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# Alaska Adapting to Changing Environments

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Midcourse Report  
October 2015



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## Message from the President



I've only been the President of the University of Alaska for a short time, but I have a long history with Alaska EPSCoR. I was the founding Chair of Alaska EPSCoR and when I was in the private sector I was a member of the State Committee on Research (SCoR), a panel of academics, lawmakers and business leaders charged with helping guide the state's research enterprise, including EPSCoR.

So I've been familiar with the current EPSCoR project, "Alaska Adapting to Changing Environments," since before it even got off the ground, and I've long been aware of its benefits. Alaska is changing. That's no surprise to any of us, because Alaska is always changing: seasons, attitudes and mores, industries, the state of our economy. But in recent years some of these changes have become more pronounced, and we need both to better understand these changes and prepare ourselves to constructively respond to them.

Alaska ACE researchers are taking a pragmatic and manageable approach to studying change in the Last Frontier by focusing their efforts on hydrologic and landscape changes and the ways Alaskans

respond to them. And they're doing it sorted by geography, with sites based on the North Slope, the Kenai Peninsula, and near Juneau. That way they can gather knowledge about the broad spectrum of community responses, from a small village off the road system to one of Alaska's largest towns.

Then they're putting the pieces together. When SCoR wrote the state's Science and Technology Plan, one of the first priorities we listed was a better grasp of community resilience and sustainability. Alaska EPSCoR is tackling this challenge by combining data about biophysical change with social data about community perceptions. This is enabling them to figure out the capacity of different sorts of communities to mount effective responses to whatever circumstances they may encounter, valuable information that will be shared with academia — and, more importantly, with Alaskans.

The other advantage of EPSCoR's regional approach is that it incorporates many research strengths of the UA system. Each EPSCoR Test Case is headquartered at one of our main UA campuses, and we have rural campus input as well. The purpose of NSF EPSCoR funding is to improve the state's research capacity, and the best way we can do that is to make sure the entire state shares in the effort and in the outcomes.

This report, then, is a testament to the quality of the research and outreach efforts taking place across the UA system. As they head into the final two years of their project, I encourage EPSCoR scientists to keep up the good work.

Regards,

Jim Johnsen  
University of Alaska President

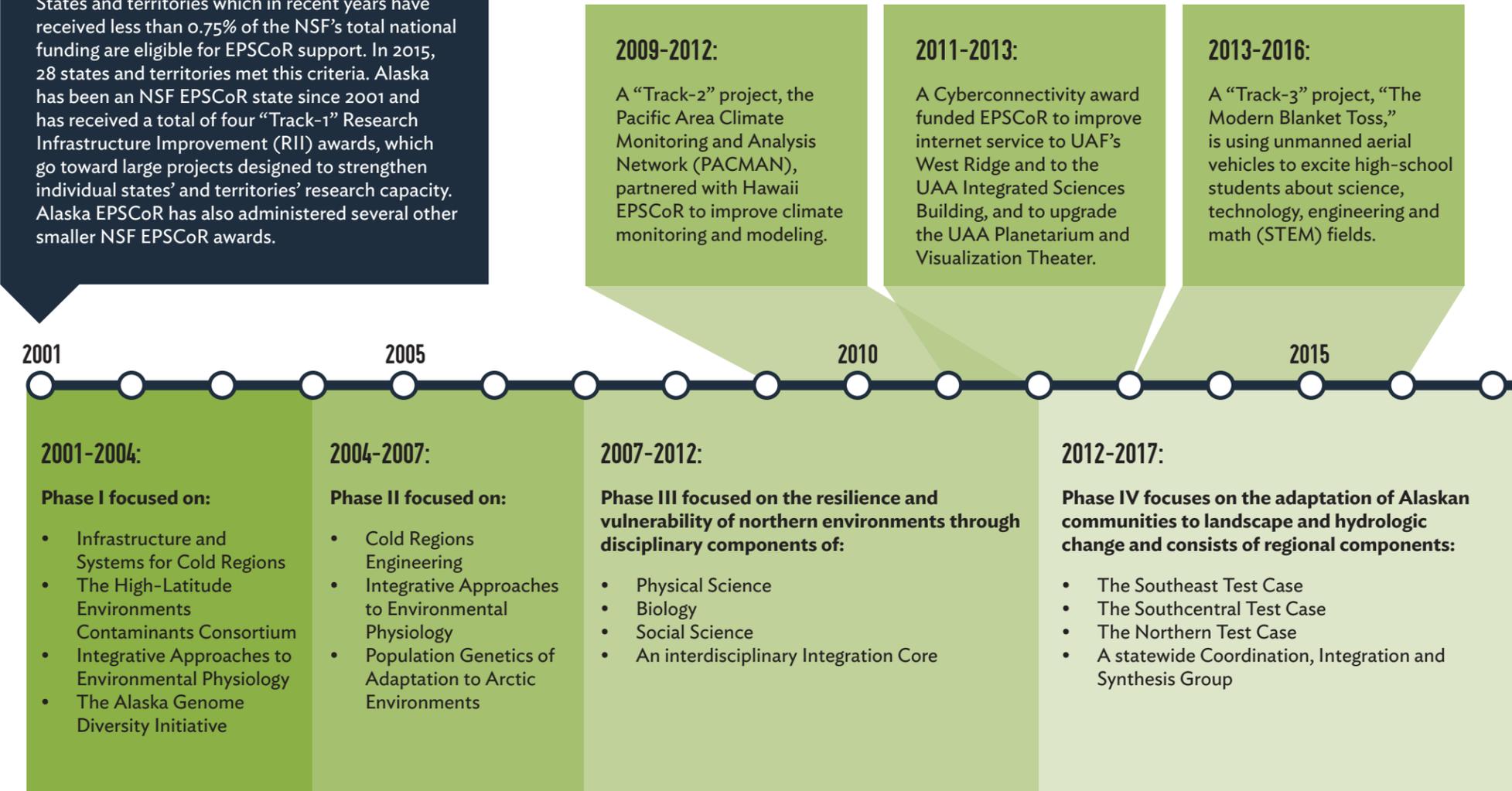
## EPSCoR: Research Across the Nation

The National Science Foundation Experimental Program to Stimulate Competitive Research (NSF EPSCoR) was established by Congress "to strengthen research and education in science and engineering throughout the United States and to avoid undue concentration of such research and education."

States and territories which in recent years have received less than 0.75% of the NSF's total national funding are eligible for EPSCoR support. In 2015, 28 states and territories met this criteria. Alaska has been an NSF EPSCoR state since 2001 and has received a total of four "Track-1" Research Infrastructure Improvement (RII) awards, which go toward large projects designed to strengthen individual states' and territories' research capacity. Alaska EPSCoR has also administered several other smaller NSF EPSCoR awards.

*"The EPSCoR states are a huge underutilized resource as the nation tries to remain competitive internationally and keep pace with the production of engineers and scientists in China, India and other competitors."*

– Paul Hill, West Virginia Higher Education Policy Commission





## Introduction: Alaska Adapting to Changing Environments

Alaska EPSCoR is in the fourth year of a five-year, \$20 million project entitled “Alaska Adapting to Changing Environments (Alaska ACE).” Alaska ACE consists of biological, physical and social research into *adaptive capacity*: the mechanisms that enable communities and groups to effectively respond to environmental and social change.

EPSCoR’s multifaceted research begins with monitoring biophysical changes (with an emphasis on hydrologic and landscape changes) by installing new sensors and by commissioning new mapping and data acquisition. Researchers are also compiling social science data and using surveys, interviews and other methods to measure community responses. These results are being synthesized into models, matrices and visualizations to form the basis for community adaptation tools.

Alaska ACE research encompasses University of Alaska campuses in Anchorage, Fairbanks and Juneau as well as rural campuses. In the current project EPSCoR has hired six new faculty and supported dozens of faculty, seven postdoctoral researchers, around 30 graduate students and almost 50 undergrads. In total nearly 250 UA faculty, students, postdocs and staff have taken part in the ACE project, in addition to an array of community partners across the state and beyond.

The ultimate goal of Alaska ACE is to build a sustainable network in Alaska for the study of northern social-ecological systems – systems with interlocking and interdependent natural and human components – and to provide adaptation assistance to Alaskans.

*“While Alaska’s vast size, extreme climate, and scattered population present challenges for science and technology development, the state also offers many advantages: a rich resource base, a unique Arctic location, an educated population and increasingly well-regarded university system, and a landscape ideally suited for the study of human and natural systems undergoing climatic and social change.”*

- The Alaska State Committee on Research

## Program Structure

EPSCoR research is organized around three “test cases” that conduct research in different regions of Alaska.

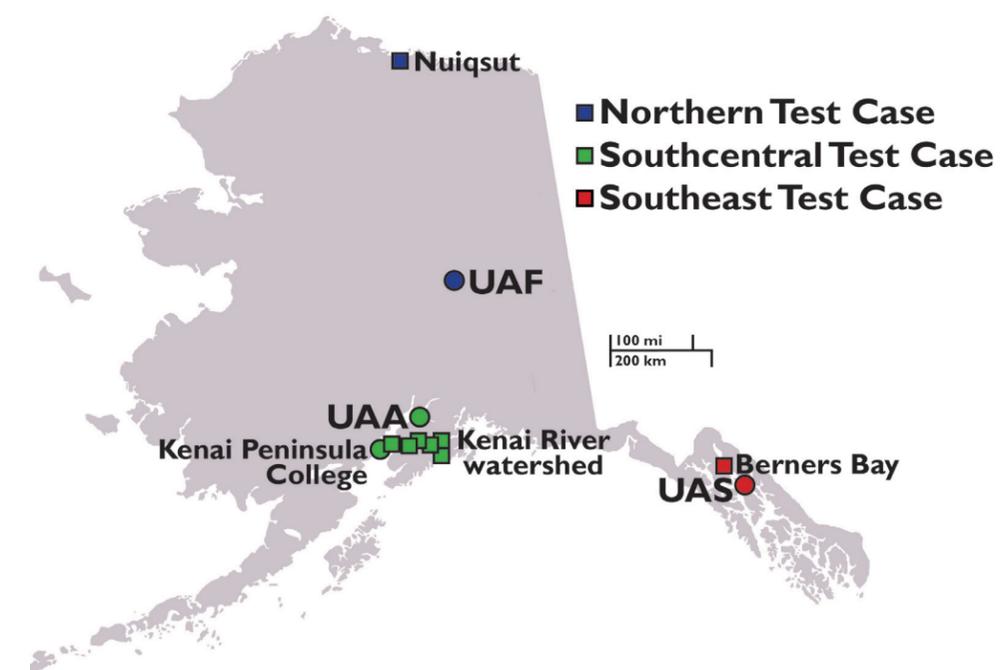
The Southeast Test Case focuses on changes to ecosystem services brought on by glacial recession in Berners Bay, near Juneau.

The Southcentral Test Case examines the effects of hydrologic and landscape changes on communities in the Kenai River watershed south of Anchorage.

The Northern Test Case studies how environmental change and oil and gas development are impacting subsistence resources around the North Slope village of Nuiqsut.

Results from the test cases are used by a statewide Coordination, Integration and Synthesis (CIS) Working Group to answer larger scientific questions about adaptation and to create decision-support tools for communities and resource managers.

A statewide Education, Outreach and Diversity (EOD) Group works to involve students and the public in EPSCoR research and to keep them informed of results.



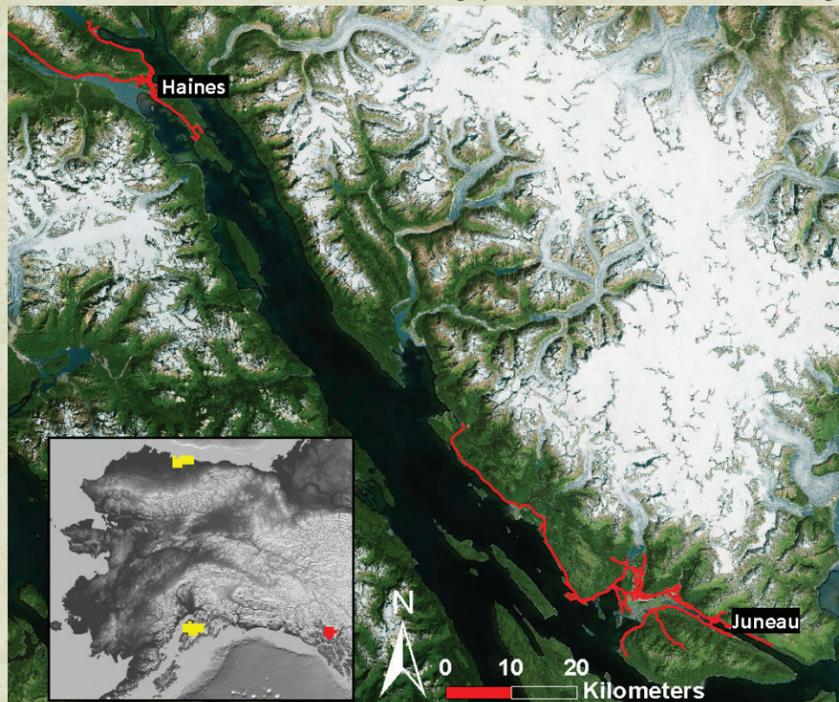
Opposite page, left to right, EPSCoR photos by Courtney Pegus, Courtney Breest, and Jiake Zhou. This page, photos by Scott Moon and graphic by Tom Moran, Alaska EPSCoR.

# From Glacier to Ocean: THE SOUTHEAST TEST CASE

The Southeast Test Case focuses on an icefield-to-estuary ecosystem in Berners Bay, near Juneau. Glaciers in the area are receding, which is changing water discharge, affecting streams and estuaries, and accelerating forest succession. These ecosystem changes in turn affect important biological resources such as plankton and salmon, and have the potential for major impacts to economic drivers like fisheries and tourism.

The test case examines patterns of key environmental variables, such as ice, forest cover and salmon, to better understand the consequences of changing environments. Researchers are evaluating how changes in these variables impact communities, as well as the capacity of resource managers and businesses to respond to projected changes.

Geographic Information Network of Alaska image



## Goals

The research goals of the test case are to:

- Understand how climate dynamics influence the spatio-temporal variability of key ecosystem indicators: ice, freshwater hydroecology, estuarine productivity, and alluvial forest.
- Understand the values of, and consequences for, the ecosystem services associated with these indicators.
- Evaluate the capacities of resource managers and nature-based tourism operators to perceive, project and respond to changes in these services.

## Partners

Major community partners include the U.S. Forest Service Pacific Northwest Research Station, the U.S. Geological Survey, the Juneau Economic Development Corporation, the Alaska Coastal Rainforest Center, the Nature Conservancy, and the Alaska departments of Natural Resources and of Fish and Game.

*“What we’re really interested in is understanding the consequences of glacial recession from a local economy and from a resource management perspective, as well as from a science perspective.”*

– Sanjay Pyare  
Southeast Test Case lead

*“It’s unique in that all over Southeast you have these glaciers very close to the ocean, and so you can study the effects of glaciers all the way down to the ocean.”*

– Brian Vander Naald  
Southeast Test Case researcher



Southeast Test Case researcher Eran Hood crunched some numbers and came up with a huge sum: 48 million tons. In a 2015 study, Hood and his co-authors determined that to be the amount of organic carbon that glacial melting will deposit in the world’s oceans by 2050. That’s one and a half times the amount of annual carbon runoff from the Amazon River, and almost a third of it — 15 million tons — can be attributed to accelerated melt due to climate warming.

photo by Frank Kovalchek

## Accomplishments

- Deployed 14 new sensors in Berners Bay to collect over 30 categories of atmospheric, icefield, hydrologic and estuarine data
- Partnered to expand hydrologic data collection to about 90 regional streams
- Compiled existing biophysical data from 12 different agencies
- Completed analysis of climate, glacier, hydrologic and salmon variables, and began retrospective downscaling and analyses of variables including glacial melt, stream temperatures, and salmon run timing
- Created regional stream temperature inventory, regional hydrography database, and other databases
- Gathered and analyzed socioeconomic data, such as surveys of game managers and tourists and marine vessel, fisheries and helitourism data
- Hired one UAS and one UAF faculty member and provided start-up funding for two UAS faculty
- Engaged one postdoc, eight graduate students and 13 undergraduate students in research

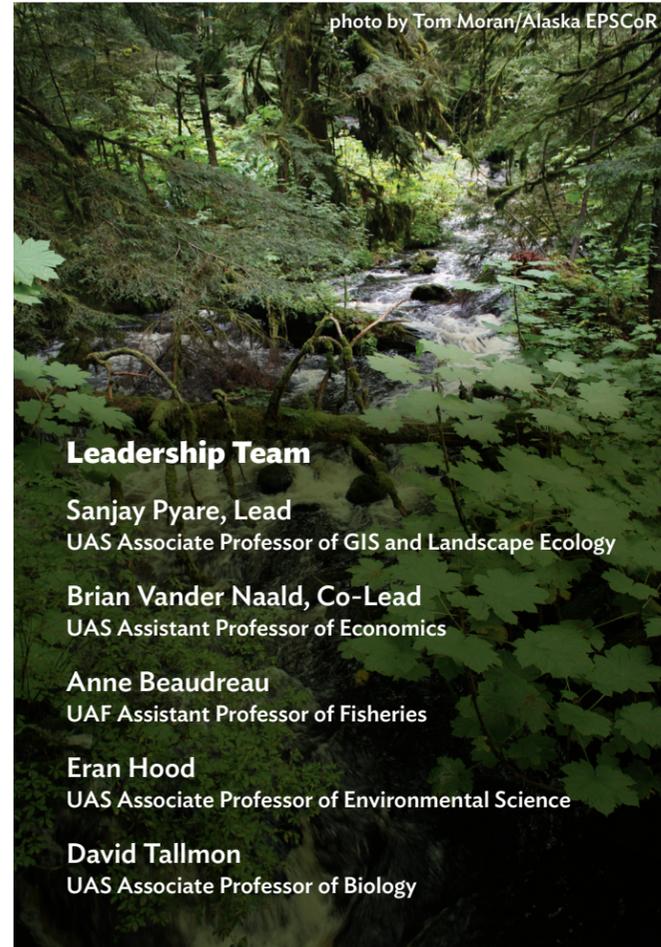
## Impacts

- Construction of a conceptual icefield-to-estuary model integrated across disciplines
- Creation of an international research network across the Pacific coastal temperate rainforest
- Installation of a long-term monitoring array for the icefield-to-estuary system
- Establishment of a mutually beneficial relationship with Southeast Alaska community stakeholders

## Activities for years 4-5

- Process oceanographic datasets and analyze the coupling of these marine patterns to freshwater, glacier, and meteorological data
- Develop an integrated ecosystem model for the icefield-to-estuary system, and test the latter using instrumented data sets
- Develop an agent-based model to support social-ecological analyses
- Continue and deepen data collection from resource managers, tourism operators, and community members, and incorporate these data into adaptive capacity analyses
- Complete economic valuation of icefield-based ecosystem services and incorporate these data into scenarios

photo by Tom Moran/Alaska EPSCoR



## Leadership Team

**Sanjay Pyare, Lead**  
UAS Associate Professor of GIS and Landscape Ecology

**Brian Vander Naald, Co-Lead**  
UAS Assistant Professor of Economics

**Anne Beaudreau**  
UAF Assistant Professor of Fisheries

**Eran Hood**  
UAS Associate Professor of Environmental Science

**David Tallmon**  
UAS Associate Professor of Biology

# A River Runs Through It: THE SOUTHCENTRAL TEST CASE

The Southcentral Test Case focuses on the Kenai Peninsula south of Anchorage, which is subject to multiple, interacting drivers of change. Primary changes in river hydrology include discharge, water temperature, and sedimentation, while land cover changes include urbanization, new resource extraction infrastructure, drying wetlands, and forest fires.

Test case researchers study these drivers and patterns of change, the effects of their interactions, and the factors contributing to community response and adaptation in the communities of Kenai, Soldotna, Sterling, Cooper Landing, Moose Pass, and Seward. A major focus of the test case is salmon, which link ecosystems, food webs, and fish production across the watershed.

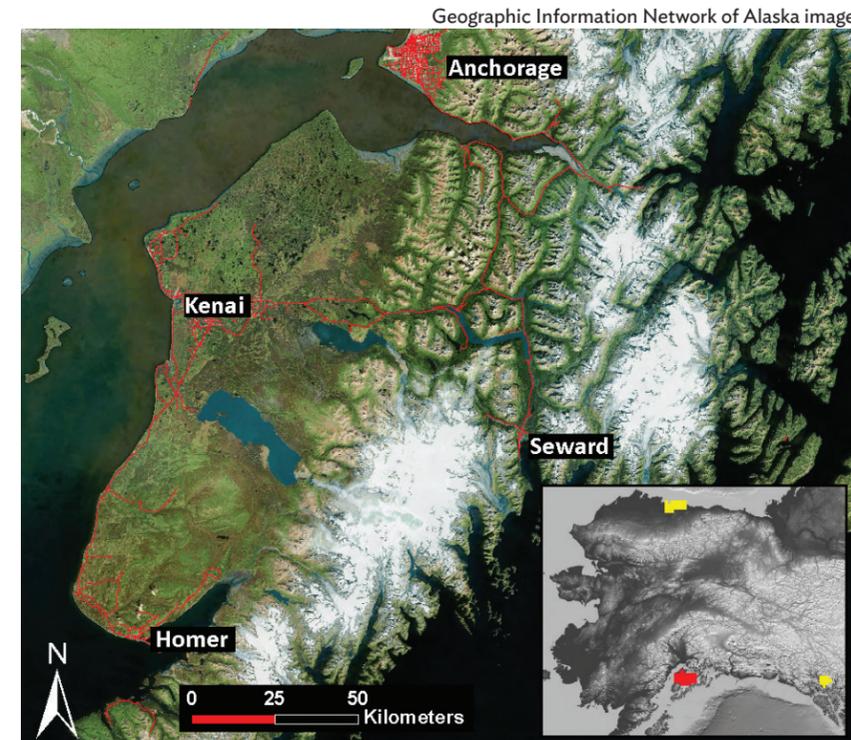
## Goals

Test case research goals are to:

- Understand how hydrologic and landscape change affect salmon populations in the Kenai River watershed.
- Understand the consequences of these changes on the use and values of salmon fisheries for communities in the watershed.
- Evaluate the capacity of Kenai River communities to perceive, project and respond to anticipated change.

## Partners

Major community partners of the Southcentral test Case include the Kenai Watershed Forum, the Kenai Peninsula Economic Development District, the Kenaitze Indian Tribe, and the Alaska Climate Science Center.



Molly McCarthy is working on a very long fish story. The UAA Biological Sciences graduate student is using sediment cores from a pair of Kenai Peninsula Lakes to estimate levels of a specific nitrogen isotope over time, a figure which directly reflects the size of salmon populations. By examining the cores she'll be able to estimate salmon abundance going back 2,000 years, and potentially to develop a model linking these numbers to environmental factors over time.

## Accomplishments

- Deployed hydrologic and temperature sensors in three Kenai River tributaries
- Contracted for aerial mapping of Kenai Peninsula to complement borough maps
- Analyzed discharge records for four Kenai River gauges since 1948 and air temperature and precipitation data since 1932, and produced time series charts of changes in these variables
- Conducted extensive surveys of local social attitudes, values, perceptions and behaviors
- Collated and analyzed sport fish license data, fish run data and regulatory decisions
- Studied salmon abundance trends through sediment core analysis and historic salmon run data
- Published "Kenaitze Youth Speak" in collaboration with Kenaitze Indian Tribe to document the knowledge and awareness of change in the Kenai River by tribal youth
- Provided support for a three-person cohort of new UAA faculty
- Engaged one postdoc, five graduate students and 24 undergraduate students in research

## Impacts

- Enhancement of hydrologic monitoring in Kenai River watershed
- Unprecedented longitudinal measurement of change in community landscape values via social-ecological systems (SES) maps integrating hydrologic, landscape and socioeconomic variables
- Improved understanding of coupling of marine and freshwater salmonid dynamics integrated with fisheries
- Novel interpretation of salmon paleodata in the context of contemporary change
- Powerful community science partnerships focused on iterative process of scenario development

## Activities for years 4-5

- Use gathered data to predict future demographics
- Complete traditional local knowledge interviews and mapping
- Undertake community interviews to measure adaptive responses
- Downscale climate forecasts to project future hydrologic and aquatic change
- Work with the Geographic Information Network of Alaska (GINA) to develop methods to detect Kenai Peninsula landscape change
- Refine a time series of social-ecological systems hotspots maps to chart change over time
- Create an integration platform for a scenario-based simulation to understand coupled social-ecological dynamics
- Engage stakeholders through scenarios, visualizations, and other methods
- Develop proposal for Kenai salmon decision-support tool

## Leadership Team

**Dan Rinella, Lead**  
UAA Assistant Professor of Aquatic Ecology

**Sveta Stuefer**  
UAF Assistant Professor of Civil Engineering

**Andrew Kliskey, Co-Lead**  
University of Idaho Professor of Natural Resources

**Jamie Trammell**  
UAA Assistant Professor of Geography and Environmental Studies

**Alan Boraas**  
UAA-Kenai Peninsula College Professor of Anthropology

**Mark Wipfli**  
UAF Professor of Freshwater Ecology

# North to the Future: THE NORTHERN TEST CASE

The Northern Test Case focuses on the community and traditional use area of Nuiqsut, a 400-person Iñupiaq village on the North Slope of Alaska that relies heavily on subsistence harvesting of wildfoods. Nuiqsut faces change on multiple fronts: first, Arctic Alaska is experiencing increases in temperatures, thawing permafrost, changes in terrestrial hydrology, reduction of sea ice, increased storm surges, changes in vegetation, and shifts in seasonality. Second, Nuiqsut is increasingly exposed to land-use change from oil and gas development.

Northern Test Case researchers are studying land use — land cover changes resulting from these climatic and industrial developments, and their consequences for Nuiqsut residents. Major research elements include examining how thawing permafrost and shrubification are affecting wildlife and subsistence harvesting; how

local traditional knowledge can inform research findings; and how governmental institutions reflect and respond to local concerns.

## Goals

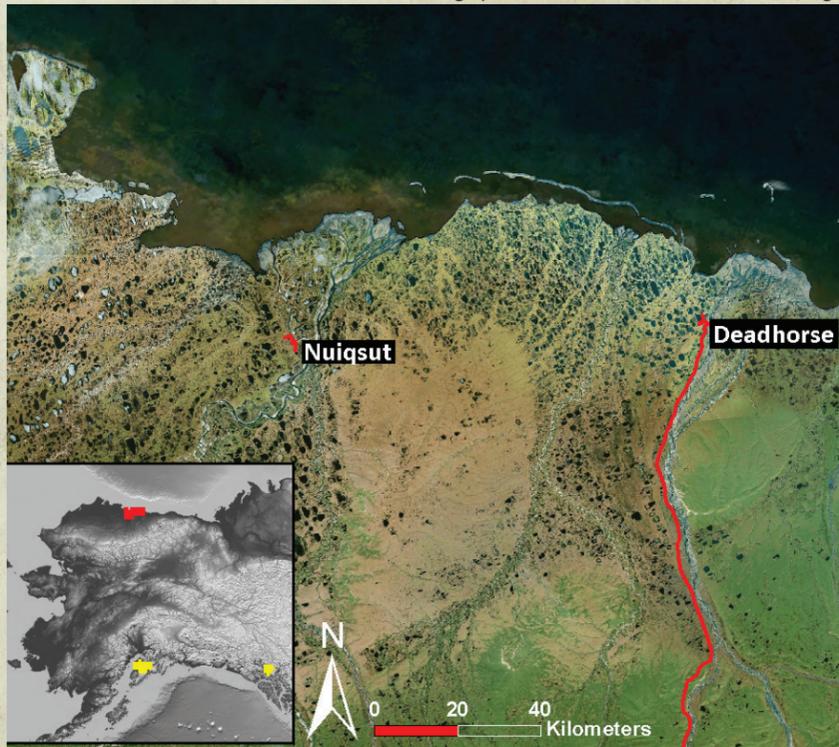
Research goals of the Northern Test Case are to:

- Document how hydrologic, landscape, and land-use changes are affecting ecosystem services on Alaska's North Slope.
- Understand the consequences of these changes to a village cash-subsistence economy.
- Evaluate the capacity of North Slope households and communities to respond to these changes.

## Partners

Major partners of the Northern Test Case include the Kuukpiik Subsistence Oversight Panel, the North Slope Science Initiative, the Alaska Department of Fish and Game, The North Slope Borough Wildlife Department, and multiple Nuiqsut community organizations.

Geographic Information Network of Alaska image



*“The Northern Test Case gives us insight into a landscape that has evolved in extreme conditions, and people who live close to the land and depend highly on harvested resources — and who also live in close proximity to some of the most intense industrial activity in all of Alaska.”*

-Gary Kofinas, Northern Test Case lead



Jiake Zhou takes field research to a whole new level. The UAF graduate student spent three weeks in summer 2014 rafting the Nigu, Etivluk and Colville Rivers through Alaska's remote North Slope, stopping more than 60 times to measure shrub characteristics along the riverbanks. He's working to calculate the amount of shrub cover needed to support moose, ptarmigan, and snowshoe hare populations, which will support efforts to model and predict moose distribution.

## Accomplishments

- Completed LiDAR mapping of study area to provide high-resolution elevation data
- Studying permafrost polygon degradation and changes in bedfast and floating ice lakes, and their effects on hydrology and fish and wildlife
- Gathered data on shrubs and browsing and constructed a model to project future moose distribution
- Developed an integrated Terrestrial Ecosystem Model to project changes in plant communities and their implications to caribou populations and moose distribution
- Interviewed Nuiqsut harvesters to document local observations and understanding of environmental change
- Issued camera-equipped GPS units to subsistence hunters to document ecosystem changes
- Developed surveys to measure indigenous perceptions of risk and local control over risk-limiting mechanisms
- Studying the responsiveness of local institutions to community concerns and needs
- Hired two UAF faculty
- Engaged three postdocs, six graduate students and one undergraduate student in research

## Impacts

- Improved hydrologic and ecological understanding of northern tundra ecosystems
- High-resolution digital elevation model of Nuiqsut area
- Innovations in spatially and temporally explicit methods of documenting traditional local knowledge
- Methods for empirically testing indicators of community adaptive capacity
- Stronger interdisciplinary partnerships across UA research and between UA and communities

## Activities for years 4-5

- Undertake a second phase of program to equip hunters with GPS devices
- Measure soundscapes in Nuiqsut use area and assess subsistence hunting access issues
- Complete traditional local knowledge interviews and analyses of institutions and socioeconomic data
- Refine and review social-ecological systems models and test them with decision-makers at UAF Decision Theatre North
- Support new Tribal Management program to provide leadership training to Alaska Natives

## Faculty Team

**Gary Kofinas, Lead**  
UAF Professor of Resource Policy and Management

**Todd Brinkman, Co-Lead**  
UAF Assistant Professor of Wildlife Biology

**Christopher Arp**  
UAF Research Assistant Professor

**Matt Berman**  
UAA Professor of Economics

**Eugenie Euskirchen**  
UAF Research Assistant Professor

**Brad Griffith**  
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**Anna Liljedahl**  
UAF Research Assistant Professor

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**Mark Wipfli**  
UAF Professor of Freshwater Ecology

# Tying It All Together: THE CIS GROUP

The statewide Coordination, Integration and Synthesis (CIS) Group serves multiple functions. First, it works with test case researchers to enable synthesis and comparison across test cases. Second, it provides venues and means to deliver research findings as large-scale visualizations and other tools that can be used for decision support. Third, CIS functions as an innovation engine for advancing new social-ecological systems (SES) methods using test case data.

One key CIS goal is to use test case findings as the basis for adaptive capacity indices - decision-making tools communities can use to gauge their ability to thrive in the face of environmental and social changes. Another is to develop methods for measuring “P-delta-I” (PΔI) — the difference between people’s perceptions of environmental change, and instrumented change — and examine how this figures into adaptive capacity. The CIS Group has also worked closely with the international Arctic Council to build the Arctic Adaptation Exchange, an online portal providing access to information resources to facilitate the cross-Arctic exchange of knowledge on climate change adaptation.

## Goals

Research goals of the CIS Group are to:

- Establish cross-test-case protocols to ensure data streams are compatible project-wide and that adaptive capacity findings can be incorporated into community tools
- Use test case data to analyze the adaptive capacity of different Alaska communities via models, indices, and other products, and to create adaptation tools
- Develop visualizations and other methods for communicating findings to Alaska communities

## Partners

Major partners of the CIS Working Group include the Geographic Information Network of Alaska, the universities of Idaho and Montana, the Network for Computational Modeling in Socio-Ecological Sciences (COMSES), the Community Observing Network for Adaptation and Security (CONAS), the Arctic Council, the Woodrow Wilson Center, the U.S. departments of State and Homeland Security, the Yukon Government, Natural Resources Canada, and other EPSCoRs across the country.

## Accomplishments

- Created and beta-tested a prototype social survey for use across test cases
- Established a cross-test-case data-sharing framework for integrated research
- Built preliminary SES hotspots maps for test case communities
- Developed and implemented methods to characterize PΔI
- Completed framework for a coupled agent-based model to enable decision-makers to run through realistic change and response scenarios
- Created immersive visualizations of Tustumena Lake and the Kenai River and nested interactive salmon visualization program within them
- Collaborating to build and host the Arctic Adaptation Exchange portal
- Increased UAA’s visualization and decision-support capacity through improvements to UAA Planetarium and Visualization Theater
- Collaborated with Montana EPSCoR to design a social-ecological systems curriculum for land managers and other professionals
- Hired one UAA faculty
- Engaged three postdocs and three graduate students in research

## Impacts

- Improved access to adaptation information through Arctic Adaptation Exchange portal
- Enhanced discourse with Alaskan communities to incorporate relevant adaptation variables
- Improved UAA visualization capacity
- Nucleation of a new group of visualization and decision-support experts at UAA across disciplines
- Material advances in social science survey protocols, SES hotspots mapping techniques, PΔI mapping, and adaptive capacity indices
- Advancement of understanding of human behavior, responses to environmental change, societal adaptation and emergent phenomena
- Foundation of a permanent entity to conduct social ecological systems science in Alaska

## Activities for years 4-5

- Incorporate more layers of data into the salmon visualization tool, including landscape and hydrologic change data, and refine the tool for visualization activities
- Complete and implement improvements to the UAA Planetarium and Visualization Theater
- Apply Arctic Water Resources Vulnerability Index (AWRVI) adaptive capacity instrument across the state, and share results with management agencies and Alaska Native Corporations and councils
- Administer pilot and full-scale SES curricula

*“Our CIS products are on the cutting edge of state and national research and are leading the way internationally. The Arctic Water Resources Vulnerability Index and the Arctic Adaptation Exchange Portal have been chosen specifically by the U.S. State Department as key deliverables during our Chairmanship of the Arctic Council.”*

– CIS lead Lilian Alessa

image by Bill Bower/Alaska Atlas of Panoramic Aerial Images

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## Leadership Team

Lilian Alessa, Lead  
University of Idaho Professor of Landscape Architecture

Fred Rainey  
UAA Professor of Biological Sciences

Jess Grunblatt  
UAF interdisciplinary PhD student

Jim Powell  
UAS postdoctoral researcher

Frank Witmer  
UAA Assistant Professor of Computer Science and Engineering

Paula Williams  
UAA postdoctoral researcher

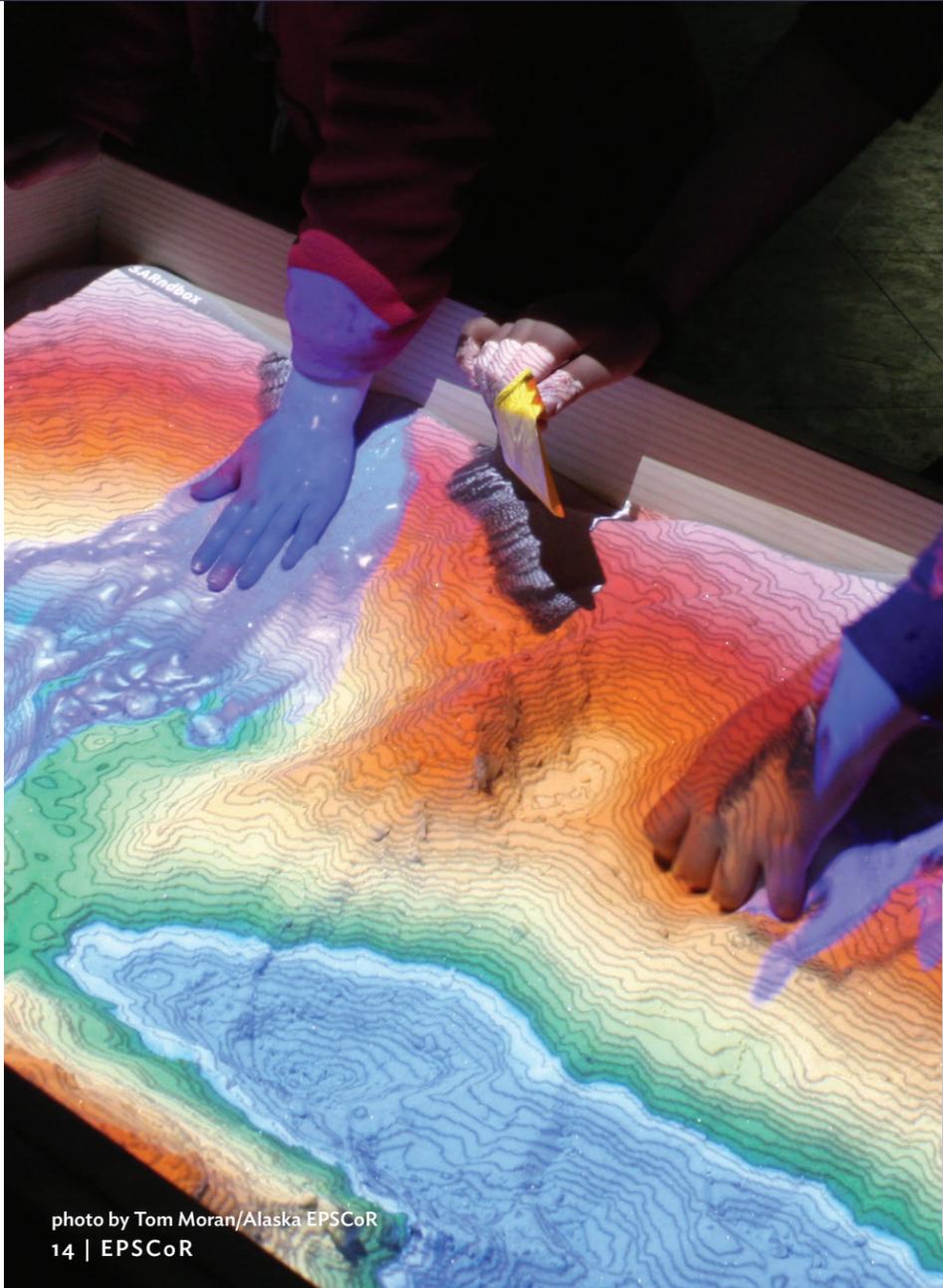
Mark Wipfli  
UAF Professor of Freshwater Ecology

image courtesy John Anderson/University of Idaho

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The Kenai Peninsula looks very different when you see it from underwater. CIS Group researchers have created a virtual world set in Tustumena Lake and the Kenai River, then stocked it with salmon which mimic the life cycles of real ones. The program is being loaded with information on landscape and hydrologic change, which will enable users to see the impacts of construction, warming, and other factors on salmon populations. Users can also pilot a salmon through the underwater landscape, enabling a greater understanding of the challenges faced by the fish.

# The Tools for the Job: EPSCoR CYBERINFRASTRUCTURE



EPSCoR's cyberinfrastructure component works to install and maintain the computer systems needed to manage EPSCoR data and to make it accessible to the public. EPSCoR cyberinfrastructure efforts are largely undertaken by the Geographic Information Network of Alaska (GINA).

GINA's chief function has been to create individual data catalogs and websites for each test case, linked through a central geospatial data portal, and to populate these portals with data collected by EPSCoR researchers as well as publicly available datasets for EPSCoR test cases.

GINA is also responsible for hosting the Arctic Adaptation Exchange Portal for the Arctic Council, and built three Augmented-Reality Sandboxes, exciting outreach tools that are being used to educate students and the public about landscape and hydrologic change.

## Goals

The goals of the cyberinfrastructure group are to:

- Build accessible online tools that will enable researchers and the public to access EPSCoR data
- Procure and process geospatial data needed by EPSCoR researchers
- Provide storage for EPSCoR data streams
- Provide technical assistance for EPSCoR research and outreach efforts

The EPSCoR/GINA Augmented-Reality Sandbox uses an overhead projector to create an interactive topographic map. When people sculpt hills and valleys with their hands, the elevation changes appear as contour lines and color striations, and when they hover a hand over the box, it "rains" on the landscape and the water collects in pools and channels. The device, which is based on a project by a faculty member at the University of California-Davis, has been displayed dozens of times to student and public audiences across the state and has quickly become the most visible part of EPSCoR's outreach efforts. GINA has built three sandboxes and EPSCoR has developed a curriculum to use it as a teaching tool.

## Partners

Major partners of EPSCoR's cyberinfrastructure component include the Polar Geospatial Center at the University of Minnesota, the North Slope Science Initiative; the NASA Pre-ABOVE program, UAF Research Computing Systems, and the Alaska Energy Authority.

## Accomplishments

- Designed and installed gLynx, an integrated system to support data storage and online access for all three test cases as well as a separate, centralized online data portal
- Installed Flexible Service and Storage Nodes (FSSNs) at all three main UA campuses, which provide processing power, storage and support
- Deployed Vector Collaboration Tools and Resources platforms, which support regional hydrography databases
- Collected, enhanced and orthorectified aerial imagery, including high-resolution imagery from the University of Minnesota Polar Geospatial Center and Alaskan aerial imagery from the 1950's, 1980's and present
- Established the Alaska High Resolution Satellite Imagery Archive for storing EPSCoR and other imagery
- Led development and hosting for Arctic Council's Arctic Adaptation Exchange Portal
- Constructed "Decision Theater North" visualization facility at UAF
- Built and operate the GINA-EPSCoR Virtual-Reality Sandbox, and arranged for design and construction of two mobile sandbox units
- Developed the Award Tracking Information System tool for administrative support in tracking internal budget awards
- Engaged one graduate student and two undergrads in research

## Impacts

- Sustainable data portal system enabling simple public access to EPSCoR data
- Aerial imagery collated and orthorectified for research use
- Publicly available state hydrography database and Southeast and Southcentral regional hydrography databases
- Adoption of GINA products by state agencies

## Activities for years 4-5

- Continue to update and expand gLynx capabilities to simplify data management and to enable easier access across operating systems and platforms
- Expand the capabilities of FSSNs to accommodate growing EPSCoR research needs
- Complete implementation of the "Decision Theater North" visualization facility

*"Your exhibit was one of the coolest things I have ever seen at AGU (and there are oh so many cool things at AGU). I have been rambling on about it for the last week."*

– World Wildlife Fund technical researcher, on the Augmented-Reality Sandbox exhibit at the 2014 American Geophysical Union Fall Meeting

## Leadership Team

Dayne Broderson, Lead  
Technical Services Manager  
Geographic Information Network of Alaska

Will Fisher  
Web Developer  
Geographic Information Network of Alaska

Kacy Krieger  
Geospatial Scientist, UAA

Lisa Wirth  
Geospatial Data Manager  
Geographic Information Network of Alaska

Greg Wirth  
Systems Analyst  
Geographic Information Network of Alaska

# Getting the Word Out: THE EDUCATION, OUTREACH AND DIVERSITY GROUP



The name of the game is education about salmon. But the name of the game — literally — is “Run Salmon Run.” EPSCoR’s Southcentral Test Case developed a board game based on the salmon life cycle and debuted it at Homer’s Kachemak Bay Research Reserve in April 2015. Coupled with videos about salmon made using EPSCoR’s salmon visualization program, as well as with the Augmented-Reality Sandbox, the game made a great impression on the young visitors to the Research Reserve’s public “Discovery Day,” and led to an article in the Homer Tribune newspaper.

## Introduction

Alaska EPSCoR conducts a number of education and outreach projects, which serve the dual purposes of bolstering science, technology, engineering and math (STEM) education and of enabling the flow of information between EPSCoR, the University of Alaska, and the Alaskan public. EPSCoR educational efforts are organized around a “cultural learning pathways” paradigm, through which audiences develop interests or shared concerns about environmental change in Alaska, which increases their connection to both the scientific and to local communities, and leads them to identify with issues related to change.

## K-12 Education

EPSCoR supports numerous efforts aimed at K-12 students and teachers, including:

- Teacher professional development workshops for Global Learning and Observations to Benefit the Environment (GLOBE), in which K-12 students engage in scientific inquiry through observing, measuring and documenting their surroundings
- The NASA “Micro to Macro” program, which brought Anchorage students to UAA’s biology labs and planetarium to learn about the different scales of scientific discovery
- Educational outreach using GINA’s Augmented-Reality Sandbox
- K-12 “Discovery Day” events at the Kachemak Bay Research Reserve in Homer
- “MapTEACH” activities in Nuiqsut, in which students use GPS units and paper and GIS maps to understand the local landscape from scientific, cultural and personal perspectives
- “Hike With the Scientists” days in Juneau, in which local educators learned about icefield-to-estuary ecosystems and test case research during expeditions to Herbert Glacier

photo by Courtney Breest/ Alaska EPSCoR  
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## Impacts

- More than 2,500 K-12 students and 300 teachers reached directly through EPSCoR-supported efforts, with over 5,000 more students reached through teacher training
- 51 teachers instructed in new GLOBE curricula that incorporate both social and biophysical variables
- Thousands of students introduced to concepts of topography, hydrology and landscape change with Augmented-Reality Sandbox

*“The most significant way for the state of Alaska to contribute to science and technology innovation is through ensuring quality K-12 and university educations, especially in science, technology, engineering and math (STEM) fields.”*

– Alaska State Committee on Research

## Post-Secondary Education and Workforce Development

Many Alaska EPSCoR outreach efforts are targeted at students and faculty across the University of Alaska, and at building a skilled Alaskan workforce. Efforts include:

- Integrating postdoctoral, undergraduate and graduate student research into test cases
- Coordinating and supporting a peer group of UAF Ph.D. students studying social-ecological systems
- Providing travel support for UA students and faculty to attend the annual AAAS Arctic Science Conference and the Western Alaska Interdisciplinary Science Conference (WAISC)
- Supporting summer internships for students in the UA Resilience and Adaptation Program (RAP) with Alaska Native organizations
- Supporting a biennial UAF graduate-level course in interdisciplinary science research methods
- Supporting three UAF grant-writing workshops, a STEM career workshop, and a workshop on statistical wildlife software
- Partnering with the UAA Technology Research and Development Center (TREND) to provide development grants to Alaskan startup businesses
- Partnering with the Fairbanks Economic Development Corporation to stage the 2015 Fairbanks Hackathon and 2015 Startup Weekend

## Impacts

- Provided support for seven postdoctoral researchers, around 30 graduate students and almost 50 undergrads
- 7 graduate students and 12 undergrads supported by EPSCoR have received degrees
- Spurred University of Alaska to build an SES curriculum to support Ph.D. cohort
- Spread knowledge by supporting 11 UA students, faculty and affiliates to attend AAAS conferences and 21 to attend WAISCs
- Imparted skills to about 110 students at grant-writing and STEM workshops
- Supported six RAP interns who contributed valuable data and findings to organizations including the Council of Athabaskan Tribal Governments, the Yakutat Cultural Association, the Wrangell Cooperative Association, and the Tanana Tribal Council
- \$35,000 in 2015 TREND grants are assisting Alaskan startups

*“One of the things we’re really interested in and the National Science Foundation is really interested in is not just doing interesting science, but also what the implications of the science are. How are you delivering the science, how does it get into the community, how does it help educate the general public?”*

– Sanjay Pyare, Southeast Test Case lead

photo by Tom Moran/ Alaska EPSCoR  
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Since 2008, the Western Alaska Interdisciplinary Science Conference has brought big-time science to small Alaskan towns. The annual event cycles through remote communities in Western Alaska, and centers on presentations and activities which both researchers and community members are encouraged to attend. It’s a rare opportunity for residents of these often heavily-studied areas to get a glimpse into just what scientists are finding out.



## EOD Leadership Team

Elena Sparrow  
EPSCoR Education Director

Tania Clucas  
EPSCoR Education, Outreach and Diversity Manager

Tom Moran  
EPSCoR Communications Manager

Courtney Breest  
EPSCoR UAA Outreach Coordinator

Suzie Teerlink  
EPSCoR UAS Outreach Coordinator

## Continued: THE EDUCATION, OUTREACH AND DIVERSITY GROUP

### Public Outreach

Part of EPSCoR's mission is to ensure the general public and academia know about the program's activities and findings. EPSCoR public and academic outreach efforts include:

- Publishing in refereed academic journals, books and reports
- Presenting on EPSCoR research topics at academic conferences
- Holding public meetings in test case communities to disseminate information and to solicit feedback on research
- Updating stakeholders on research and outreach efforts through print newsletters
- Broadcasting short videos on KUAC-TV and YouTube
- Maintaining a comprehensive project website and engaging in social media
- Supporting lectures and presentations on relevant topics, including the Science for Alaska lecture series
- Personally representing EPSCoR at public events

### Impacts

- Published 54 peer-reviewed academic articles, reports, book chapters and books as of spring 2015
- Gave hundreds of presentations on EPSCoR topics at academic conferences in Alaska and across the nation and world
- Helped to scope and disseminate research through multiple meetings with stakeholder groups and residents in Nuiqsut, Juneau, and key Kenai Peninsula communities
- Reached hundreds of subscribers through four newsletters
- Produced 16 EPSCoR videos viewable on YouTube and KUAC-TV, which have been viewed more than 7,000 times online
- Raised awareness of EPSCoR through website, social media, and booths promoting the program at events across the state and nation
- Spread knowledge about science topics through supporting Science for Alaska lectures, which drew almost 2,500 attendees in 2015

The "Kenaitze Youth Speak" project engaged young members of the Kenaitze tribe in conversations about traditional places, salmon fishing, local effects of climate change, and the health of the Kenai River, which flows through their traditional lands. Observations and photos by the children were then compiled into a hardcover book, which was distributed to local schools and libraries and members of the tribe. EPSCoR also provided instructors to the tribe's 2015 Janteh Science Camp, pictured at right.



photo by Courtney Breest/Alaska EPSCoR



photo by Tania Clucas/Alaska EPSCoR

A few thousand feet from Alaska's famous drive-in glacier, Juneau's tour guides gathered in May 2015 for a crash course in EPSCoR science. More than 50 people attended the "Icefield-To-Estuary" workshop at the Mendenhall Glacier Visitor Center, at which Southeast Test Case researchers discussed key issues of climate change and glacier recession and their impacts on runoff, estuaries, salmon, and the local economy.

### Diversity

Part of Alaska EPSCoR's charge is to encourage diversity in Alaskan research. Efforts include:

- Funding Native American student interns in Southeast Alaska through the Alaska Native Science and Engineering Program (ANSEP)
- Awarding three Alaska Native Engagement Grants to UA faculty for projects to increase the interest of Alaska Native students in STEM fields
- Involving all three UA campuses and multiple rural campuses in EPSCoR research and outreach
- Reaching rural K-12 schools through the Permafrost Active Layer Monitoring program, in which UAF scientists install soil and permafrost temperature sensors and frost tubes and train students to monitor them
- Offering a Quantum Geographic Information Systems (QGIS) training program for Alaskan Upward Bound students, who are largely Alaska Natives
- Instructing in summer camps in Barrow and the Kenai Peninsula with high percentages of underrepresented minorities
- Awarding small cash prizes to female winners at Alaska regional science fairs in partnership with the Alaska chapter of the Association for Women in Science

*"Successful adaptation will require engaging not only governments, but also private business, communities and community leaders, and individual households."*

- Alaska Climate Change Subcabinet

### Impacts

- Directly engaged 705 K-12 minority students (28% of the students reached by EPSCoR) and 1435 female K-12 students (57% of the students reached by EPSCoR)
- Increased or roughly maintained the percentages of minority faculty, student, and staff participants in Alaska EPSCoR between 2012 and 2015
- Awarded cash prizes to 170 female K-12 students at Fairbanks, Anchorage and Juneau science fairs
- Awarded three Alaska Native Engagement Grants, which supported: a Fairbanks K-12 class that blended lessons in tree ring identification and animal taxonomy with artistic content; a project to use unmanned aerial vehicles to study coastal change in Shishmaref; and a project in which high school students from the Kenaitze tribe discussed observations of local change

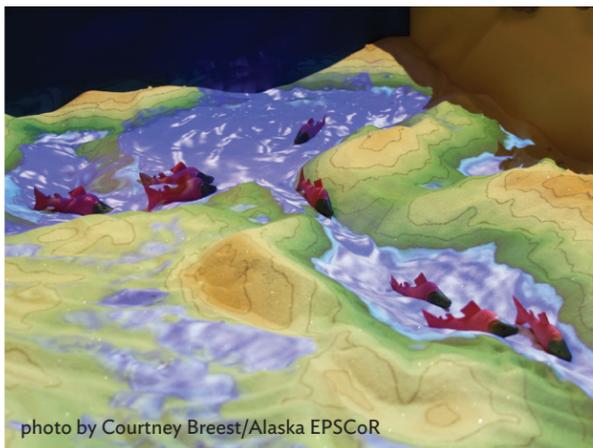
*"Diversity is one of our country's greatest assets: diversity of experience, perspective, ethnicity, gender, geography. You name it. That diversity is what feeds the spectacular array of ideas from innovative people across the United States. And EPSCoR is about keeping this diversity at the heart of our scientific enterprise."*

- John Holdren, Office of Science and Technology Policy, the White House

# Future Plans: THE ROAD AHEAD

## Plans for Years 4-5

The first three years of the current five-year EPSCoR award have focused on establishing community connections and on gathering data. The final two years will focus on analyzing this data, synthesizing it into useful products, and distributing it to Alaskans.



## Final research products

All three test cases will produce distinct research products to serve local communities, which are discussed in their individual sections. The CIS Group will synthesize statewide findings into larger products, including:

- Arctic Water Resource Vulnerability Index (AWRVI) assessments
- Adaptive capacity indexes for selected test case communities
- SES hotspots maps for selected test case areas
- PΔI maps for test case areas
- Visualization products for use across the state for community engagement and decision-making

*We are going to have to do some adaptation, and we are going to have to help communities be resilient, because of these trend lines we are not going to be able to stop (climate change) on a dime. We're not going to be able to stop tomorrow.*

– President Barack Obama



“Decision Theater North” provides a cutting-edge immersive visual environment to facilitate dialogue and decision-making by agencies, industry, and academia. The facility consists of a conference room on UAF’s West Ridge retrofitted with walls composed of high-definition 3-D stereoscopic screens providing upwards of 50 million pixels of resolution, connected directly to UA supercomputing infrastructure. It is the first facility of its kind in Alaska.

photo by Tom Moran/Alaska EPSCoR

## Visualization Improvements

A major undertaking of EPSCoR in years 4 and 5 will be improving the University of Alaska’s ability to exhibit research findings, and to aid in decision-making, through large-scale visualizations. EPSCoR is building interactive software, such as its salmon visualization program; experimenting with portable visualization techniques, such as Oculus Rift goggles; and improving and building visualization facilities, including continual and ongoing improvements to the Planetarium and Visualization Theater on the UAA campus, and construction of a “Decision Theater North” visualization facility on UAF’s West Ridge. A “Data to Decisions” mini-grant program will generate content for Decision Theater North and the UAA Planetarium and Visualization Theater.

## Sustainable Adaptation Network

These visualization facilities will form the brick-and-mortar core of a permanent network to support social-ecological systems research and community sustainability after the current award period ends. Elements of the network will include:

- Education: SESTEP and SES graduate student curricula, and GLOBE teacher training
- Outreach: The Augmented-Reality Sandbox and Arctic Adaptation Exchange Portal
- Cyberinfrastructure: EPSCoR data portals and storage and imagery archives
- Scenario Development: Scenario-building using EPSCoR and other data
- Decision-making: Use of UAA Planetarium and UAF Decision Theater North by University of Alaska, communities and agencies

*“There are lots of statistics we can show people saying what the alternatives are, but it’s very difficult for people to put their minds to and actually perceive change into the future without taking them into a spatial environment that we’re used to.”*

– John Anderson, chief designer of salmon visualization program



# Making a Difference: IMPACTS OF ALASKA EPSCoR



## Funding

Alaska EPSCoR has received approximately \$46 million in federal funding since 2001. \$12 million of that total has come to the Alaska ACE project. That funding has resulted in EPSCoR researchers receiving an additional \$139 million in funding from other sources.

## Personnel

Since 2001, EPSCoR has:

- Hired 20 UAF, 10 UAA and 2 UAS faculty members
- Supported 28 postdoctoral researchers, 299 graduate students and 184 undergrads
- Provided seed grants, early-career awards, buyouts, travel funds, and other support to hundreds of UA researchers

*“Alaska ACE will continue to set the trend by advancing our knowledge of social dynamics in changing environments, as well as help provide decision support for Alaska’s sustainable future.”*

– Lilian Alessa, Co-Project Director

photo by Courtney Breest/Alaska EPSCoR  
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## Infrastructure

NSF EPSCoR has directly contributed to UA research infrastructure by funding key equipment, and indirectly by catalyzing support for new facilities. Other EPSCoR contributions to Alaska research facilities include:

- New equipment for the UAF Core Facility for Nucleic Acid Analysis, the UAA Applied Sciences, Engineering, and Technology Lab, the UAF Irving-Murdock Arctic Environmental Facility, the UAF Geotechnical Laboratory, the UAF Civil Engineering Department Frozen Ground Laboratory, and UAF permafrost observatories
- Partial funding of an ultra-low temperature “cold room” in the UAF Duckering Building
- Outfitting of a UAS Social-Ecological Sciences Laboratory
- Installation or improvement of sensor networks in Berners Bay and the Kenai Peninsula
- Upgrades to internet connectivity, data storage, supercomputing, and data access at UAA, UAF, and UAS
- Three augmented-reality sandboxes
- Upgrades to the UAA Planetarium and Visualization Theater
- The Decision Theater North facility at UAF



## Economic Development

Alaska EPSCoR’s support of the Technology Research and Development Center of Alaska (TREND) has had a noteworthy impact on Alaskan entrepreneurship. From 2007-12, for example, \$262,500 in EPSCoR support resulted in \$6.3 million in additional federal funding – a 23:1 return on investment.

## Institutional Culture

Alaska EPSCoR has raised the profile of UA research through public outreach and through coordinating research across campuses. It has catalyzed support for increased SES and interdisciplinary research and outreach at UA and has fostered increases in research collaborations across campuses, in publications co-authored by junior and senior researchers across campuses, and in mobility of faculty and students within the UA system.

## Research Findings

More than 600 scholarly articles and books have resulted from EPSCoR research. EPSCoR tools, techniques and findings have been adopted by groups including the U.S. Geological Survey, the U.N.’s Sustainable Development Commission, the Harvard School of Forestry, and the Pacific Northwest-wide Mountain Social-Ecological Systems Observing Network, in addition to EPSCoR’s ongoing partnership with the Arctic Council.

## External Experts Advisory Council

EPSCoR benefits from the advice of a panel of authorities on integrative science and social-ecological systems. Members are:

### Michael Barton

Director, Center for Social Dynamics and Complexity, Arizona State University

### Michael Khonsari

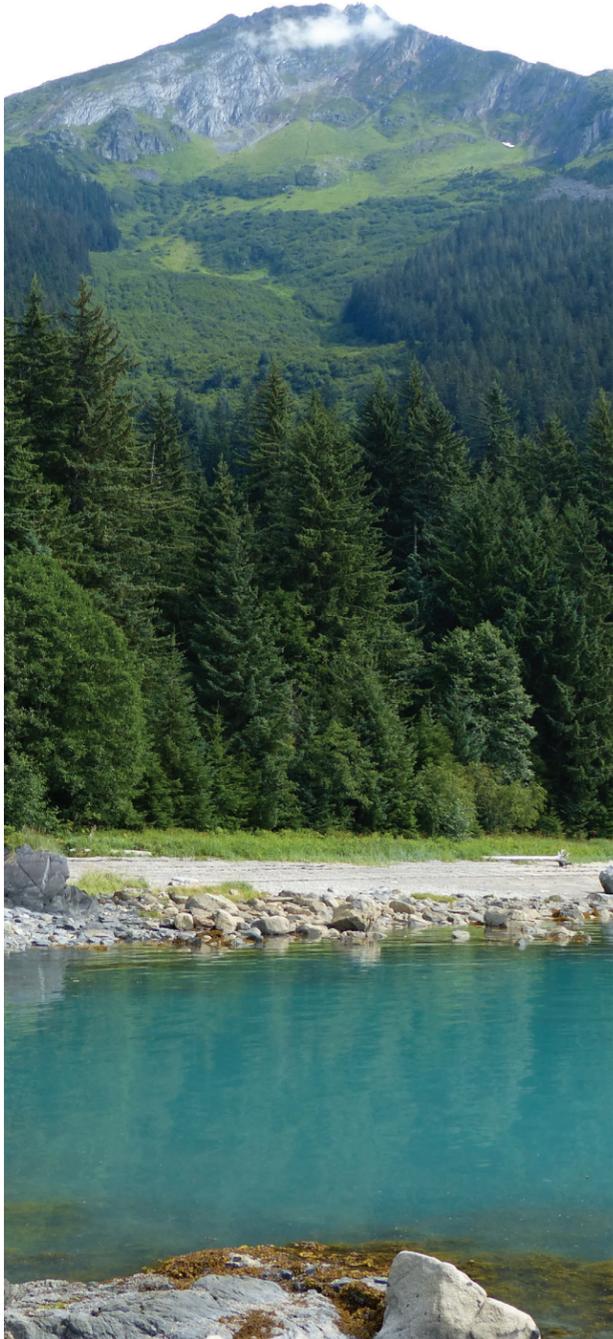
Dow Chemical Endowed Chair and Professor and Director of the Center for Rotating Machinery, Louisiana State University

### Jack Liu

Director, Center for Systems Integration and Sustainability, Michigan State University

photo by Courtney Breest/Alaska EPSCoR  
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## Appendix A: Key Personnel and Faculty Hires

Name	Primary Affiliation	Expertise	Role
Anupma Prakash	UAF Geophysical Institute	Remote Sensing	Principal Investigator/ Co-Project Director
Lilian Na'ia Alessa	U. of Idaho	SES Science	Co-PI/Co-PD/CIS Lead
Pips Veazey	Alaska EPSCoR, UAF	Outreach	Associate Project Director/ Program Administrator
Sanjay Pyare	UAS Environmental Science	Landscape Ecology	Co-PI/Southeast Lead
Brian Vander Naald	UAS Social Science	Economics	Southeast Co-Lead
Dan Rinella	UAA Biological Sciences	Aquatic Ecology	Southcentral Lead
Andrew Kliskey	U. of Idaho	Behavioral Geography	Southcentral Co-Lead
Gary Kofinas	UAF Institute of Arctic Biology	Resource Geography	Northern Lead
Todd Brinkman	UAF Institute of Arctic Biology	Wildlife Biology	Northern Co-Lead
Elena Sparrow	UAF International Arctic Research Center	K-12 and University Education	Education Outreach Lead
Dayne Broderson	UAF, Geographic Info. Network of Alaska	Computing	Cyberinfrastructure Lead
Gary Turner	UAA Kenai Peninsula College	Rural Campus Management	Rural Campus Representative
Susie Carson	Alaska EPSCoR	Financial Management	Fiscal Officer

### Alaska ACE Faculty Hires

Srijan Aggarwal  
Assistant Professor of Civil and Environmental  
Engineering, UAF

Todd Brinkman  
Assistant Professor of Wildlife Biology, UAF

Brian Buma  
Assistant Professor of Forest Ecosystem Ecology,  
UAS

photo by Sarai Timothy/Alaska EPSCoR

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Elaine Drew  
Assistant Professor of Anthropology, UAF

Sarah Trainor  
Assistant Professor of Social-Ecological Systems  
Sustainability, UAF

Frank Witmer  
Assistant Professor of Computer Science and  
Engineering, UAA

## Appendix B: Publications

### Southeast Test Case

**Beaudreau, A.H.**, Levin, P.S. (2014). Advancing the use of local ecological knowledge for assessing data-poor species in coastal ecosystems. *Estuaries and Coasts*, 24(2).

**Buma, B.**, Brown, C., Donato, D., Fontaine, J., Johnstone, J. (2013). The impacts of changing disturbance regimes on serotinous plant populations and communities. *BioScience*, 63(11), 866-876.

**Buma, B.**, Hennon, P.E., Bidlack, A.L., Baichtal, J.F., Ager, T.A., Streveler, G. (2014). Correspondence regarding “The problem of conifer species migration lag in the Pacific Northwest region since the last glaciation” by Elias, S.A. *Quaternary Science Reviews*, 77, 53-69.

**Buma, B and Johnson, A.** (2015). The role of windstorm exposure and yellow cedar decline on landslide susceptibility in southeast Alaskan temperate rainforests. *Geomorphology*, 228, 504-511.

Ciannelli, L., Hunsicker, M., **Beaudreau, A.**, Bailey, K., Crowder, L.B., Finley, C., Webb, C., Reynolds, J., Sagmiller, K., Anderies, J.M., Hawthorne, D., Parrish, J., Heppell, S., Conway, F. & Chigbu, P. (2014). Transdisciplinary graduate education in marine resource science and management. *ICES Journal of Marine Science*, 71 (5), 1047-1051.

D’Amore, D., Edwards, R., Herendeen, P., **Hood, E. & Fellman, J.** (2015). Dissolved organic carbon fluxes from hydrogeologic units in Alaskan coastal temperate rainforest watersheds. *Soil Science Society of America Journal*, 79(2), 378-388.

**Fellman, J.B., Nagorski, S., Pyare, S.**, Vermilyea, A.W., Scott, D. and **Hood, E.** (2013). Stream temperature response to variable glacier coverage in coastal watersheds of Southeast Alaska. *Hydrological Processes*, 28, 2062-2073.

**Fellman, J.B., Hood, E.**, Raymond, P.A., Hudson, J., Bozeman, M. & Arimitsu, M. (2015). Evidence for the assimilation of ancient glacier organic carbon in a proglacial stream food web. *Limnology and Oceanography*. doi: 10.1002/lno.10088

**Fellman, J.B., Hood, E.**, Spencer, R.G.M., Stubbins, A., Raymond, P. (2014). Watershed glacier coverage influences dissolved organic matter biogeochemistry in coastal watersheds of southeast Alaska. *Ecosystems*, 17, 1014-1025.

Froehlich, H.E., Essington, T.E., **Beaudreau, A.H.**, Levin, P.S. (2013). Movement patterns and distributional shifts of Dungeness crab (*Metacarcinus magister*) and English sole (*Parophrys vetulus*) during seasonal hypoxia. *Estuaries and Coasts*, 37(2), 449-460.

Froehlich, H.E., Hennessey, S.M., Essington, T.E., **Beaudreau, A.H.** & Levin, P.S. (2015). Spatial and temporal variation in nearshore macrofaunal community structure in a seasonally hypoxic estuary. *Marine Ecology Progress Series*, 520, 67-83.

Hill, D., Bruhis, N., Calos, S., **Arendt, A.** & Beamer, J. (2015). Spatial and temporal variability of freshwater discharge into the Gulf of Alaska, *J. Geophys. Res. Oceans*, 120, 634-646.

**Hood, E.**, Battin, T.J., **Fellman, J.**, O’Neel, S & Spencer, G.M. (2015). Storage and release of organic carbon from glaciers and ice sheets. *Nature Geoscience*, 8, 91-96.

Kovach, R. P., Joyce, J. E., Vulstek, S. C., Barrientos, E. M., & **Tallmon, D. A.** (2014). Variable effects of climate and density on the juvenile ecology of two salmonids in an Alaskan lake. *Canadian Journal of Fisheries and Aquatic Sciences*, 71(6), 799-807.

Kovach, R.P., **Ellison, S.C., Pyare, S.** and **Tallmon, D.A.** (2014). Temporal patterns in adult salmon migration timing across southeast Alaska. *Global Change Biology*. doi: 10.1111/gcb.12829

Livneh, B., Deems, J.S., **Buma, B.**, Barsugli, J.J., Schneider, D., Molotch, N.P., Wolter, K. & Wessman, C.A. (2015). Catchment response to bark beetle outbreak in the upper Colorado River basin. *Journal of Hydrology*, 523, 196-210.

**Nagorski, S.**, Engstrom, D., Hudson, J., Krabbenhoft, D., **Hood, E.**, DeWild, J., Aiken, G. (2014). Spatial distribution of mercury in southeastern Alaskan streams influenced by glaciers, wetlands, and salmon. *Environmental Pollution*, 182, 62-72.

O’Neel, S., **Hood, E., Arendt, A.** & Sass, L. (2014). Assessing streamflow sensitivity to variations in glacier mass balance. *Climatic Change*, 123(2), 329-341.

O’Neel, S., **Bidlack, A., Hood, E.**, Fleming, S., Arimitsu, Y., **Pyare, S.** et al. (2014). Icefield-to-ocean linkages across the northern Pacific coastal temperate rainforest ecosystem, *Bioscience*. doi: 10.1093/biosci/biv027

Sawchuk, J.H., **Beaudreau, A.H.**, Tonnes, D., Fluharty, D. (2015). Using stakeholder engagement to inform endangered species management and improve conservation. *Marine Policy*, 54, 98-107.

Sergeant, C.J. & **Nagorski, S.A.** (2014). The implications of monitoring frequency for describing riverine water quality regimes. *River Research and Applications*.

Shanley, C.S., **Pyare, S., Kofinas, G.P.** (2013). Balancing the conservation of wildlife habitat with subsistence hunting access: A geospatial-scenario planning framework. *Landscape and Urban Planning*, 115, 10-17.

Shanley, C.S., **Pyare, S.**, Goldstein, M.I., Alaback, P.B., Albert, D.M., Beier, C.M., **Brinkman, T.J.**, Edwards, R.T., **Hood, E.**, MacKinnon, A., McPhee, M.V., Patterson, T.M., Suring, L.H., **Tallmon, D.A., Wipfli, M.S.** (2014). Climate change implications

in the northern coastal temperate rainforest of North America. *Climatic Change*. DOI 10.1007/s10584-015-1355-9.

Spencer, R.G.M., Vermilyea, A., **Fellman, J.**, Raymond, P., Stubbins, A., Scott, D., **Hood, E.** (2014). Seasonal variability of organic matter composition in glacier outflow: Insights into glacier carbon sources. *Environmental Research Letters*, 9, 055005.

Spencer, R.G.M., Guo, W., Raymond, P., Dittman, T., **Hood, E.**, **Fellman, J.** and Stubbins, A. (2014). Source and biolability of ancient dissolved organic matter in glacier and lake ecosystems on the Tibetan Plateau. *Geochimica et Cosmochimica Acta*, 142, 64-74.

### Southcentral Test Case

**Alessa, L., Kliskey, A.**, Gamble, J., Fidel, M., Beaujean, G. & Gosz, J. (2015). The role of Indigenous science and local knowledge in integrated observing systems: Moving toward adaptive capacity indices and early warning systems. *Sustainability Science*. DOI: 10.1007/s11625-015-0295-7

**Bauret, S.**, and **Stuefer, S.L.** (2013). Kenai Peninsula precipitation and air temperature trend analysis. Proceedings of the 19th International Northern Research Basins Symposium and Workshop, Southcentral Alaska, August 11-17, 2013, p.35-44.

Leppi, J.C., **Rinella, D.J.**, Wilson, R.R., Loya, W.M. (2014). Linking climate change projections for an Alaskan watershed to future coho salmon production. *Global Change Biology*, 20(6), 1808-1820.

Smith, A., Kolden, C., Tinkham, W., Talhem, A., Marshall, J., Hudak, A., Boschetti, L., Falkowski, M., Greenberg, Anderson, J., **Kliskey, A.**, **Alessa, L.**, Keefe, R., Gosz, J. (2014). Remote sensing the vulnerability of vegetation in natural terrestrial ecosystems. *Remote Sensing of Environment*, 154, 322-337.

**Toniolo, H.** and **Hopkins, H.** (2014). Discharge evolution along the Kenai River Watershed, Alaska, USA. *Proceedings of XXVI Latin American Congress of Hydraulics*. 25 - 29 August 2013, Chile.

### Northern Test Case

**Arp, C. D.**, Whitman, M.S., Jones, B.M., Grosse, G., Gaglioti, B.V. & Heim, K.C. (2015). Distribution and biophysical processes of beaded streams of Arctic permafrost landscapes. *Biogeosciences*, 12, 1-19.

Bali, A. and **Kofinas, G.** (2014). Voices of the caribou people: A participatory videography method to document and share local knowledge from the North American human-rangifer systems. *Ecology and Society*, 19(2), 16.

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**Blair, B.**, Lovecraft, A. & **Kofinas, G.** (2014). Meeting institutional criteria for social resilience: a nested risk system model. *Ecology and Society*, 19(4), 36.

**Carothers, C.**, Brown, C., Moerlein, K. J., Lopez, J. A., Andersen, D. B., & Retherford, B. (2014). Measuring perceptions of climate change in northern Alaska: pairing ethnography with cultural consensus analysis. *Ecology and Society*, 19(4), 27.

Christie, K. S., **Lindberg, M. S.**, Ruess, R. W., & Schmutz, J. A. (2014). Spatio-temporal patterns of ptarmigan occupancy relative to shrub cover in the Arctic. *Polar Biology*, 37(8), 1111-1120.

Christie, K. S., Ruess, R. W., **Lindberg, M. S.**, & Mulder, C. P. (2014). Herbivores Influence the Growth, Reproduction, and Morphology of a Widespread Arctic Willow. *Plos One*, 9(7).

**Euskirchen, E. S.**, Carman, T. B., & McGuire, A. D. (2014). Changes in the structure and function of northern Alaskan ecosystems when considering variable leaf-out times across groupings of species in a dynamic vegetation model. *Global Change Biology*, 20(3), 963-978.

Forbes, Bruce C., **Kofinas, G.**, Beach, H., Brattland, C., Kankaanpää, P., Kesitalo, C., Lennert, M., **Meek, C.L.**, Metcalf, V.K., Robards, M.D. & Young, O.R. (2015). Resource Governance. In G. Fondal & J. Larsen (Eds.), *Arctic Human Development Report II* (ppg. 253-289.) Copenhagen: Nordisk Ministerråd.

Hansen, W.D., **Brinkman, T.J.**, Leonawicz, M.W., Chapin III, F.S., **Kofinas, G.** (2013). Changing daily wind speeds on Alaska's North Slope: Implications for rural hunting opportunities. *Arctic*, 66(4), 448-58.

Knapp, C. N., Chapin, F. S., III, **Kofinas, G. P.**, Fresco, N., Carothers, C., & Craver, A. (2014). Parks, people, and change: the importance of multistakeholder engagement in adaptation planning for conserved areas. *Ecology and Society*, 19(4).

**Kofinas, G.**, Clark, D. and Hovelsrud, G.K. (2013). Adaptive and Transformative Capacity. *Arctic Resilience Interim Report 2013* M. Davis and T. Gill. Stockholm Environment Institute and Stockholm Resi. Stockholm, Sweden. 73.

**Neuswanger, Jason R., Wipfli, M.**, Rosenberger, A. & Hughes, N. (2014). Mechanisms of drift-feeding behavior in juvenile Chinook salmon and the role of inedible debris in a clear-water Alaskan stream. *Environmental Biology of Fishes*, 97(5), 489-503.

Padilla, E. & **Kofinas, G.** (2014). "Letting the leaders pass:" Barriers to using traditional ecological knowledge in co-management as the basis of formal hunting regulations. *Ecology and Society*, 19(2), 7.

**Raynolds, M. K., Walker, D. A.**, Ambrosius, K. J., Brown, J., Everett, K. R., Kanevskiy, M., . . . Webber, P. J. (2014). Cumulative geoecological effects of 62 years

of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. *Global Change Biology*, 20(4), 1211-1224.

### CIS Group

Jochum, K., **Kliskey, A.**, Hundertmark, K., **Alessa, L.** (2014). Integrating complexity in the management of human-wildlife encounters. *Global Environmental Change*, 26, 73-86.

Johnson, N., **Alessa, L.**, Behe, C., Danielsen, F., Gearhead, S., Gofman, V., **Kliskey, A.**, Krummel, E., Lynch, A., Mustonen, T., Pulsifer, P. & Svoboda, M. (2015). The contributions of community-based monitoring and traditional knowledge to Arctic observing networks: Reflections on the state of the field. *Arctic*, 68(5).

Pundsack, J., Bell, R., **Broderson, D.**, Fox, G.C., Dozier, J., Helly, J., Li, W., Morin, P., Parsons, M., Roberts, A., Tweedie, C. and Yang, C. (2013). *Report on Workshop on Cyberinfrastructure for Polar Sciences*. St. Paul, Minnesota. Minneapolis: University of Minnesota Polar Geospatial Center.

Stevenson, K., **Alessa, L. & Kliskey, A.** (2014). Sustainable agriculture for Alaska and the circumpolar North: Part I. Development and status of northern agriculture and food security. *Arctic*, 67, 271-295.

Stevenson, K., Rader, H., **Alessa, L., Kliskey, A.**, Pantoja, A., Clark, M. & Smeenck, J. (2014). Sustainable agriculture for Alaska and the circumpolar North: Part II. Environmental, geophysical, biological and socioeconomic challenges. *Arctic*, 67, 296-315.

Stevenson, K., **Alessa, L., Kliskey, A.**, Rader, H., Pantoja, A., Clark, M. & Smeenck, J. (2014). Sustainable agriculture for Alaska and the circumpolar North: Part III. Meeting the challenges of high-latitude farming. *Arctic*, 67, 320-339.

### Education, Outreach and Diversity Group

Bestelmeyer, S.V., Elsner, M.M., Spellman, K.V., **Sparrow, E.B.**, Haan-Amato, S.S. & Keener, A. (2015). Collaboration, interdisciplinary thinking, and communication: New approaches to K-12 ecology education. *Front Ecol Environ*, 13(1), 37-43.

Boger, R., Yule, S. & **Sparrow, E.** (2013). Strategies for teaching to a changing world: Lessons from Arusha, Tanzania. *International Research in Geographical and Environmental Education*, 22(3), 209-225.

**Sparrow, E.B.**, Gordon, L.S., **Kopplin, M.R.**, Boger, R., Yule, S., Morris, K., Jaroensutasinee, K., Jaroensutasinee, M. & Yoshikawa, K. (2013). Integrating geoscience research in primary and secondary education. In Tong, V. (Ed.), *Innovations in Science and Technology, Vol. 21: Geoscience Research and Outreach* (ppg. 227-250.) London: Springer.

**Yoshikawa, K., Sparrow, E.** & Stanilovskaya, J. (2013). Engaging Alaskan communities and students in cryospheric research. In Tong, V. (Ed.), *Innovations in Science and Technology, Vol. 21: Geoscience Research and Outreach* (ppg. 19-45). London: Springer.

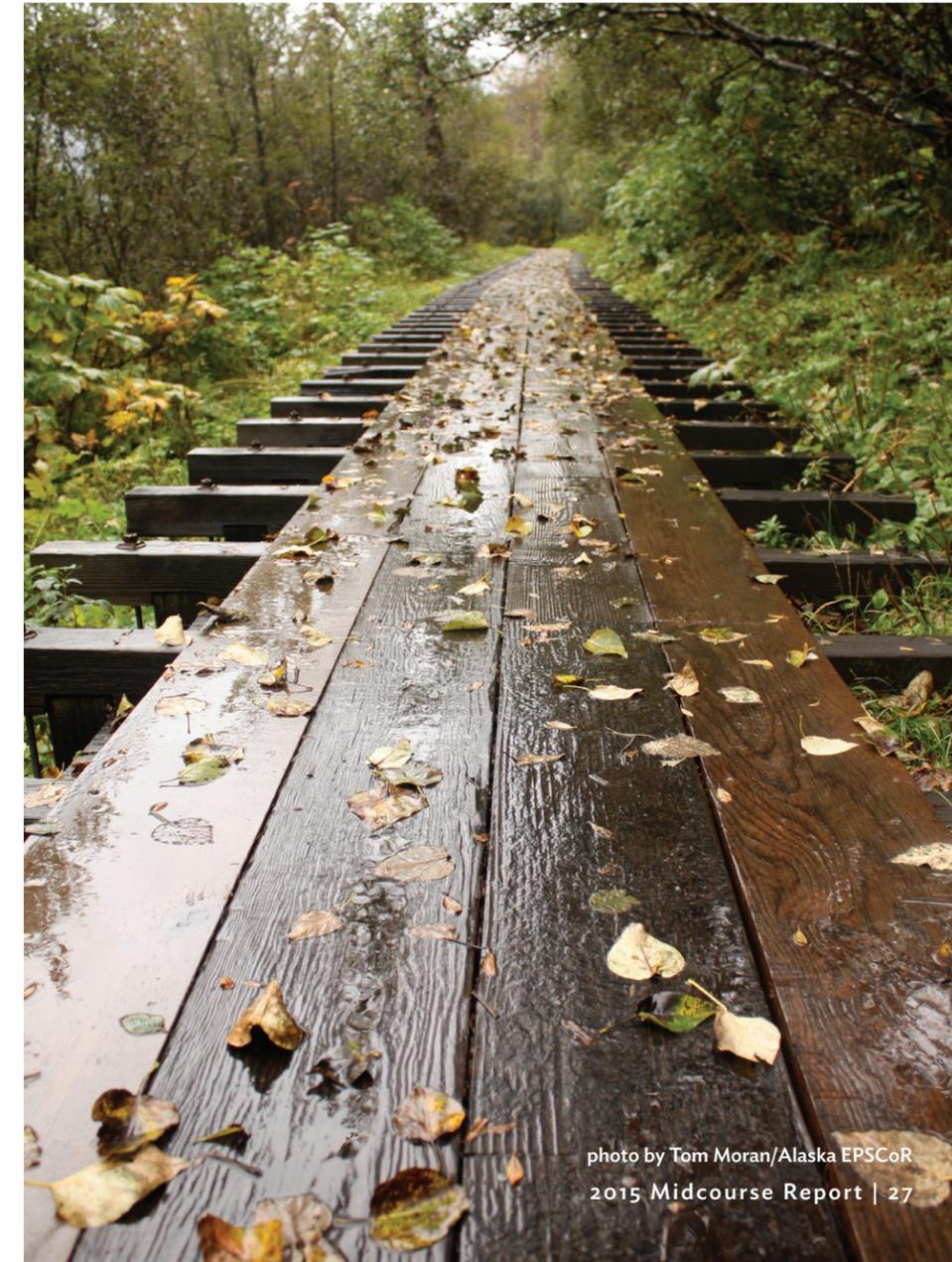


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