



National Science Foundation
WHERE DISCOVERIES BEGIN

Award Abstract # 1928189

NNA Track 1: Collaborative Research: The climate impacts on Alaskan and Yukon rivers, fish, and communities as told through co-produced scenarios

NSF Org: [ICER](#)
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Awardee: REGENTS OF THE UNIVERSITY OF COLORADO, THE

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GEO Directorate For Geosciences

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Sponsor Congressional District: 02

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ABSTRACT

Navigating the New Arctic (NNA) is one of NSF's 10 Big Ideas. NNA projects address convergence scientific challenges in the rapidly changing Arctic. The Arctic research is needed to inform the economy, security and resilience of the Nation, the larger region and the globe. NNA empowers new research partnerships from local to international scales, diversifies the next generation of Arctic researchers, and integrates the co-production of knowledge. This award fulfills part of that aim.

Northern communities in Alaska and Canada rely upon productive fisheries. For many of these communities, rivers are used to access fishing and hunting grounds and to transport supplies during ice-free seasons and over river-ice in winter. As the Arctic and its rivers continue to warm, the ultimate impacts on people, their fisheries and winter travel corridors are highly uncertain. Improved understanding of the ongoing and possible future changes requires close partnership among Native groups and researchers from diverse scientific disciplines. This project is a collaboration among the Institute of Arctic and Alpine Research (INSTAAR) at the University of Colorado Boulder (CU), the U.S. Geological Survey (USGS), the Yukon River Inter-Tribal Watershed Council (YRITWC), the National Center for Atmospheric Research (NCAR), the Institute for Tribal Environmental Professionals (ITEP) at North Arizona University (NAU), and two major Canadian universities. The YRITWC is a non-profit organization of 74 First Nations and Tribes that conducts monitoring of the Yukon River Watershed. Three Indigenous interns are working with YRITWC and USGS researchers and staff to enhance the community-based and federal river monitoring networks with automated water quality sensors. The new data are being used by researchers to monitor river conditions and change and to improve computer simulations of rivers, ice, and fish. Outreach to Indigenous K-12 students in the communities where monitoring is being conducted will include traveling lectures and an ask-scientists website. A Native Advisory Council will be formed in Year 1 to provide input into research directions and refinements and to ensure the production of useable outcomes. Importantly, the Council will guide the agenda of a two-day Arctic Rivers Summit in project Year 3 and the selection of 42 Indigenous community members to receive a scholarship to attend the Summit. The Summit will bring together Tribal and First Nation resource managers, Arctic and Boreal community members, and academic, federal, state, and provincial researchers to unify the state of knowledge on Arctic Rivers as a community of observers, investigators, knowledge holders, and stewards. Results from the Summit will include a white paper co-authored by all attendees. Researchers from NCAR and CU are conducting computer simulations of weather, streamflow, river ice, and water temperature for historical and potential future climate conditions over Alaska and western Canada. The data are being used by USGS and CU scientists to assess potential risks to Arctic river fish species. The project results will be communicated through co-produced scenarios jointly developed by all investigators and community members and designed to make future scenarios of Arctic change and potential societal impacts tangible and relatable to a broad audience. Thus, the project is assessing how socially important fish habitat and river-ice transport corridors of Arctic rivers may be impacted by climate-driven environmental changes.

Changes in temperature, precipitation, snowmelt and streamflow timing, ice-cover, permafrost,

hydrologic connectivity, river geochemistry, and groundwater are poorly characterized in northern regions, and the integrated effects on rivers and fish are critically unresolved. This project is advancing collective understanding of terrestrial hydrologic change and the potential impacts on rivers, fish, and communities in the Arctic. The project facilitates knowledge co-production through Indigenous community-based monitoring of rivers, Native engagement and oversight, ethnographic methods, and advances in climate, hydrologic, and river-ice, and fish bioenergetic models. Indigenous Knowledge (IK) and Western Science (WS) will be used to co-develop scenarios of past and plausible future conditions. An Arctic Rivers Summit co-developed by Tribal Environmental experts, YRITWC, USGS, and a Native Advisory Council identifying IK and WS baseline conditions of rivers and fish. This includes continuous water quality measurements of major rivers to observe hydrologic conditions and guide model development. The Regional Arctic System Model and the Community Terrestrial Systems Model are coupled to simulate river ice and water temperature with a chain of process-based models. Historical reanalysis, verified against baseline conditions, and future climate scenarios are simulated, and a fish bioenergetics model is being used to assess vulnerabilities of co-identified river-run Arctic fish species. Rich scenarios with IK of past events, changes, community challenges and adaptation successes will provide unique context to best communicate future model projections and impacts on the social, built and natural Arctic environment. Combining IK, climate and hydrologic modeling techniques with parallel advances in river ice, stream temperature, and fish models, the project collectively identifies convergent opportunities to monitor, map, model, assess, and communicate climate sensitivities of Arctic and boreal hydrology, rivers, and fish with respect to Indigenous culture, livelihood, transportation, and subsistence.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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