                                                                                                                                              |
| 2020               | Looking Forward, Looking Back: Building Resilience Today Community Report Kwigillingok, AK                                                 | Community of Kwigillingok, Littell JS, Fresco N, Toohey RC, Chase M (eds.)                                                                                                                                                                                     |
| 2020               | Looking Forward, Looking Back: Building Resilience Today Community Report Kotlik, AK                                                       | Community of Kotlik, Littell JS, Fresco N, Toohey RC, Chase M (eds.)                                                                                                                                                                                           |
| 2020               | Looking Forward, Looking Back: Building Resilience Today Community Report Quinhagak, AK                                                    | Community of Quinhagak, Littell JS, Fresco N, Toohey RC, Chase M (eds.)                                                                                                                                                                                        |
| 2020               | Looking Forward, Looking Back: Building Resilience Today Community Report St. Michael, AK                                                  | Community of St. Michael, Littell JS, Fresco N, Toohey RC, Chase M (eds)                                                                                                                                                                                       |
| 2020               | Looking Forward, Looking Back: Building Resilience Today Community Report Iliamna, AK                                                      | Community of Iliamna, Littell JS, Fresco N, Toohey RC, Chase M (eds)                                                                                                                                                                                           |
| 2020               | 'You really see it': environmental identity shifts through interacting with a climate change-impacted glacier landscape                    | Joanna C. Young, Laura D. Carsten Conner, Erin Pettit                                                                                                                                                                                                          |

| <b><u>Year</u></b> | <b><u>Title</u></b>                                                                                                                           | <b><u>Authors</u></b>                                                                                                                                                                                                                                  |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2020               | Northern Ecohydrology of Interior Alaska Subarctic. In Yang, D et al., Arctic hydrology, permafrost, and ecosystem: linkages and interactions | Young-Robertson, J., Bolton, W., and R.C. Toohey.                                                                                                                                                                                                      |
| 2020               | Stormflows drive stream carbon concentration, speciation, and dissolved organic matter composition in coastal temperate rainforest watersheds | Fellman, J. B., Hood, E., Behnke, M. I., Welker, J. M., & Spencer, R. G. M.                                                                                                                                                                            |
| 2020               | Glacier loss impacts riverine organic carbon transport to the ocean                                                                           | Hood, E., Fellman, J. B., & Spencer, R.G. M.                                                                                                                                                                                                           |
| 2020               | Using Information From Global Climate Models to Inform Policymaking—The Role of the US Geological Survey                                      | Terando, A., Reidmiller, D., Hostetler, S.W., Littell, J.S., Beard Jr, T.D., Weiskopf, S.R., Belnap, J. and Plumlee, G.S.                                                                                                                              |
| 2020               | The record low Bering Sea ice extent in 2018: Context, impacts and an assessment of the role of anthropogenic climate change                  | Thoman, R.L., Bhatt, U.S., Bieniek, P.A., Brettschneider, B.R., Brubaker, M., Danielson, S.L., Labe, Z., Lader, R., Meier, W.N., Sheffield, G., and Walsh, J.E.                                                                                        |
| 2020               | A classification of streamflow patterns across the coastal Gulf of Alaska                                                                     | Sergeant, C.J., Falke, J.A., Bellmore, R.A., Bellmore, J.R., and Crumley, R.L.                                                                                                                                                                         |
| 2020               | So goes the snow: Alaska snowpack changes in a warming climate                                                                                | Littell, J.S., Reynolds, J.H., Bartz, K.K., McAfee, S.A., and Hayward, G.                                                                                                                                                                              |
| 2020               | Risk and recreation in a glacial environment: Understanding glacial lake outburst foods at Bear Glacier in Kenai Fjords National Park         | Kurtz, D. and Wolken, G.                                                                                                                                                                                                                               |
| 2020               | Deglacierization of a marginal basin and implications for outburst floods, Mendenhall Glacier, Alaska                                         | Kienholz, C., Pierce, J., Hood, E., Amundson J., Wolken, G., Jacobs, A., Hart, S., Wikstrom Jones, K., Abdel-Fattah, D., Johnson, B., and Conaway, J.                                                                                                  |
| 2020               | Unfamiliar Territory: Emerging Themes for Ecological Drought Research and Management                                                          | Crausbay, S. D., Betancourt, J., Bradford, J., Cartwright, J., Dennison, W.C., Dunham, J., Enquist, C. A. F., Frazier, A. G., Hall, K. R., Littell, J. S., Luce, C.H., Palmer, R., Ramirez, A. R. Rangwala, I., Thompson, L., Walsh, B. M., Carter, S. |
| 2020               | Dynamical Downscaling for Southeast Alaska: Historical Climate and Future Projections                                                         | Lader, R., A. Bidlack, J. E. Walsh, U. S. Bhatt, and P. A. Bieniek                                                                                                                                                                                     |

| <b><u>Year</u></b> | <b><u>Title</u></b>                                                                                                                        | <b><u>Authors</u></b>                                                                                                                                                                                                                                           |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2020               | Increased drought severity tracks warming in the United States' largest river basin                                                        | Martin, J. T., Pederson, G.T., Woodhouse, C. A., Cook, E. R., McCabe, G. J., Anchukaitis, K. J., Wise, E. K., Erger, P. J., Dolan, L., McGuire, M., Gangopadhyay, S., Chase, K. J., Littell, J. S., Gray, S. T., St. George, S., Friedman, J. M., Sauchyn, D. J |
| 2020               | A Comparison of Fire Weather Indices with MODIS Fire Days for the Natural Regions of Alaska                                                | Ziel, R.H., Bieniek, P.A.; Bhatt, U.S., Strader, H., Rupp, T.S., York, A.                                                                                                                                                                                       |
| 2020               | Climate and disturbance driven changes in subsistence berries in coastal Alaska: Using Indigenous knowledge to inform ecological inference | Herman, Mercer, N., Loehman, R.A., Toohey, R.C. and Paniyak, C.                                                                                                                                                                                                 |
| 2020               | Glaciers and climate of the Upper Susitna basin, Alaska                                                                                    | Bliss, A., Hock, R., Wolken, G., Whorton, E., Aubry-Wake, C., Braun, J., Gusmeroli, A., Harrison, W., Hoffman, A., Liljedahl, A., and Zhang, J.                                                                                                                 |
| 2020               | Lightning variability in dynamically downscaled simulations of Alaska's present and future summer climate                                  | Bieniek, P.A., Bhatt, U.S., York, A., Walsh, J., Lader, R., Strader, H., Ziel, R., and Thoman, R.L.                                                                                                                                                             |
| 2019               | Managing Effects of Drought and Other Water Resource Challenges in Alaska and the Pacific Northwest                                        | Halofsky, J. E.; Littell, J. S.; Peterson, D. L.; Hayward, G. D.; Gravenmier, R.                                                                                                                                                                                |
| 2019               | Extent changes in the perennial snowfields of Gates of the Arctic National Park and Preserve, Alaska                                       | Tedesche, M.E., Trochim, E.D., Fassnacht, S.R., and Wolken, G.J.                                                                                                                                                                                                |
| 2019               | Changing characteristics of runoff and freshwater export from watersheds draining Northern Alaska                                          | Rawlins, M.A., Cai, L., Stuefer, S.L., and Nicolsky, D.                                                                                                                                                                                                         |
| 2019               | Radiative forcing by dust and black carbon on the Juneau Icefield, Alaska                                                                  | Nagorski, S., Kaspari, S., Hood, E., Fellman, J. and McKenzie Skiles, S.                                                                                                                                                                                        |
| 2019               | Salmon-derived nutrient and organic matter fluxes from a coastal catchment in southeast Alaska                                             | Hood, E., Fellman, J., Edwards, R.T., D'Amore, D.V. and Scott, D.                                                                                                                                                                                               |
| 2019               | Converting snow depth to snow water equivalent using climatological variables                                                              | Hill, D.F., Burakowski, E.A., Crumley, R.L., Keon, J., Hu, J.M., Arendt, A.A., Wikstrom Jones, K., and Wolken, G. J.                                                                                                                                            |
| 2019               | Interactive physical and biotic factors control dissolved oxygen concentrations in salmon spawning streams in coastal Alaska               | Fellman, J., Hood, E., Nagorski, S., Hudson, J. and Pyare, S.                                                                                                                                                                                                   |

| <b><u>Year</u></b> | <b><u>Title</u></b>                                                                                                               | <b><u>Authors</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2019               | The 2016 Lamplugh rock avalanche, Alaska: deposit structures and emplacement dynamics                                             | Dufresne, A., Wolken, G.J., Hibert, C., Bessette-Kirton, E.K., Coe, J.A., Geertsema, M., and Ekström, G.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 2019               | Impact of glacier loss and vegetation succession on annual basin runoff                                                           | Carnahan, E., Amundson, J., and Hood, E.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 2019               | Warming Effects of Spring Rainfall Increase Methane Emissions From Thawing Permafrost                                             | Neumann, R.B., Moorberg, C.J., Lundquist, J.D., Turner, J.C., Waldrop, M.P., McFarland, J.W., Euskirchen, E.S., Edgar, C.W., and Turetsky, M.R.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2019               | Vulnerability of Subsistence Systems Due to Social and Environmental Change: A Case Study in the Yukon-Kuskokwim Delta, Alaska    | Herman-Mercer, N., Laituri, M., Toohey, R., Matkin, E., Massey, M., Schuster, P., and Elder, K.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2019               | Valdez Glacier ice-dammed lake: June 2018 glacial lake outburst flood                                                             | Wikstrom Jones, K., and Wolken, G.J.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2019               | The smoothing of landscapes during snowfall with no wind                                                                          | Filhol, S., Sturm, M.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2019               | Risks of hydroclimatic regime shifts across the western United States                                                             | Gangopadhyay, S., McCabe, G., Pederson, G., Martin, J., and Littell, J.S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 2019               | Photogrammetry-derived digital surface model and orthoimagery of Valdez Glacier ice-dammed lake, Valdez, Alaska, October 15, 2014 | Wikstrom Jones, K., Wolken, G.J., Whorton, E.N., and Hendricks, M.D.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2019               | Permafrost is warming at a global scale                                                                                           | Biskaborn, B.K., Smith, S.L., Noetzli, J., Vieira, G., Streletskiy, D., Schoeneich, P., Romanovsky, V., Wu, Q., Christiansen, H., Lanckman, J.P., Abramov, A., Allard, M., Boike, J., Delaloye, R., Derevyanko, Diekmann, B., Drozdov, D., Etzelmöller, B., Grosse, G., Guglielmin, M., Ingeman-Nielsen, T., Isaksen, K., Ishikawa, M., Johannson, M., Johannsson, H., Joo, A., Kholodov, A., Konstantinov, P., Kröger, T., Lambiel, C., Lewkovic, A., Luo, D., Malkova, G., Matthes, H., Meiklejohn, I., Moskalenko, N., Kaverin, D., Olivia, M., Paetzold, R., Phillips, M., Ramos, Sannel, B., Sergueev, D., Seybold, C., Skryabin, P., Sletten, R., Yoshikawa, K., Zheleznyak, M., and Lantuit, H. |

| <b><u>Year</u></b> | <b><u>Title</u></b>                                                                                                            | <b><u>Authors</u></b>                                                                                                                                                                                                                                                                                                         |
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| 2019               | Methodological application of quantile mapping to generate precipitation data over Northwest Himalaya                          | Devi, U., Shekhar, M.S., Singh, G.P., Rao N.N., and Bhatt U.S.                                                                                                                                                                                                                                                                |
| 2019               | Key indicators of Arctic climate change: 1971-2017                                                                             | Box, J., Colgan, W., Brown, R., Wang, M., Overland, J., Walsh, J., Bhatt, U.; Christensen, T., Schmidt, N., Lund, M., Parmentier, F.-J., Euskirchen, E., Romanovsky, V., Corell, R., Meier, W., Wouters, B., Mernild, S., Mord, J., Pawlak, J., and Andersen, M.                                                              |
| 2019               | Glaciers and climate of the upper Susitna Basin, Alaska; supporting data                                                       | Bliss, A.K., Hock, R., Wolken, G.J., Whorton, E.N., Aubry-Wake, C., Braun, J., Gusmeroli, A., Harrison, W.D., Hoffman, A., Liljedahl, A.K., and Zhang, J.                                                                                                                                                                     |
| 2019               | Evaluation of synoptic-scale patterns during extreme temperature and precipitation events in Alaska                            | DeLaFrance, A. and McAfee, S. A.                                                                                                                                                                                                                                                                                              |
| 2019               | Co-production of knowledge: Developing the Integrated Ecosystem Model to inform resource management decisions in Arctic Alaska | Euskirchen, E., Timm, K., Breen, A.L., Gray, S., Rupp, T.S., Martin, P., Reynolds, J., Sessler, A., Murphy, K., Littell, J.S., Bennett, A., Bolton, W.R., Carman, T., Genet, H., Griffith, B., Kurkowski, T., Lara, M.J., Marchenko, S., Nicolsky, D., Panda, S., Romanovsky, V., Rutter, R., Tucker, C.L., and McGuire, A.D. |
| 2019               | Arctic vegetation mapping using unsupervised training datasets and convolutional neural networks                               | Langford, Z., Kumar, J., Hoffman, F., Breen, A., and Iversen, C.                                                                                                                                                                                                                                                              |
| 2019               | Anticipated changes to the snow season in Alaska: Elevation dependency, timing and extremes.                                   | Lader, R., J. E. Walsh, U. S. Bhatt, and P. A. Bieniek.                                                                                                                                                                                                                                                                       |
| 2018               | Glaciers and ice caps outside Greenland (in "State of the Climate in 2017")                                                    | Wolken, G.J., Wouters, B., Sharp, M., Andreassen, L.M., Baker, E.H. , Burgess, D., Kohler, J., Luks, B., and O'Neel, S.                                                                                                                                                                                                       |
| 2018               | Interactive physical and biotic factors control dissolved oxygen concentrations in salmon spawning streams in coastal Alaska   | Fellman, J., Hood, E., Nagorski, S., Hudson, J. and Pyare, S.                                                                                                                                                                                                                                                                 |

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| 2018               | Validation of the SMAP freeze/thaw product using categorical triple collocation                                       | Lyu, H., McColl, K.A., Lu, X., Derksen, C., Berg, A., Black, T.A., Euskirchen, E.S., Langlois, A., Lorant, M., Pulliainen, J., Rautiainen, K., Rowlandson, T., Roy, A., Royer, A., Stephens, J., Lu, H., and Entekhabi, D. |
| 2018               | The role of environmental driving factors in historical and projected carbon dynamics of wetland ecosystems in Alaska | Lyu, Z., Genet, H., He, Y., Zhuang, Q., McGuire, A.D., Bennett, A., Breen, A., Klein, J., Euskirchen, E.S., Johnson, K., Kurkowski, T., Pastick, N.J., Rupp, T.S., Wylie, B.K., and Zhu, Z.                                |
| 2018               | Terrestrial Permafrost                                                                                                | Romanovsky, V.E., S.L. Smith, S.L., Isaksen, K., Shiklomanov, N.I., Streletskiy, D.A., Kholodov, A.L., Christiansen, H.H., Drozdov, D.S., Malkova, G.V., and Marchenko, S.S.                                               |
| 2018               | Terrestrial carbon modeling: Baseline and projections in upland ecosystems                                            | Genet, H., Y. He, A.D. McGuire, Q. Zhuang, Y. Zhang, F. Biles, D.V. D'Amore, X. Zhou, and K.D. Johnson                                                                                                                     |
| 2018               | Spring photosynthetic onset and net CO <sub>2</sub> uptake in Alaska triggered by landscape thawing                   | Parazoo, N., Arneth, A., Pugh, T., Smith, B., Steiner, N., Luus, K., Commane, R., Benmergui, J., Stofferahn, E., Liu, J., Rodenbeck, C., Kawa, S., Euskirchen, E., Zona, D., Arndt, K., Oechel, W., and Miller, C.         |
| 2018               | Remote sensing quantifies widespread abundance of permafrost region disturbances across the Arctic and Subarctic      | Nitze, I., Grosse, G., Jones, B., Romanovsky, V., and Boike, J.                                                                                                                                                            |
| 2018               | Regional Climate Model Simulation of Surface Moisture Flux Variations in Northern Terrestrial Regions                 | Fischer, R., Walsh, J.E., Euskirchen, E.S. and Bieniek, P.A.                                                                                                                                                               |
| 2018               | Drought and fire in the Western USA: Is climate attribution enough?                                                   | Littell, J.S.                                                                                                                                                                                                              |
| 2018               | Downscaling of climate model output for Alaskan stakeholders                                                          | Walsh, J.E., Bhatt, U.S., Littell, J., Leonawicz, M., Lindgren, M., Bieniek, P.A.                                                                                                                                          |
| 2018               | Data Quality from a Community-Based, Water-Quality Monitoring Project in the Yukon River Basin                        | Herman-Mercer, N.M., Antweiler, R.C., Wilson, N.J., Mutter, E.A., Toohey, R.C., and Schuster, P.F.                                                                                                                         |



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| 2018               | Climate change in Port Heiden, Alaska – Strategies for Community Health                                                                                       | Lujan, E., Brubaker, M., Warren, J., Christensen, J., Anderson, S., O'Domin, M., Littell, J.S., Buzard, R.M., Overbeck, J.R., Holen, D., Flensburg, S., and Powers, E.                                   |
| 2018               | Climate Change and Future Wildfire in the Western United States: An Ecological Approach to Nonstationarity                                                    | Littell, J., Mckenzie, D., Wan, H., and Cushman, S.                                                                                                                                                      |
| 2018               | Assessment of Alaska rain-on-snow events using dynamical downscaling                                                                                          | Bieniek, P., Bhatt, U.S., Walsh, J.E., Lader, R., Griffith, B. Roach, J. K., Thoman R. L.                                                                                                                |
| 2018               | Assessing the interplay between canopy energy balance and photosynthesis with cellulose $\delta^{18}O$ : large-scale patterns and independent ground-truthing | Helliker, B.R., Song, X., Goulden, M.L., Clark, K., Bolstad, P., Munger, J.W., Chen, J., Noormets, A., Dragoni, D., Hollinger, D., Wofsy, S.C., Martin, T., Baldocchi, D., Euskirchen, E., and Desai, A. |
| 2018               | Arctic and boreal carbon                                                                                                                                      | Schuur, E.A.G., McGuire, A.D., Romanovsky, V., Sch $\ddot{u}$ del, C., and Mack, M.                                                                                                                      |
| 2018               | Impacts, Risks, and Adaptation in the United States: Alaska section                                                                                           | Markon, C., Gray, S., Berman, M., Eerkes-Medrano, L., Hennessy, T., Huntington, H., Littell, J., McCammon, M., Thoman, R., and Trainor, S.                                                               |
| 2018               | A synthesis dataset of permafrost-affected soil thermal conditions for Alaska, USA                                                                            | Wang, K., Jafarov, E., Schaefer, K., Overeem, I., Romanovsky, V.E., Clow, G., Urban, F., Cable, W., Piper, M., Schwalm, C., Zhang, T., Kholodov, A., Sousanes, P., Loso, M., Swanson, D., and Hill, K.   |
| 2017               | Toward improved parameterization of a macro-scale hydrologic model in a discontinuous permafrost boreal forest ecosystem                                      | Endalamaw, A., Bolton, W. R., Young-Robertson, J. M., Morton, D., Hinzman, L., and Nijssen B.                                                                                                            |
| 2017               | Projections of Twenty-First-Century Climate Extremes for Alaska via Dynamical Downscaling and Quantile Mapping                                                | Lader, R., Walsh, J. E., Bhatt, U.S., and Bieniek, P. A.                                                                                                                                                 |
| 2017               | Mass Balance Evolution of Black Rapids Glacier, Alaska, 1980-2100, and Its Implications for Surge Recurrence                                                  | Kienholz, C., Hock, R., Truffer, M., Bieniek, P., and Lader R.                                                                                                                                           |
| 2017               | Foundations of translational ecology                                                                                                                          | Enquist, C. A., Jackson, S. T., Garfin, G. M., Davis, F. W., Gerber, L. R., Littell, J. A., et al.                                                                                                       |

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| 2017               | Climate change vulnerability assessment for the Chugach National Forest and the Kenai Peninsula                     | Hayward, G. H, Colt, S., McTeague, M. L., Hollingsworth, T. N.                                                                   |
| 2017               | Climate change and the eco-hydrology of fire: Will area burned increase in a warming western USA?                   | Mckenzie, D. and Littell, J. S.                                                                                                  |
| 2017               | Broadening the sea-ice forecaster toolbox with community observations: A case study from the northern Bering Sea    | Deemer, G.J., Bhatt, U.S., Eicken, H., Posey, P.G., Hutchings, J.K., Nelson, J., Heim, R., Allard, R., Wiggins, H. and Creek, K. |
| 2017               | Balancing research and service to decision makers                                                                   | Littell, J. S., Terando, A. J., & Morelli, T. L.                                                                                 |
| 2017               | Atmospheric circulation patterns associated with monthly and daily temperature and precipitation extremes in Alaska | Bieniek, P. A., and Walsh, J. E.                                                                                                 |