



Impacts and Feedbacks in a Warming Arctic: Engaging Diverse Learners in Geoscience Education and Research

Elena Sparrow (1), Katie Spellman (2), Cindy Fabbri (3), David Verbyla (4), Kenji Yoshikawa (5), Gilberto Fochesatto (6), Josefino Comiso (7), Malinda Chase (8), Debra Jones (9), and Mara Bacsujlaky (10)

(1) International Arctic Research Center, University of Alaska Fairbanks, Fairbanks, United States (ebsparrow@alaska.edu), (2) Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, United States (katie.spellman@alaska.edu), (3) School of Education, University of Alaska Fairbanks, Fairbanks, United States (cfabbri@alaska.edu), (4) School of Natural Resources and Extension, University of Alaska Fairbanks, Fairbanks, United States (dlverbyla@alaska.edu), (5) Institute of Northern Engineering, University of Alaska Fairbanks, Fairbanks, United States (kyoshikawa@alaska.edu), (6) Geophysical Institute, University of Alaska Fairbanks, Fairbanks, United States (gjfoschesatto@alaska.edu), (7) Cryospheric Sciences Branch, NASA Goddard Space Flight Center, Greenbelt, United States (josefino.c.comiso@nasa.gov), (8) Association of Interior Native Educators, Fairbanks, United States (malinda@ainealaska.org), (9) School of Natural Resources and Extension, University of Alaska Fairbanks, Fairbanks, United States (deb.jones@alaska.edu), (10) School of Natural Resources and Extension, University of Alaska Fairbanks, Fairbanks, United States (mara.bacsujlaky@alaska.edu)

A warming climate has changed the timing of the seasons in the Arctic and elsewhere. Our project will engage learners in the investigation of the shifting seasons' impacts on vegetation, soils, hydrology, infrastructure, livelihoods, and communities and the feedbacks between these factors. Primary and secondary students, pre- and in-service teachers and lifelong learners will use historical and current National Aeronautics and Space Agency (NASA) data, NASA experts, and the Global Learning and Observations to Benefit the Environment (GLOBE) methods to help uncover the surprises from and consequences of earlier springs, warmer and later falls, changing ice cover, later freeze-up and earlier break-up of rivers and lakes. Key objectives are to: 1) provide new opportunities to bring NASA assets to learners of all ages, 2) enhance Science, Technology, Engineering and Mathematics (STEM) learning and understanding of the Earth system, 3) improve STEM instruction, 4) enhance STEM experience of undergraduate students, and 5) increase participation of groups historically underrepresented in STEM such as Native Americans who are also more vulnerable to climate change impacts. Incorporating issues of local importance with national and global implications, into educational experiences will make learning relevant which may be helpful to communities in developing strategies for adaptation. We intend to use NASA assets (e.g. MODIS snow data, NDVI, Cloudsat, and SMAP data), GLOBE methodologies (classic and new ground observations and measurements) to develop and deliver curriculum materials including culturally responsive learning activities, course/modules, professional development workshops, and educational experiences using best practices in pedagogy such as constructivism, inquiry- and place- based, interdisciplinary and systems approach, and cutting-edge technology to reach a variety of target audiences, while improving STEM education. Audiences include K-12 teachers and their students, home-schooled students, pre-service teachers, undergraduate students, and community members as citizen scientists. Those served will include groups historically under-represented in STEM fields (e.g. Alaska Natives). Learners will be engaged using face-to-face, online, and mobile technologies. Formative and summative assessments as well as outcome-based metrics will be developed to evaluate the success of program efforts. To accomplish objectives and leverage efforts, this project brings together subject matter experts, educational professionals, and practitioners in a teaming arrangement as well as leveraged partnerships that include the GLOBE Program, NASA Langley Education Program, NASA Goddard Space Flight Center, International Arctic Research Institute, School of Education, School of Natural Resources and Extension, Geophysical Institute, Institute of Arctic Biology, University of Alaska Fairbanks, Association of Interior Native Educators, Kenaitze Tribe Environmental Education Program, Urban and Rural School Districts, 4-H Program, Goldstream Group, Inc., National Science Foundation (NSF) Alaska Experimental Program to Stimulate Competitive Research, NSF Bonanza Creek Long Term Ecological Research and the NSF Polar Learning and Responding Climate Change Education Partnership.